Appendix D. Biodiversity Development Assessment Report

Hume Battery Energy Storage System Project

Biodiversity Development Assessment Report

IA213400_Hume BESS_BDAR | Final

31 July 2020

Meridian Energy Australia

Hume Battery Energy Storage System Project – Stage 1

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Glossary of terms

Definitions	
Biodiversity Assessment Method	The Biodiversity Assessment Method (BAM) is the assessment manual that outlines how an accredited person assesses impacts on biodiversity at development sites and stewardship sites. It is a scientific document that provides: • a consistent method for the assessment of biodiversity on a proposed development or major project, or clearing site, • guidance on how a proponent can avoid and minimise potential biodiversity impacts, and • the number and class of biodiversity credits that need to be offset to achieve a standard of 'no net loss' of biodiversity.
Biodiversity credits	Ecosystem credits or species credits.
Biodiversity credit report	The report produced by the BAM Calculator (BAM-C) that sets out the number and class of biodiversity credits required to offset the remaining adverse impacts on biodiversity values at a development site, or on land to be biodiversity certified, or that sets out the number and class of biodiversity credits that are created at a biodiversity stewardship site.
Biodiversity offsets	Management actions that are undertaken to achieve a gain in biodiversity values on areas of land in order to compensate for losses to biodiversity values from the impacts of development.
Bioregion	Bioregions are relatively large land areas characterised by broad, landscape-scale natural features and environmental processes that influence the functions of entire ecosystems. They capture the large-scale geophysical patterns across Australia. These patterns in the landscape are linked to fauna and flora assemblages and processes at the ecosystem scale.
BAM Credit Calculator (BAM-C)	The computer program that provides decision support to assessors and proponents by applying the Biodiversity Assessment Method, which calculates the number and class of biodiversity credits required to offset the impacts of a development or created at a biodiversity stewardship site.
Cumulative impact	The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. Refer to the project Secretary's Environmental Assessment Requirements for cumulative impact assessment requirements.
Development site	The area of land that is directly impacted on by a proposed development, including access roads, and areas used to store construction materials
Direct impact	An impact on biodiversity values that is a direct result of vegetation clearance and loss of habitat for a development. It is predictable, usually occurs at or near to the development site and can be readily identified during the planning, design, construction, and operational phases of a development.
Ecological community	An ecological community is a naturally occurring group of native plants, animals and other organisms living in a unique location. Ecological communities can be listed as threatened under the EPBC Act and/or BC Act.
Ecosystem credit	A measurement of the value of endangered ecological communities (EECs), critically endangered ecological communities (CEECs) and threatened species habitat for species that can be reliably predicted to occur with a plant community type (PCT). Ecosystem credits measure the loss in biodiversity values at a development site and the gain in biodiversity values at a biodiversity stewardship site.
Ecosystem credit species	Threatened species that can be reliably predicted to occur with a PCT, for which species-specific biodiversity credits are not required.

Definitions	
Habitat	An area or areas occupied, or periodically or occasionally occupied, by a species, population or ecological community, including any biotic or abiotic component.
Indirect impact	An impact on biodiversity values that occurs when development related activities affect threatened species, threatened species habitat, or ecological communities in a manner other than direct impact. Compared to direct impacts, indirect impacts often: • occur over a wider area than just the site of the development • have a lower intensity of impact in the extent to which they occur compared to direct impacts • occur off site • have a lower predictability of when the impact occurs • have unclear boundaries of responsibility.
Locality	This is defined as the area within a 10-kilometre radius surrounding the development site
Local population	The population that occurs in the development site. In cases where multiple populations occur in the development site and/or a population occupies part of the development site, impacts on the entirety of each population must be assessed separately.
MNES	A matter of national environmental significance (MNES) protected by a provision of Part 3 of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).
Mitchell landscape	Landscapes with relatively homogeneous geomorphology, soils and broad vegetation types, mapped at a scale of 1: 250,000.
Mitigation	Action to reduce the severity of an impact.
Mitigation measure	Any measure that facilitates the safe movement of wildlife and/or prevents wildlife mortality.
Patch	A patch is defined in the BAM as an area of intact native vegetation that occurs on the subject land. The patch may extend onto adjoining land beyond the development site of the subject land, and for woody ecosystems, includes native vegetation separated by ≤100 metres from the next area of intact native vegetation. For non-woody vegetation, this gap is reduced to ≤30 metres.
Plant community type	A NSW plant community type identified using the plant community type (PCT) classification system. The PCT classification was created in 2011 by consolidating two existing community-level classifications: the NSW Vegetation Classification and Assessment database; and the BioMetric Vegetation Types database used in NSW regulatory programs. The PCT classification is now maintained in the BioNet Vegetation Classification application. It is a way to classify vegetation types.
Population	A group of organisms, all of the same species, occupying a particular area.
Species credits	The class of biodiversity credits created or required for the impact on threatened species that cannot be reliably predicted to use an area of land based on habitat surrogates. Species that require species credits are listed in the Threatened Biodiversity Data Collection.
Species credit species	Threatened species that are assessed according to section 6.4 of the BAM which may generate species-specific biodiversity credit requirements.
Study area	The development site and any other areas surveyed and assessed for biodiversity values which may be subject to indirect impacts.
Target species	A species that is the focus of a study or intended beneficiary of a conservation action or connectivity measure.
Threatened Biodiversity	Part of the BioNet database, accessible from the BioNet website at www.bionet.nsw.gov.au.

Definitions	
Data Collection	
Threatened species	A species listed under the NSW *Biodiversity Conservation Act 2016* (BC Act), *Fisheries Management Act 1994* (FM Act) or *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).
Threatened ecological community	A community of different species associated with one another and sharing the same habitat, that is listed under the NSW *Biodiversity Conservation Act 2016* (BC Act), *Fisheries Management Act 1994* (FM Act) and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Threatened ecological communities are listed as endangered or critically endangered under the NSW *Biodiversity Conservation Act 2016* (BC Act), or may be listed as vulnerable, endangered or critically endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).
1,500-metre landscape buffer	The assessment area surrounding the development site includes the area of land in the 1,500-metre landscape buffer around the development site. The study area is situated within the 1,500-metre landscape buffer. The landscape buffer is an assessment area used to identify landscape features surrounding the development site to provide site context and to inform the likely habitat suitability of the development site.

Abbreviations	
BAM	Biodiversity Assessment Method
BAM-C	BAM Calculator
BC Act	*Biodiversity Conservation Act 2016* (NSW)
BDAR	Biodiversity Development Assessment Report
CEEC	Critically Endangered Ecological Community
CEMP	Construction Environmental Management Plan
DPI	Department of Primary Industries
EEC	Endangered ecological community
EIS	Environmental Impact Statement
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Federal)
FM Act	*Fisheries Management Act 1994* (NSW)
IBRA	Interim Biogeographically Regionalisation of Australia
MNES	Matters of National Environmental Significance
PCT	Plant community type
SEARs	Secretary's Environmental Assessment Requirements
SEPP	State Environmental Planning Policy
SSD	State Significant Development
TECs	Threatened Ecological Communities
VIS	Vegetation Information System (BioNet Vegetation Classification)

Executive Summary

Meridian Energy Australia Pty Ltd (as 'the proponent') is seeking approval for the development of the Hume Battery Energy Storage System (BESS) (the Project), to be constructed on WaterNSW land near the pre-existing Hume Dam Hydro Power Station in NSW. The Project would be considered as State significant development under the *Environmental Planning and Assessment Act 1979*. This Biodiversity Development Assessment Report (BDAR) has been prepared for the Project in accordance with the requirements of the *Biodiversity Conservation Act 2016* (BC Act) and the Biodiversity Assessment Method (BAM). This BDAR documents the results of the biodiversity assessment carried out for the development in line with the relevant State and Commonwealth environmental and threatened species legislation and policy. It also considers relevant matters under the *Fisheries Management Act 1994*.

Existing environment

The development site is located in the local government area (LGA) of Albury City Council, in the NSW South Western Slopes Bioregion (IBRA 7) and the Inland Slopes subregion. The study area is situated in a predominantly cleared rural landscape that has highly modified vegetation and habitat which is mostly dominated by exotic grassland with scattered remnant and regrowth woodland patches. Less modified native vegetation is situated along the edges of the Murray River to the south west of the site. Two plant community types were identified in the development site:

- White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion (PCT 266).
- River Red Gum herbaceous-grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the eastern Riverina Bioregion (PCT 5).

On the basis of these PCTS and the bioregion, seven threatened plant species were identified as requiring assessment by the Biodiversity Assessment Calculator and a review of databases. Six of these were identified as candidate species and were targeted during surveys, though none were identified within or adjacent to the development site.

The following threatened fauna species were identified by the BAM Calculator as potential candidate species and their potential presence on the site was addressed via habitat assessment, and targeted survey where warranted:

- Sloane's Froglet (*Crinia sloanei*)
- Birds:
    - Owls: Masked Owl (*Tyto novaehollandiae*), Powerful Owl (*Ninox strenua*) (breeding)
    - Nectarivores: Regent Honeyeater (*Anthochaera phrygia*), Swift Parrot (*Lathamus discolor*), Superb Parrot (*Polytelis swainsonii*),
    - Cockatoos: Gang-gang Cockatoo (*Callocephalon fimbriatum*), Glossy Black-Cockatoo (*Calyptorhynchus lathami*) (breeding)
    - Bush Stone-curlew (*Burhinus grallarius*)
    - Raptors: Little Eagle (*Hieraaetus morphnoides*), Square-tailed Kite (*Lophoictinia isura*), White-bellied Sea-Eagle (*Haliaeetus leucogaster*) (breeding)
- Mammals:
    - Squirrel Glider (*Petaurus norfolcensis*)
    - Insectivorous bats: Large Bent-winged Bat (*Miniopterus orianae oceanensis*), Southern Myotis (*Myotis macropus*)

    - Grey-headed Flying Fox (*Pteropus poliocephalus*)
    - Brush-tailed Rock-wallaby (*Petrogale penicillate*)
    - Brush-tailed Phascogale (*Phascogale tapoatafa*)
    - Koala (*Phascolarctos cinereus*)
- Pink-tailed Legless Lizard (*Aprasia parapulchella*)
- Golden Sun Moth (*Synemon plana*).

Of these, only the Squirrel Glider and the Sloane's Froglet were considered likely to have potential breeding habitat and be potential candidate threatened species for which a biodiversity credit requirement may be generated. In the absence of breeding habitat, the remaining species are only ecosystem credit species for the purposes of this assessment.

Targeted surveys were undertaken for the Squirrel Glider and the Sloane's Froglet in June and August 2019 and June 2020.

The Squirrel Glider was not identified from targeted surveys undertaken as part of this assessment. However, this species is known to occur commonly in the locality from BioNet Atlas (Office of Environment and Heritage, 2020) records and, more specific to the development site, from survey data collected by the local conservation group *Friends of the Lake Hume Squirrel Glider*. Nest box monitoring undertaken by the group between 2013-2020 has found gliders have been observed in all but one of the 20 nest boxes installed and important movement corridors are known around the north and south of the development site. Only one tree with hollows suitable for nesting was identified within the study area, which is located along the spillway access road. The species is assumed present and a species polygon has been developed, which includes areas of PCT 266 with an intact canopy (excluding derived grasslands). This species is also likely to use planted native vegetation along west and northern boundary of the spillway site, however as this cannot be assigned to a PCT, it was not included in the species polygon.

The Sloane's Froglet was not identified during targeted surveys of the development site, however an ephemeral *Carex appressa* dominated wetland occurs within the study area containing native tree and shrub plantings on the edge. This wetland was dry at the time of survey but may temporarily fill with water during heavy rainfall and drains into the Murray River. An assessment of the *Carex appressa* wetland on the development site against known habitat characteristics described from the Albury population demonstrate that the habitat is marginal due to its inability to retain water. The habitat is connected to the Murray River by an unmapped drainage line, though there are no records of the Sloane's Froglet along the Murray River near the site. Therefore, the likelihood of Sloane's Froglet occurring in habitat on the development site is considered to be low.

Impacts to biodiversity

The potential for direct impacts to biodiversity is limited to clearing of native vegetation and habitat. The development would not impact any areas of land that the Minister for Energy and Environment has declared as an area of outstanding biodiversity value in accordance with Section 3.1 of the BC Act.

Plant community types

Despite avoidance and minimisation measures, the direct impacts to biodiversity values that would occur as a result of the development construction includes 0.44 hectares of native vegetation, which includes the following PCTs:

- White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion (PCT 266) – 0.43 hectares (4,225 square metres)
    - Poor condition – 0.02 hectares (164 square metres)

- Derived native grasslands - 0.41 hectares (4,061 square metres)

- River Red Gum herbaceous-grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the eastern Riverina Bioregion (PCT 5) – 0.01 hectares (105 square metres).

Threatened Ecological Communities

One Threatened Ecological Community (TEC) listed under the BC Act will be impacted by the development:

- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland – 0.43 hectares (4,225 square metres) comprising PCT 266 noted above.

All the areas of PCT 266 in the development site are too small and degraded to meet the condition threshold criteria for the EPBC Act listed White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland TEC detailed in the listing and conservation advice.

Threatened species

Direct impacts on species credit threatened species habitat associated with the clearing of native vegetation is limited to 0.02 hectares (164 square metres) of habitat for Squirrel Glider, which represents foraging and connectivity habitat. The one hollow-bearing tree within this habitat would be retained, however may require some trimming for the proposed access track.

The Squirrel Glider may also be indirectly impacted by fencing and infrastructure associated with the development that is constructed within or close to known movement corridors around the development site. This includes injury and mortality caused by collision with barbed-wire fences. Measures to minimise the potential for impact have been discussed in this report.

The native vegetation is likely to provide foraging habitat for a range of mobile threatened fauna species including the Grey-headed Flying Fox, Swift Parrot and a number of insectivorous bat species. The impact to these species would be limited to foraging habitat only.

Other impacts to threatened species habitat including impacts to connectivity and species movement, impacts to non-native vegetation and disturbed areas, and impacts to water quality and hydrology are considered to be minimal and manageable through the implementation of suitable mitigation measures.

Prescribed biodiversity impacts

As noted, the development may affect the movement of some threatened species, specifically the Squirrel Glider. This includes injury and mortality caused by collision with barbed-wire fences. Measures to minimise the potential for impact have been discussed in this report.

Up to 0.07 hectares (682 square metres) of exotic and 0.009 hectares (91 square metres) planted native trees and shrubs would be impacted by the development. Twelve threatened fauna species may utilise the non-native vegetation, including both native and exotic planted trees and shrubs, that are found within the development sites, including the Grey-headed Flying Fox and Swift Parrot. Due to the marginal, non-natural structure of the vegetation present, it is unlikely to be used as breeding habitat by any threatened species. It is unlikely that the development would detrimentally affect the bioregional persistence of these species.

Considering the highly disturbed nature of the landscape within which the development sits, indirect impacts are not expected to adversely affect areas of retained vegetation adjacent to the project. There is potential for unmitigated indirect impacts to nearby aquatic habitats (e.g. Murray River) from surface run-off during construction and operation. The implementation of standard mitigation measures (i.e. sediment control, spill control) would be implemented to control sediment and pollutants from any significant runoff events.

Mitigation and management

Once all practicable steps to avoid or minimise impacts have been implemented at the detailed design phase, mitigation and management measures would be implemented to further lessen the potential ecological impacts of the development. Mitigation measures outlined in this report would be implemented during construction.

Offsetting biodiversity impacts

An offset is required for the impacts to PCTs and threatened (species credit) species and the biodiversity credit obligation has been calculated using the Biodiversity Assessment Calculator and presented in this BDAR. Areas of the development site that do not possess PCTs have not been assessed and offset credits are not required. Offsets were identified as being required for the Squirrel Glider, however the impact area is so small that no credits were generated by the calculator. A summary of the biodiversity credit requirements for the development include:

- White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion (PCT 266) – Poor: 1 credit
- River Red Gum herbaceous-grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the eastern Riverina Bioregion (PCT 5) – Poor: 1 credit
- Squirrel Glider (*Petaurus norfolcensis*) – 0 credits

1. Introduction

1.1 Hume Battery Energy Storage System

Meridian Energy Australia Pty Ltd proposes to develop the Hume Battery Energy Storage System (BESS) Project (the Project), to be constructed on WaterNSW land near the pre-existing Hume Dam Hydro Power Station (HPS) in NSW. The project is proposed to be undertaken in the Albury City Council Local Government Area (LGA), with an estimated capex cost of $32 million. The Project location is illustrated in Figure 1-1.

The Project works will include the following elements:

- Installation, commissioning, and operation of a 20MW/40MWh BESS
- Construction and operational access track from existing internal WaterNSW access road
- Ancillary upgrades to the existing substation switchyard to connect the BESS to the National Energy Market (NEM)
- Underground 11 kV electricity cabling infrastructure from the existing switchyard to the BESS
- Construction of fencing around the perimeter of the BESS compound.

The BESS would have storage capacity to facilitate maximum discharge for a two-hour period. During operation, power generated by the HPS would be used to charge the BESS during periods of low energy demand. This energy would then be available for distribution to the National Energy Market in periods of higher demand. The BESS would also be able to charge from the NEM in circumstances where the HPS is not generating.

The BESS would be connected to the existing TransGrid transmission lines to Albury and the existing Ausnet transmission line to Wodonga. The connection would be established via a short below ground cable to the existing switchyard which would require minor augmentation.

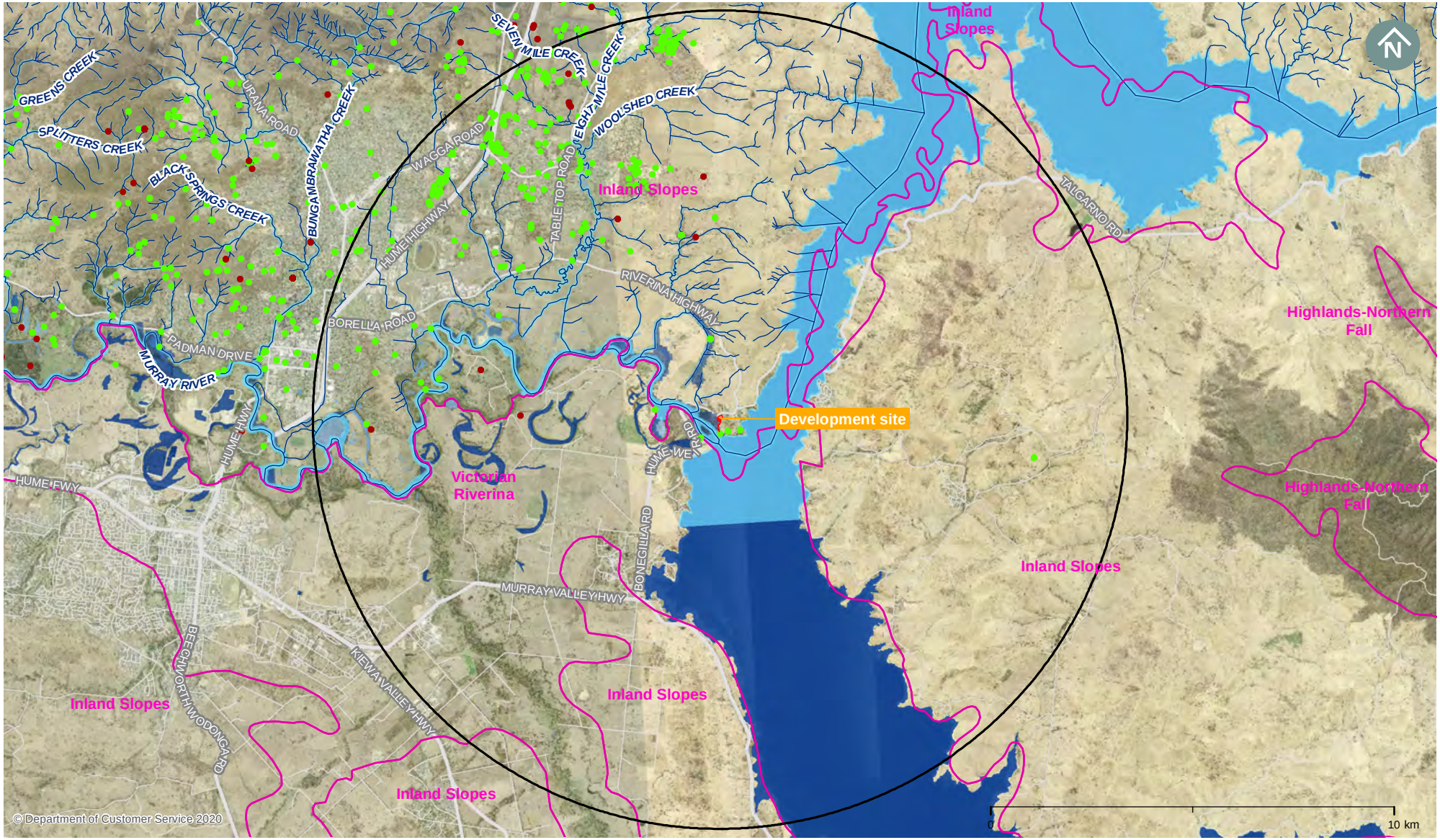
The maximum disturbance area for the project, including temporary construction areas and permanent footprint, would be approximately 1.2 hectares. Permanent infrastructure is anticipated to require a maximum 0.8 hectares. Batteries are expected to be mounted on concrete footings and be containerized or otherwise enclosed. Environmental controls for hazardous substances management would be provided and suitable for the selected technology in accordance with applicable guidelines.

The BESS is intended to have an operational life of 20 years and depending on the selected technology components may be replaced and or upgraded to extend this timeframe. Following the end of economic life, above ground components would be removed and land rehabilitated to achieve a safe, stable and non-polluting condition. End of life or defective battery cells would be returned to the provider for recycling or appropriate disposal.

Further details are provided in Chapter 2 of the Environmental Impact Statement. An overview of the project is shown in **Figure 1-2**.

1.2 Purpose and scope of this report

This Biodiversity Development Assessment Report (BDAR) forms part of the Environmental Impact Statement (EIS). The purpose of the BDAR is to identify and assess the biodiversity impacts of the development. In doing so it responds directly to the Secretary's Environmental Assessment Requirements (SEARs) outlined in **Section 1.3**.



Development site
Locality (10km)
IBRA region boundary

Threatened species records (BioNet Atlas)
Fauna
Flora

Waterways
NSW Riparian corridor
Wetlands
Waterbodies

Figure 1-1 Location map

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Figure 1-2 Site map

1.3 Secretary's Environmental Assessment Requirements

Schedule 2 of the EP&A Regulation and the Project SEARs establish the general form and content requirements to be addressed in the preparation of the EIS. The requirements specific to biodiversity, and where these requirements are addressed in this BDAR, are outlined in **Table 1-1**.

The Secretary's Environmental Assessment Requirements also received agency comments from the NSW Department of Planning, Industry and Environmental (DPIE) Biodiversity and Conservation Division (BCD). Where these requirements are addressed in this technical paper are outlined in **Table 1-2**.

Table 1-1 Secretary's Environmental Assessment Requirements – Biodiversity

Requirement	Where addressed
An assessment of the biodiversity values and the likely biodiversity impacts of the project in accordance with Section 7.9 of the *Biodiversity Conservation Act 2016* (NSW), the Biodiversity Assessment Method (BAM) and documented in a Biodiversity Development Assessment Report (BDAR), unless BCD and DPIE determine that the proposed development is not likely to have any significant impacts on biodiversity values.	This report is the BDAR as required under Section 7.9 of the BC Act. The BDAR was prepared in accordance with the Biodiversity Assessment Method (Office of Environment and Heritage, 2017) and guidance provided in the Biodiversity Assessment Method Operation Manual Stage 1 (State of NSW and Office of Environment and Heritage, 2018) and Biodiversity Assessment Method Operation Manual Stage 2 (State of NSW and Department of Planning Industry and Environment, 2019) (see **Chapter 2**). The Biodiversity Assessment calculator case associated with this BDAR is 00020694/BAAS19068/20/00020695. The biodiversity surveys undertaken during preparation of this BDAR were guided by the Threatened Species Survey and Assessment Guidelines (see **Chapter 2**).
The BDAR must document the application of the avoid, minimise and offset framework including assessing all direct, indirect and prescribed impacts in accordance with the BAM.	Avoidance and minimisation are discussed in **Chapter 8 and Chapter 10**. All direct, indirect and prescribed impacts are discussed in **Chapter 9**. Offsetting requirements are detailed in **Chapter 11** and **Chapter 12**. This BDAR has been prepared in accordance with the Biodiversity Assessment Method as described in **Chapter 2**.

Table 1-2 Recommended Environmental Assessment Requirements for Hume Battery Energy Storage System – Biodiversity

Requirement	Where addressed
Biodiversity impacts related to the proposed development are to be assessed in accordance with Section 7.9 of the Biodiversity Conservation Act 2016 using the Biodiversity Assessment Method (BAM) and documented in a Biodiversity Development Assessment Report (BDAR). The BDAR must include information in the form detailed in the Biodiversity Conservation Act 2016 (s6.12), Biodiversity Conservation Regulation 2017 (s6.8) and the BAM, unless DPIE determine that the proposed development is not likely to have any significant impact on biodiversity values.	The BDAR has been prepared in accordance with s6.12 of the BC Act. This report has been prepared by an accredited person as described in **Section 1.5**. The four specific requirements of s6.12 are located: a) assesses in accordance with the biodiversity assessment method the biodiversity values of the land subject to the proposed development, activity or clearing, and (refer **Chapters 2, 3, 4, 5, 6, 7**) b) assesses in accordance with that method the impact of proposed development, activity or clearing on the biodiversity values of that land, and (refer **Chapter 9**) c) sets out the measures that the proponent of the proposed development, activity or clearing proposes to take to avoid or minimise the impact of

Requirement	Where addressed
	the proposed development, activity or clearing, and (refer **Chapter 8** and **10**) d) specifies in accordance with that method the number and class of biodiversity credits that are required to be retired to offset the residual impacts on biodiversity values of the actions to which the biodiversity offsets scheme applies (refer **Chapter 11** and **12**). The BDAR has been prepared in accordance with cl6.8 of the Biodiversity Conservation Regulation 2017. A biodiversity development assessment report must include: a) the number and classes of biodiversity credits required to be retired in accordance with the like-for-like requirements of the offset rules, and (refer **Chapter 11** and **12**). b) the number and classes of biodiversity credits that could be retired in accordance with the variation rules (in any case in which the proponent of the development proposes to use the variation rules), and (N/A to this development) c) details of any proposal to fund a biodiversity conservation action in accordance with the offset rules, and (N/A to this development) d) details of any ecological rehabilitation of a site impacted by mining under a mining lease that is proposed as a measure to offset or compensate for those impacts, and (N/A to this development) e) the date of the report and the requisite certification under section 6.15 of the Act, and (refer to the Title page of this report for date) f) details of the accreditation of the person preparing the report and of the qualifications and experience of any other person commissioned to conduct research or investigations that are relied on in preparing the report, and (refer to **Section 1.5**) g) any other information required by the biodiversity assessment method or ancillary rules to be included in the report (refer **Chapters 2, 3, 4, 5, 6, 7**) This BDAR has been prepared in accordance with the Biodiversity Assessment Method as described in **Chapters 2**).
1. The BDAR must document the application of the avoid, minimise and offset framework including assessing all direct, indirect and prescribed impacts in accordance with the BAM.	Avoidance and minimisation are discussed in **Chapter 8 and Chapter 10**.
2. The BDAR must include details of the measures proposed to address the offset obligation as	Offsetting requirements are detailed in **Chapter 11** and

Requirement	Where addressed
follows; a) The total number and classes of biodiversity credits required to be retired for the development/project; b) The number and classes of like-for-like biodiversity credits proposed to be retired; c) The number and classes of biodiversity credits proposed to be retired in accordance with the variation rules; d) Any proposal to fund a biodiversity conservation action; e) Any proposal to make a payment to the Biodiversity Conservation Fund. If seeking approval to use the variation rules, the BDAR must contain details of the reasonable steps that have been taken to obtain requisite like-for-like biodiversity credits.	**Chapter 12**.
3. The BDAR must be submitted with all digital spatial data associated with the survey and assessment as per Appendix 10 (Tables 25 and 26) of the BAM.	Digital spatial data supplied. Refer to the following figures included in this BDAR: • Figure 1-1 Location map • Figure 2-1 Location of plot based floristic vegetation survey and vegetation integrity assessments • Figure 2-2 Threatened plant surveys • Figure 2-3 Threatened animal surveys • Figure 4-1 Map of plant community types and vegetation zones • Figure 4-2 Map of threatened ecological communities • Figure 5-1 Threatened species polygon for Squirrel Glider (*Petaurus norfolcensis*) • Figure 6-1 Aquatic habitats • Figure 11-1 Impacts requiring offsets and impacts not requiring offsets
4. The BDAR must be prepared by a person accredited in accordance with the Accreditation Scheme for the Application of the Biodiversity Assessment Method Order 2017 under s6.10 of the Biodiversity Conservation Act 2016.	Details of the accreditation of the persons preparing the report are provided in **Section 1.5**

1.4 Key terms used in this report

The following areas are discussed throughout the technical paper which aligns with terminology of the Biodiversity Assessment Method (BAM) are defined as:

- Development site: this area includes all areas to be directly impacted, i.e. the maximum disturbance footprint (see **Figure 1-2**). The development site is also known as the 'subject land' in the BAM. For the purposes of this BDAR, the term *development site* is used.
- Study area: the study area is larger than the development site and includes the development site and surrounding area within a 20-metre buffer (**Figure 2-1**) that may be subject to surface indirect impacts.
- Locality: This is defined as the area within a 10-kilometre radius surrounding the development site (Figure 1-1).
- Bioregion: The study area is located in the South Western Slopes Bioregion within the Inland Slopes subregion (Thackway and Cresswell, 1995).
- 1,500-metre landscape buffer: The assessment area surrounding the development site (or subject land) includes the area of land in the 1,500-metre landscape buffer around the development site. The study area is situated within the 1,500-metre landscape buffer. The landscape buffer is an assessment area used to identify landscape features surrounding the development site to provide site context and to inform the likely habitat suitability of the development site (**Figure 1-2**).

1.5 Authors

The work to prepare this BDAR was undertaken by appropriately qualified and experienced ecologists as outlined in **Table 1-3**.

Table 1-3 Personnel, role and qualifications

Name	Role	Qualifications
Brenton Hays	Ecologist - Technical lead, targeted surveys, reporting, GIS analysis	Bachelor of Environmental Science and Management (Hons) Accredited under Section 6.10 of the Biodiversity Conservation Act 2016 as a Biodiversity Assessment Method Assessor (No. BAAS19068)
Chris Thomson	Principal Ecologist – Technical review	Graduate Certificate in Natural Resources Bachelor of Applied Science (Environmental Management) Accredited under Section 6.10 of the *Biodiversity Conservation Act 2016* as a Biodiversity Assessment Method Assessor (No. BAAS18058)

2. Methodology

This section documents the methodology applied in the preparation of the BDAR. The BDAR was prepared in accordance with the *Biodiversity Assessment Method* (Office of Environment and Heritage, 2017) and guidance provided in the *Biodiversity Assessment Method Operation Manual Stage 1* (State of NSW and Office of Environment and Heritage, 2018) and *Biodiversity Assessment Method Operation Manual Stage 2* (State of NSW and Department of Planning Industry and Environment, 2019). Further detail on the methodology for aquatic environments in provided in **Section 6**.

2.1 Study area

As defined in **Section1.4**, the study area includes the development site and adjacent areas within a 20-metre buffer to capture areas around the development site that may be subject to indirect impacts (see **Figure 2-1**). The study area is located in the local government area (LGA) of Albury City Council.

2.2 Background research and data sources

A background review of existing information was carried out to identify the existing environment within a nominal search area of 10 kilometres surrounding the development site. In some cases, databases only pertain to NSW land (BioNet), therefore due to the proximity of the NSW/VIC border, a 20-kilometre radius was deemed more appropriate. The review focussed on database searches, relevant ecological reports pertaining to the development site (where publicly available) and relevant GIS layers. The review was used to prepare a list of plant community types (PCTs), threatened species, populations and communities as well as important habitat for migratory species with a likelihood of occurrence in the survey area and locality. The searches were also carried out to identify if any Areas of Outstanding Biodiversity Value were present.

The following databases were searched or viewed:

- BioNet – Atlas of NSW Wildlife and Threatened Biodiversity Data Collection (searched 11 June 2020)
- Department of Environment and Primary Industries (DEPI, 2016) Victorian Biodiversity Atlas interactive map
- NSW Department of Primary Industries (DPI) Fisheries Spatial Data Portal (viewed 25 June 2020)
- The federal Department of Agriculture, Water and the Environment Protected Matters Search Tool (PMST) (searched 12 June 2020) (refer to Appendix F)
- BioNet NSW Vegetation Classification database (viewed June 2020)
- BAM Calculator (BAM-C)
- Atlas of Living Australia (viewed June 2020)
- The federal Bureau of Meteorology's Atlas of Groundwater Dependent Ecosystems (GDE) (viewed June 2020)
- Department of Agriculture, Water and the Environment directory of important wetlands (viewed June 2020).

Regional vegetation mapping, geology and soil mapping projects were reviewed including:

- State Vegetation Type Map: Riverina Region Version v1.2 - VIS_ID 4469 (Department of Planning, Industry and Environment 2020).
- Extant Vegetation Map of Albury Shire. VIS_ID 3926 (Department of Planning, Industry and Environment 2013).
- Mitchell Landscapes Version V3.1 (NPWS, 2002)

- Australian Soil Classification (ASC) Soil Type map of NSW (State Government of NSW and Office of Environment and Heritage (OEH), 2012).

Data was also provided by the local conservation group *Friends of the Lake Hume Squirrel Glider*, through personal communication with Stuart Lucas.

Preliminary and provisional determinations to list species and ecological communities as threatened under the BC Act were viewed from the NSW Threatened Species Scientific Committee web resources. At the time of writing, there are no preliminary or provisional listings of relevance. The annual Final Priority Assessment List of nominated species and ecological communities that have been approved for assessment by the Minister.

2.3 Mapping extent of native vegetation cover

The extent of native vegetation in the development site was ground-truthed and mapped using up to date aerial imagery. Polygons were digitised in a GIS (ArcGIS 10.6) at a scale of between 1:1,000 and 1:5,000. The vegetation extent within the development site has been mapped as accurately as possible although some boundary errors may still exist.

To assess percent of current extent of native vegetation, a landscape buffer of 1,500 metres was placed around the boundary of the development site in accordance with Section 4.2 of the BAM. Percent native vegetation cover in the landscape buffer was calculated using a combination of regional vegetation mapping and aerial imagery, in some cases making assumptions of native vegetation where no mapping exists (e.g. along Trout Farm Road).

2.3.1 Definition of native vegetation

Under the BAM, native vegetation has the same meaning as in section 1.6 of the BC Act which states that native vegetation and clearing native vegetation have the same meanings as in Part 5A of the *Local Land Services Act 2013*. Part 5A 60B of the *Local Land Services Act 2013* defines the meaning of native vegetation as any of the following types of plants native to New South Wales:

a) trees (including any sapling or shrub or any scrub)

b) understorey plants

c) groundcover (being any type of herbaceous vegetation)

d) plants occurring in a wetland.

A plant is native to New South Wales if it was established in New South Wales before European settlement. This includes planted vegetation which is important as the development site and broader study area contains several native species plantings.

2.4 Plant community type identification

The type and distribution of PCTs within the development site and broader study area were identified and mapped progressively during the field surveys. The identification of PCTs presented here in this BDAR is according to the NSW PCT classification as described in the BioNet Vegetation Classification database. Each PCT was assigned to the relevant corresponding Threatened Ecological Community (TEC) where applicable. A plot-based floristic vegetation survey as described in Section 5.2 of the BAM was carried out in areas where the vegetation was of sufficient size and shape to allow for plots to be completed. The plot-based floristic vegetation surveys were carried out over two days in August 2019 and one day in June 2020.

2.4.1 Stratification of native vegetation into survey units

Using existing vegetation mapping, survey sites (plots/midlines) were established within each area of mapped vegetation to provide a representative assessment of the vegetation prior to the field survey. Plots were also positioned to provide a wide spatial coverage of the development site and broader study area. Once the

identification of PCTs had been finalised, each PCT was then divided into vegetation zones (an area of native vegetation that is the same PCT and has a similar broad condition state). The PCTs identified within the development site are described in detail in **Section 4** of this BDAR.

The vegetation within the development site has been assigned to a PCT as listed in the BioNet Vegetation Classification database based on the observed plant species composition, vegetation structure, landscape position, and underlying geology and soils.

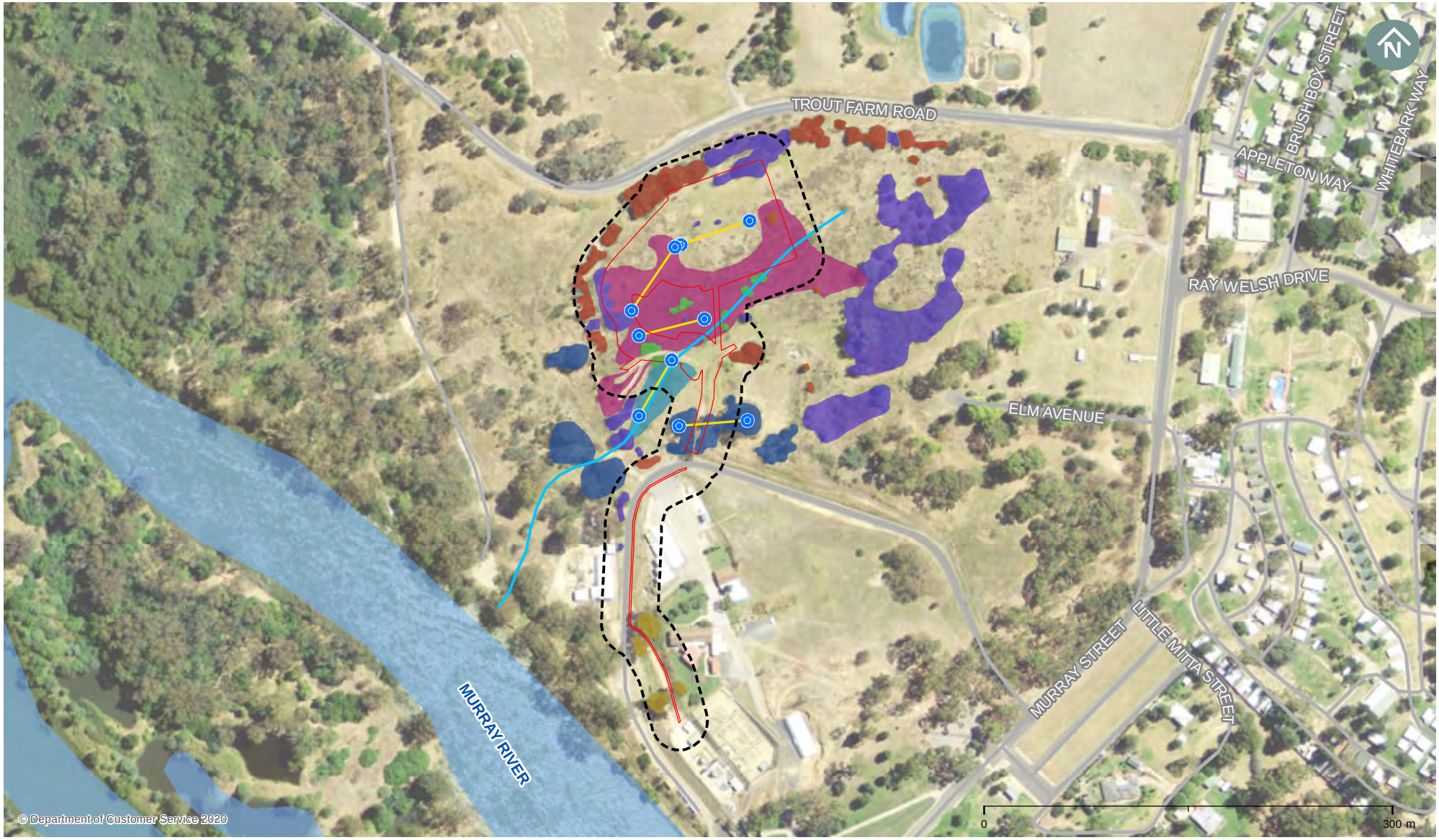
2.4.2 Plot based floristic vegetation survey and Vegetation Integrity Assessment

A plot-based full floristic survey and Vegetation Integrity Assessment was carried out according to the BAM using a series of 20 x 20 metre plots (or equivalent 400 square metre area) nested inside a 20 x 50 metre plot (or equivalent 1,000 square metre area). The location of each plot/mid-line completed during the survey is illustrated in **Figure 2-1**. Plots/mid-lines were established to provide a representative assessment of the vegetation integrity of the vegetation zone, accounting for the level of variation in the broad condition state of the vegetation zone.

A summary of the survey effort completed in each vegetation zone is provided in **Table 2-1**.

Table 2-1 Plant community types and vegetation zones identified in the development site

Vegetation zone	Plant community type ID No.	Plant community type name	Broad condition class	Vegetation zone area in development site (ha)	Minimum number of plots/mid-lines required	Number of plots/mid-lines completed
1	266	White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion	Moderate	0.02	1	1
2			Derived native grassland	0.41	1	2
3	5	River Red Gum herbaceous-grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the eastern Riverina	*Carex* wetland	0.01	1	1



Study area
Development site
Drainage line
Waterbodies
Vegetation integrity plots
Vegetation integrity transects

Plant community types
Blackberry
Exotic Trees and Shrubs
Planted Native Trees and Shrubs
River Red Gum herbaceous-grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the eastern Riverina Bioregion (PCT 5) - Carex appressa wetland
River Red Gum herbaceous-grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the eastern Riverina Bioregion (PCT 5) - Poor
White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion (PCT 266) - Derived grassland
White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion (PCT 266) - Poor

Figure 2-1 Vegetation Integrity Survey

Date: 30/07/2020 Path: \\jacobs.com\ANZ\IE\Projects\04_Eastern\IA213400\22_Spatial\GIS\Directory\Templates\Ecology\BDAR\IA213400_BDAR_F005_PlantCommunityTypes_r1v1.mxd
Created by : AA | QA by : LC

2.5 Patch size

A patch is defined in the BAM as an area of intact native vegetation that occurs on the development site. The patch may extend onto adjoining land beyond the footprint of the development site, and for woody ecosystems the patch would include native vegetation separated by less than or equal to 100 metres from the next area of intact native vegetation. For non-woody vegetation, this gap is reduced to less than or equal to 30 metres. Patch size for each vegetation zone located on the development site was mapped in accordance with subsection 5.3.2 of the BAM using the following steps:

- Identify vegetation zones that will be included in the same patch
- Identify the boundary of any adjoining intact native vegetation which extends beyond the limit of the development site
- Digitise each patch in a GIS using separate polygons where multiple patches exist
- Calculate the area of each patch in hectares in a GIS.

The patch was then allocated to a patch size class (being less than five hectares, five to 24 hectares, 25 to 100 hectares and greater than 100 hectares). Patch size class is used as a filter in the Biodiversity Assessment Calculator to predict threatened species likely to occur or use habitat on the development site. The patch size of all vegetation zones within the development site is within the five to 24 hectares patch size class.

2.6 Threatened species habitat assessment – creating a candidate species list

The list of candidate threatened species for assessment was developed based on the assessed landscape context, known PCTs and vegetation integrity of the development site. As outlined in Section 6.4.1.3 of the BAM, the following criteria (a – f) were used to predict the threatened species that require assessment:

a) The distribution of the species includes the IBRA subregion which the development site is, in the opinion of the assessor, mostly located within, and

b) The development site is within any geographic constraints of the distribution of the species within the IBRA subregion, and

c) The species is associated with any of the PCTs identified by the assessor under Chapter 5 as occurring within the development site, and

d) The native vegetation cover within an assessment area 1,500 metres wide surrounding the boundary of the subject site as determined by the assessor in accordance with subsection 4.3.2 of the BAM is equal to or greater than the minimum class that is required for the species (unless the development is, or is part of, a linear shaped development), and

e) The patch size which the vegetation zone is part of, as identified in subsection 5.3.2 of the BAM is equal to or greater than the minimum specified for that species, and

f) The species is identified as an ecosystem or species credit species in the Threatened Biodiversity Data Collection.

A threatened species was predicted as requiring assessment if that species meets all the criteria (a to f) that are relevant to the species. The Biodiversity Assessment Calculator was used to derive the list of candidate species based on criteria a to f. If any one of the criteria (a to f) relevant to a species was not met, the development site was considered not to be suitable habitat for the threatened species and no further assessment was undertaken for that species.

The results of the BioNet search and the PMST search were also used to inform development of the candidate species list. Some species returned from the database searches (i.e. BioNet and the PMST) were removed from the assessment due to the absence of suitable habitat in the development site. The development site itself is highly disturbed, with fragmented vegetation that lacks high quality natural habitats, and species that are known

to no longer occur in the Albury rural area were removed from the assessment based on the lack of these habitat types from the development site.

The threatened species habitat suitability assessment is provided in **Section 5** and **Appendix A**. The candidate list of threatened species for assessment is provided in **Section 5**.

2.7 Targeted threatened species surveys

After the candidate species list had been developed (see **Section 5.3**), targeted threatened species surveys were undertaken where possible. The surveys carried out for candidate threatened species of plants and animals are outlined in **Section 2.7.1** and **Section 2.7.2**. The habitat assessment identified that there is limited habitat in the development site for most threatened species. Targeted surveys were undertaken in August 2019 and June 2020.

2.7.1 Threatened plants

After the PCTs and finer scale habitats within the development site had been identified, and the threatened species habitat assessment had been undertaken, threatened plant surveys were conducted across areas of suitable habitat. **Table 2-2** lists the species that were targeted. The target species in **Table 2-2** were identified by the BAM-Calculator. Only one plant species, *Grevillea wilkinsonii* (Tumut Grevillea) was excluded from the assessment as it has a very restricted distribution along the Goobarragandra River.

Surveys for threatened plants were guided by the methodology and effort as outlined in the *NSW Guide to Surveying Threatened Plants* (Office of Environment and Heritage, 2016). Where possible, transects were walked by through the suitable habitats within the development site at 10-metre spacing. In general, the habitats on the development site are highly modified, containing a high cover of exotic and high-threat exotic species. However, the species listed in **Table 2-2** have been recorded in disturbed habitats and therefore were included in the assessment. Walked transects were conducted through suitable habitat (i.e. any native species present) as they were identified in the field. The small patch of poor condition remnant woodland was also surveyed, however it contained a very high cover of exotic species. Threatened plant surveys were conducted out of the recommended survey period for all species except *Acacia ausfeldii*, however the site was survey on two occasions (August 2019 and June 2020) and is relatively small in size, meaning that coverage was adequate.

Table 2-2 Summary of survey effort for threatened plant species

Species name	Common name	EPBC Act	BC Act	Required survey period	Survey completed
Acacia ausfeldii	Ausfeld's Wattle	-	V	August, September and October	Surveys completed in August 2019 and June 2020.
Ammobium craspedioides	Yass Daisy	V	V	September, October and November	Surveys completed in August 2019 and June 2020.
Cullen parvum	Small Scurf-pea	-	E	December and January	Surveys completed in August 2019 and June 2020.
Euphrasia arguta	Euphrasia arguta	CE	CE	November, December, January, February and March	Surveys completed in August 2019 and June 2020.
Swainsona recta	Small Purple-Pea	E	E	September, October and November	Surveys completed in August 2019 and June 2020.
Swainsona sericea	Silky Swainson-pea	-	V	September, October and November	Surveys completed in August 2019 and June 2020.
Key: V = Vulnerable species, E = Endangered species, EP = Endangered population, CE = Critically Endangered species					

*Note: = the survey was undertaken outside of the allocated survey period for *Ammobium craspedioides*, *Cullen parvum*, *Euphrasia arguta*, *Grevillea Wilkinsonii*, *Swainsona recta* and *Swainsona sericea.*

2.7.2 Threatened animals

Targeted threatened species surveys were undertaken for animals that had potential habitat within the development footprint and broader study area. The habitat assessment identified that there is limited habitat in the development site for most threatened species. However, two species, the Squirrel Glider (*Petaurus norfolcensis*) and the Sloane's Froglet (*Crinia sloanei*) were considered moderately likely to occur in the development site and surrounding habitat based on the presence of suitable habitat. To determine presence or absence from within or adjacent to the proposed development footprint, targeted surveys for these species were undertaken in accordance with the following guidelines:

- *Threatened species survey and assessment guidelines: field survey methods for fauna – Amphibians* (Department of Environment and Climate Change 2009).
- *Threatened Species Survey and Assessment: Guidelines for developments and activities (working draft)*, (New South Wales Department of Environment and Conservation 2004).

Table 2-3 outlines the threatened animal species that were identified by the BAM-Calculator and assessed during surveys of the development site. Locations of targeted surveys are illustrated in **Figure 2-3**.

Table 2-3 Summary of survey effort for threatened animal species

Species name	Common name	EPBC Act	BC Act	Required survey period	Survey completed
Anthochaera phrygia	Regent Honeyeater (breeding habitat)	CE	CE	None allocated	No survey undertaken. Species excluded through habitat assessment. No breeding habitat present.
Aprasia parapulchella	Pink-tailed Legless Lizard	V	V	September, October and November	No survey undertaken. Species excluded through habitat assessment.
Callocephalon fimbriatum	Gang-gang Cockatoo (breeding habitat)	-	V	October, November, December, January	No large tree hollows considered suitable as nesting sites. No breeding habitat present.
Calyptorhynchus lathami	Glossy Black-Cockatoo (breeding habitat)	-	V	April, May, June, July and August	No large tree hollows considered suitable as nesting sites. No breeding habitat present
Crinia sloanei	Sloane's Froglet	E	V	July and August	Targeted surveys for this species were undertaken on and around the development site in June 2019, August 2019 and June 2020, and included nocturnal searches for active frogs and use of call playback. Known reference sites were also surveyed in August 2019 to confirm status. Further detail below
Haliaeetus leucogaster	White-bellied Sea-Eagle (breeding habitat)	-	V	July, August, September, October, November, December	Search for large stick nests conducted, no breeding evidence observed.
Hieraaetus morphnoides	Little Eagle (breeding habitat)	-	V	August, September, October	Search for large stick nests conducted, no breeding evidence observed.

Species name	Common name	EPBC Act	BC Act	Required survey period	Survey completed
Lathamus discolor	Swift Parrot (breeding habitat)	CE	E	None allocated	No survey undertaken. No breeding habitat present. Foraging habitat assumed present.
Lophoictinia isura	Square-tailed Kite (breeding habitat)	-	V	September, October, November, December, January	Search for large stick nests conducted, no breeding evidence observed
Miniopterus orianae oceanensis	Large Bent-winged Bat (breeding habitat)	-	V	December, January, February	No survey undertaken. Species excluded through habitat assessment. Only foraging habitat present in development site, no bridges, caves or artificial structures present
Myotis macropus	Southern Myotis	-	V	October, November December, January, February, March	No survey undertaken. Species excluded on basis of habitat constraints deemed absent from the site. These include Hollow-bearing trees within 200 m of riparian zone and bridges, caves or artificial structures within 200 m of riparian zone.
Ninox strenua	Powerful Owl (breeding habitat)	-	V	May, June, July, August	No large tree hollows considered suitable as nesting sites.
Petaurus norfolcensis	Squirrel Glider	-	V	All year	Spotlighting and stag-watching around the development site in August 2019. Further details below.
Petrogale penicillata	Brush-tailed Rock-wallaby	V	E	August, September, October and November	No survey undertaken. Species excluded through habitat assessment.
Phascogale tapoatafa	Brush-tailed Phascogale	-	V	December, January, March, April, May and June	No survey undertaken. Species excluded through habitat assessment.
Phascolarctos cinereus	Koala (breeding habitat)	V	V	All year	No survey undertaken. Species excluded through habitat assessment.
Polytelis swainsonii	Superb Parrot (breeding)	V	V	September, October and November	No large tree hollows considered suitable as nesting sites. No breeding habitat present.
Pteropus poliocephalus	Grey-headed Flying-fox (breeding habitat)	V	V	October, November December	Search of site for roosting / breeding camp. . No breeding camps present.
Synemon plana	Golden Sun Moth	CE	E	October, November and December	No survey undertaken. Species excluded through habitat assessment.
Tyto novaehollandiae	Masked Owl (breeding habitat)	-	V	May, June, July, August	No large tree hollows considered suitable as nesting sites. No breeding habitat present.
Key: V = Vulnerable species, E = Endangered species, EP = Endangered population, CE = Critically Endangered species					

The fauna species which were identified from the background review and habitat assessment that were targeted during the survey are discussed in **Table 2-4**.

Table 2-4 Targeted fauna survey details

Threatened fauna species	Minimum survey requirements (TBDC)*	Survey completed
Squirrel Glider (*Petaurus norfolcensis*)	Survey year round but sites with bipinnate acacia, autumn winter flowering trees and shrubs such as *Eucalyptus robusta* and *Banksia* species (*integrifolia* etc) should be subject to a more retracted survey period of between March-August. Relies on large old trees with hollows for breeding and nesting. These trees are also critical for movement and typically need to be closely-connected (i.e. no more than 50 m apart). Observing potential roost hollows for 30 minutes prior to sunset and 60 minutes following sunset.	Spotlighting was conducted in the development site on 20 August 2019 within suitable habitat. The survey duration was around one hour and included stag-watching the singe hollow-bearing tree close the development area. The local conservation group *Friends of the Lake Hume Squirrel Glider* have undertaken extensive surveys of the Lake Hume Village area, including installing and monitoring nest boxes (one of which is located on the edge of the development site.
Sloane's Froglet (*Crinia sloanei*)	Detection is optimised during dawn and midday and avoiding periods of heavy rainfall (negative relationship between calling activity and rainfall, peak calling period was associated with the lowest rainfall months of the year (<100mm)). Surveyors should be able to distinguish this species call from other *Crinia* species likely to be calling at the same time.	Midday inspections and evening spotlighting conducted on two nights (19 and 20 August 2019). The first evening comprised a survey of the Murray River close to the development site as access was not possible. The following diurnal and nocturnal surveys focused on the *Carex appressa* drainage line wetland in the development site. This site was assessed for habitat value using known habitat characteristics identified in the literature. A midday inspection of the *Carex appressa* drainage line wetland was also undertaken on 28 June 2019 and 10 June 2020. Surveys were completed by one ecologist, using nocturnal searches, spotlighting, call detection and call playback techniques. Total survey effort was over 4 days and 2 nights (around 1.5 hours each night and 2 hours of diurnal inspections) within 0.13 hectares of potential habitat.

*BioNet Threatened Biodiversity Data Collection (TBDC)

Squirrel Glider

Potential habitat for the Squirrel Glider was identified in and adjacent to the development site during an initial site walkover of the development site in June 2019. This includes remnant *Eucalyptus albens* and regrowth *Acacia implexa* along the spillway entrance road. All native vegetation is likely to provide some amount of habitat potential, including the strip of planted native trees and shrubs outside the fence line along the western and northern boundaries of the development site. This vegetation has been identified as an important movement corridor, which runs in an east-west direction both above and below the development site (Stuart Lucas, pers. comm., June 2020). The development site contains one single hollow bearing tree *Eucalyptus albens* containing multiple small hollows on the edge of the development site. Nest boxes have also been installed in this location and others around the outside of the development site to assist in habitat creation and monitoring of this species.

These areas were surveyed using a hand-held LED spotlight and LED head torch on 20 August 2019. No native tree or shrub species were flowering at the time of survey. The singular hollow bearing tree (*Eucalyptus albens*) was stag-watched at dusk. The duration of the sampling event was around two hours. Details of the survey effort are described in **Table 2-5** and illustrated in **Figure 2-3.**

Table 2-5 Squirrel Glider survey timing and sampling effort

Survey date	Survey type	Total duration (hours)
20/08/2019	Spotlighting and stag watching	2 hours

Sloane's Froglet

Targeted surveys for Sloane's Froglet included nocturnal and diurnal searches of suitable potential habitat within and around the development site on 28 June 2019, 19 and 20 August 2019, and 10 June 2020. Surveys were undertaken by one ecologist. The weather and rainfall conditions present in the locality during the fauna surveys are shown in **Table 2-6**. Weather conditions were taken from data recorded at the Albury Airport, AWS 072160 (BOM 2020). Heavy rainfall was not experienced during any of the surveys.

Table 2-6 Weather and rainfall conditions during fauna surveys (Albury Airport AWS 072160)

Date	Min temp (ºC)	Max temp (ºC)	Wind (3pm)	Rainfall (24 hours)	Total rainfall in 7 days before survey	Observations
28/06/2019	0.3	16.7	SE 7 km/h	0.2 mm	0.6 mm	Clear skies
19/08/2019	4.7	11.3	W 26 km/h	9 mm	0.8 mm	Cloudy with light rain
20/08/2019	4.3	11.1	NNW 13 km/h	9 mm	9.8 mm	Cloudy
10/06/2020	2.5	14.3	ESE 4 km/h	0 mm	0.8 mm	Clear skies

Details of the survey effort are described in **Table 2-7** and illustrated in **Figure 2-3**.

Nocturnal surveys were conducted on 19 and 20 August 2020 and involved visual inspection of suitable potential habitat using a LED hand held torch and LED head torch. Call playback was undertaken at two locations in the *Carex appressa* wetland, which involved playing calls through a 20W loudspeaker for a total of 2-5 minutes, followed by a period of listening. The duration of each sampling event was around 2 hours per night.

Around 12 known reference sites around Albury (Knight, 2013) were also surveyed on both nights (19 and 20 August 2019) to check for activity and compare habitat features to the development site.

Diurnal surveys were also conducted (28 June 2019, 19 and 20 August 2019 and 10 June 2020) as this species is known to be best detected around dawn and midday. Four diurnal surveys and two nocturnal surveys were conducted between June 2019 and June 2020, Surveys involved visual inspection and call playback around midday.

Table 2-7 Sloane's Froglet survey timing and sampling effort

Survey date	Timing	Survey location	Survey type	Duration (hours)
28/06/2019	Midday	*Carex appressa* wetland	Visual inspection	0.5 hour
19/08/2019	Midday	*Carex appressa* wetland	Visual inspection and call playback	0.5 hour
	Night	Reference sites around Albury (6 sites)	Visual inspection and call playback	0.5 hour
		Murray River close to the	Visual inspection	1 hour

		development site	and call playback	
20/08/2019	Midday	*Carex appressa* wetland	Visual inspection and call playback	0.5 hour
	Night	Reference sites around Albury (6 sites)	Visual inspection and call playback	1 hour
		Carex appressa wetland	Visual inspection and call playback	0.5 hour
10/06/2020	Midday	*Carex appressa* wetland	Visual inspection	0.5 hour

2.8 Survey limitations

The desktop assessment and field survey carried out for this BDAR provides a limited view into the ecological values of the development site present at the time of the survey. The diversity of flora and fauna species recorded from this study should not be seen to be comprehensive. It is unlikely that every species present within the development site has been recorded. The field survey aimed to sample the development site and a comprehensive inventory of species was not made. A period of several seasons or years is often needed to identify all the species present in an area, especially as some species are only apparent at certain times of the year (e.g. orchids or migratory birds) and require specific weather conditions for optimum detection (e.g. breeding and flowering periods). The conclusions of this report are therefore based upon available data and are indicative of the environmental condition of the development site at the time of the survey. Site conditions, including the presence of threatened species, can change with time. To address this limitation, the assessment has aimed to identify the presence and suitability of the habitat for threatened species.

The vegetation within the development site has been assigned to the most likely PCT (where possible) as they are described in the BioNet Vegetation Classification database. In many cases there are no sharp boundaries defining the transition between PCTs, so the mapping provided in this BDAR is supported by on ground floristic surveys and observations of potential ecotones. However, a choice must be made to map and assign a PCT to an area of the site. As mapping necessitates that a hard boundary is drawn to separate PCTs, boundaries of PCTs and vegetation zones have been mapped as best as possible based on observations made during the field survey and based on patterns observed on aerial photography. It is likely that the boundaries of PCTs and vegetation zones will change with time and in response to long-term variation in biophysical conditions on the site such as rainfall and surface drainage patterns.

Figure 2-2 Threatened plant surveys

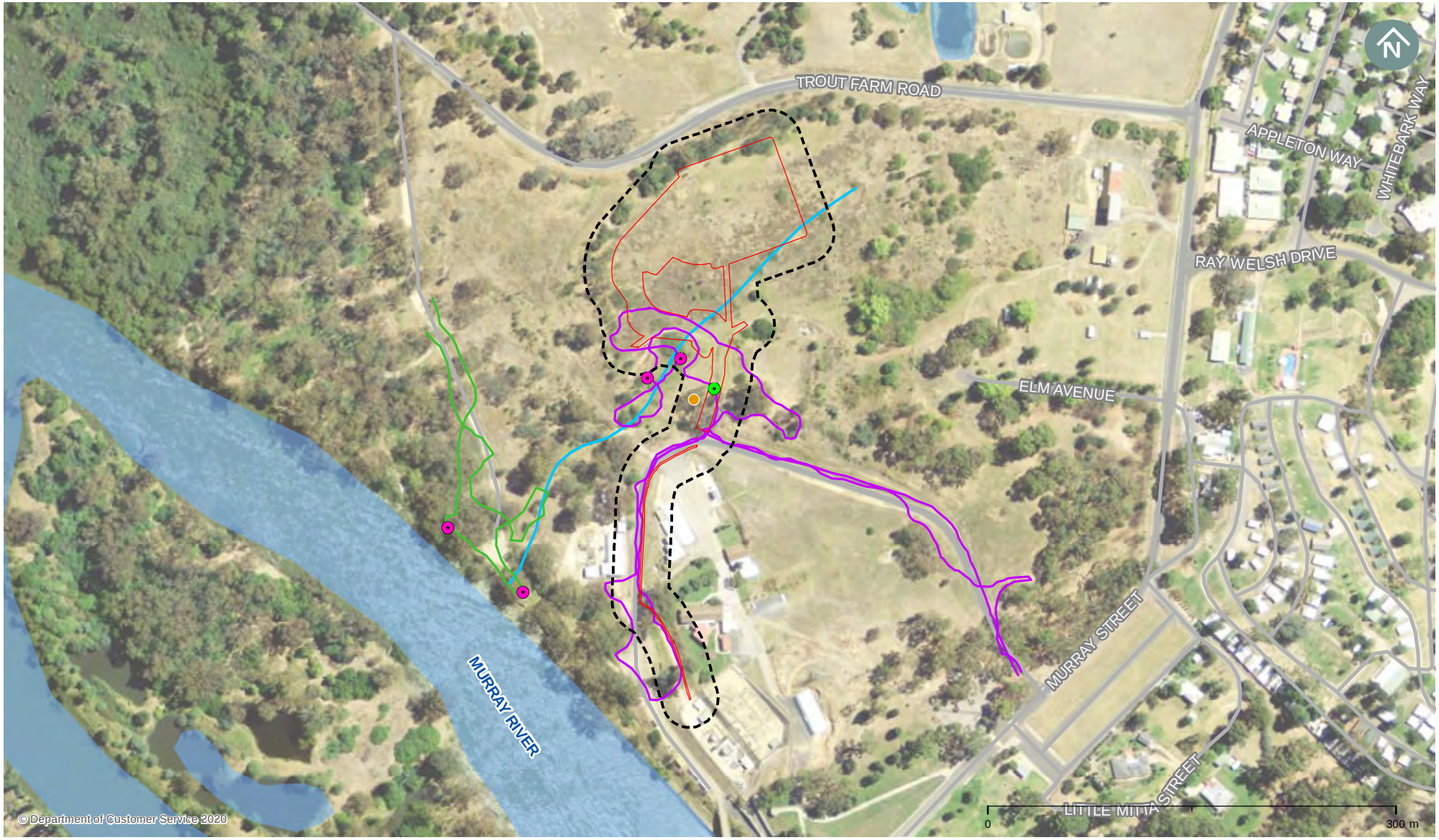


Figure 2-3 Threatened animal surveys

3. Landscape features

3.1 IBRA Bioregions and sub-regions

The development site is located in the NSW South Western Slopes Bioregion (IBRA 7), within the Inland Slopes subregion (Thackway and Cresswell, 1995) (see Error! Reference source not found. and Error! Reference source not found.).

3.2 BioNet NSW Landscapes

The development site is located on the Murray Channels and Floodplains landscape as mapped by the NSW National Parks and Wildlife Service (NPWS) (2002) and described by the then NSW Department of Environment and Climate Change (2001).

The Murray Channels and Floodplains landscape is characterised by active channels and seasonally inundated floodplains of the Murray streams in Quaternary alluvium with associated billabongs, swamps, channels, levees and source bordering dunes, relief to 10 m. The landscape also includes scalded alluvial flats, broad elevated floodplains and associated relict channels and isolated sandy rises, relief to 5 m. Channel banks of grey and brown clays are characterised by vegetation consisting of river red gum (*Eucalyptus camaldulensis*), black box (*Eucalyptus largiflorens*), and river cooba (*Acacia stenophylla*). River red gum around billabongs has dense lignum (*Muehlenbeckia cunninghamii*), common reed (*Phragmites australis*) and cumbungi (*Typha orientalis*). Flats comprise silty or cracking grey clays, rimmed with black box, lignum, and canegrass (*Eragrostis australasica).* The highest flooded terraces are of brown clays or red-brown texture-contrast soils and carry yellow box (*Eucalyptus melliodora*). Dunes and sandplains of deep sandy brown soils or texture-contrast soils, locally calcareous, with belah (*Casuarina cristata*), white cypress pine (*Callitris glaucophylla*), mallee (*Eucalyptus* sp.), rosewood (*Alectryon oleifolius*), needlewood (*Hakea leucoptera*) and marginal clumps of black box, belah, prickly wattle (*Acacia victoriae*) over bluebush (*Maireana* sp.) and grasses (NSW Department of Environment and Climate Change 2001).

The Murray Channels and Floodplains landscape is estimated as being 56 percent cleared.

3.3 Rivers, streams and estuaries

The development site is located entirely within the Murray Riverina catchment. The Murray River is a ninth order stream (Strahler) which feeds into the Hume Dam. It is located approximately 65 metres southwest from closest point of the development footprint (trenching work along the existing access road). The Hume Dam is located immediately downstream of the Murray River and Mitta Mitta River confluence, 16 kilometres east of Albury. Hume Dam is the major operating storage of the River Murray system. The storage regulates the River Murray, and re-regulates water discharged from the Snowy Mountains Hydro-electric Scheme.

Other waterways in the 1,500-metre landscape buffer include several unnamed first and second order tributaries (see Error! Reference source not found. and Error! Reference source not found.).

3.4 Wetlands

The Hume Dam (artificial dam) is located approximately 530 metres to the south of the development footprint. There are no other wetlands located within the 1,500-metre landscape buffer apart from farm dams and small areas of impeded drainage.

3.5 Connectivity of habitat

According to the BAM, for development sites, the assessor must identify the connectivity of different areas of habitat that may facilitate the movement of threatened species across their range. The riparian woodland and habitats surrounding the Hume Dam and the Murray River are physically connected to the vegetation in and around the development site through approximately 150 metres of scattered woody vegetation. Scattered

isolated patches of remnant woodland and young regrowth and planted native and exotic vegetation characterise the vegetation on and surrounding the development site. East-west connectivity currently exists through the development site within this vegetation for more mobile species, such as birds and bats. There are no intact patches of native vegetation within the development site.

3.6 Areas of geological significance and soil hazard features

Areas of geological significance generally include karst, caves, crevices and cliffs. There are no areas of geological significance within or adjacent to the development site.

3.7 Areas of outstanding biodiversity value

The proposed development site does not contain any areas of outstanding biodiversity value listed on the register of declared areas of outstanding biodiversity value.

3.8 Native vegetation extent

The 1,500-metre landscape buffer is approximately 847 hectares in size and contains approximately 130 hectares of native vegetation (excluding derived native grasslands) (refer Error! Reference source not found.**)**. This area was calculated with a combination of available regional mapping (i.e. VIS_ID 4469), aerial imagery and native vegetation mapped within the study area as part of this assessment. This results in a percent native vegetation cover in the landscape of approximately 15 percent. Therefore, native vegetation cover in the landscape is in the '10 – 30 percent' cover class. These calculations are an approximation only based on existing regional mapping and aerial imagery.

4. Native vegetation and vegetation integrity

This section outlines the native vegetation within and directly adjacent to the development site.

4.1 Plant community type descriptions

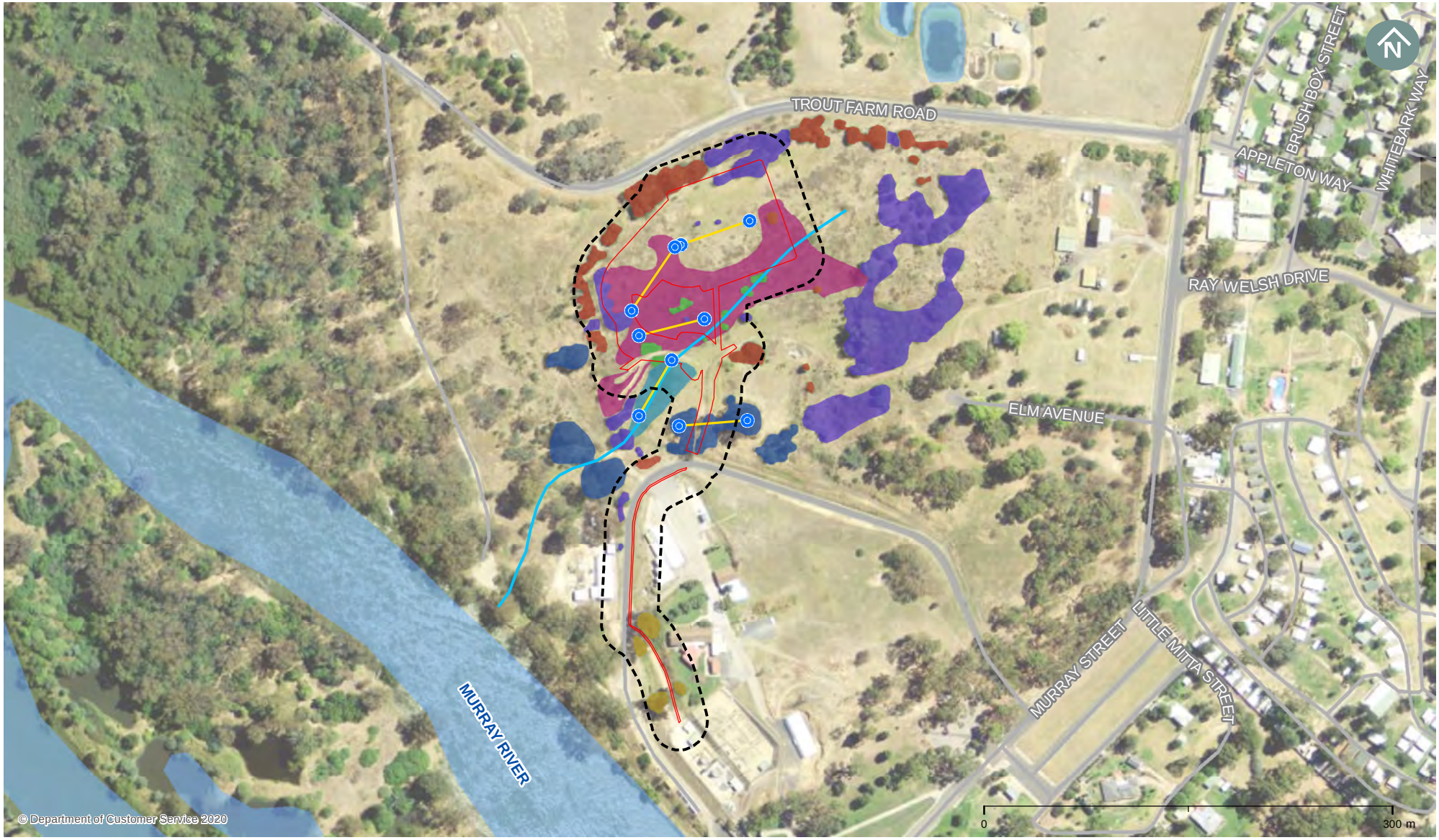
This BDAR describes PCTs in terms of their floristic composition, geological substrate and relevant regional vegetation classification. The distribution of PCTs within the development site is outlined in **Figure 4-1**. Descriptions of the vegetation that occurs in the development site are provided below and matched to the most likely PCT as described in the BioNet Vegetation Classification database. In some cases, the vegetation on site does not strictly meet the definition of a PCT as per the BioNet Vegetation Classification database so the vegetation has been allocated to the PCT with which it most closely aligns. The mapping provided in this BDAR is supported by on ground observations and quantitative data. Plant communities are naturally variable and the boundaries between different PCTs can be difficult to identify, particularly for derived native grasslands. However, a choice must be made to map and assign a PCT to a particular area of the site.

The development site is located within a highly modified landscape. Historical imagery shows most of the site was clear of vegetation in 1961. The imagery also shows rows of planted vegetation along the western and northern (Trout Farm Road) boundaries of the development site. The planted vegetation consists primarily of native non-indigenous shrub species that are not characteristic of the local PCT according to the BioNet Vegetation Classification database. Therefore, it was not possible to assign this planted vegetation to a PCT.

Table 4-1 provides a summary of the PCTs found within and adjacent to the development site.

Table 4-1 Plant community types and vegetation zones identified in the development site footprint and adjacent study area

Vegetation zone	Plant community type ID No.	Plant community type name	Broad condition class	Vegetation zone area (ha)	
				Development site	Study area
1	266	White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion	Moderate	0.02	0.17
2			Derived native grassland	0.41	0.83
3	5	River Red Gum herbaceous-grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the eastern Riverina Bioregion	Carex wetland	0.01	0.07
4			Poor	0	0.06
			SUB-TOTAL	**0.43 ha**	**1.08 ha**
5	N/A	Planted native trees and shrubs	Planted	0.01	0.22
			TOTAL	**0.44 ha**	**1.3 ha**



Study area
Development site
Drainage line
Waterbodies
Vegetation integrity plots
Vegetation integrity transects

Plant community types
Blackberry
Exotic Trees and Shrubs
Planted Native Trees and Shrubs
River Red Gum herbaceous-grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the eastern Riverina Bioregion (PCT 5) - Carex appressa wetland
River Red Gum herbaceous-grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the eastern Riverina Bioregion (PCT 5) - Poor
White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion (PCT 266) - Derived grassland
White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion (PCT 266) - Poor

Figure 4-1 Map of plant community types

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Created by : AA | QA by : LC

4.1.1 White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion (PCT 266)

Vegetation formation: Grassy Woodlands

Vegetation class: Western Slopes Grassy Woodlands

Classification confidence level (BioNet): High

Vegetation zones / survey effort / extent in development site:

- Zone 1 (Poor) / One plot (Plot 3) / 0.02 ha
- Zone 2 (Derived native grassland) / Two plots (Plot 1 and Plot 5) / 0.41 ha

The White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion (PCT 266) is described in the BioNet Vegetation Classification database as a tall woodland with trees to 25 metres high dominated by White Box (*Eucalyptus albens*) often as the only tree species. Kurrajong (*Brachychiton populneus* subsp. *populneus*) is often present, particularly on limestone or rocky ground. *Eucalyptus bridgesiana*, *Eucalyptus blakelyi* or *Eucalyptus melliodora* may also be present as minor components of the canopy. The shrub layer is usually sparse or absent depending on grazing history or soil type. Wattles are common shrubs including *Acacia decora*, *Acacia implexa*, *Acacia pycnantha*, *Acacia deanei* subsp. *paucijuga*, *Acacia genistifolia*, *Acacia penninervis* var. *penninervis*, *Acacia buxifolia* subsp. *buxifolia* and *Acacia paradoxa*. Other shrubs include *Dodonaea viscosa* subsp. *cuneata*, *Bursaria spinosa* subsp. *spinosa* and *Cassinia* spp. The ground cover is usually mid-dense to dense except during drought and may be very diverse in grass and forb species. Very few areas contain a native ground cover with a rich flora but where this occurs it typically contains grasses such as *Themeda australis*, *Poa sieberiana*, *Elymus scaber* var. *scaber* and a range of *Austrodanthonia* species including *Monachather paradoxus* and *Austrodanthonia auriculata*. Forbs in such sites include *Wurmbea dioica*, *Gonocarpus elatus*, *Microseris lanceolata*, *Leptorhynchos squamatus* sens lat., *Craspedia variabilis*, *Podolepis jaceoides*, *Hypericum gramineum*, *Stackhousia monogyna*, *Ranunculus lappaceus*, *Dichopogon strictus*, *Velleia paradoxa* and *Diuris dendrobioides*. In heavily grazed sites fewer native species are present and the sites are dominated by *Austrostipa* spp, *Aristida* spp. and *Austrodanthonia* spp. Grasses with some hardy forbs such as *Calotis* spp, *Xerochrysum viscosa*, *Vittadinia cuneata*, *Wahlenbergia luteola*, *Solenogyne dominii*, *Scutellaria humilis* and *Oxalis perennans*. In sites exposed to continuous grazing, soil disturbance and fertilizer application, exotic species dominate the ground cover including *Bromus* spp., *Vulpia* spp., *Avena fatua*, *Echium plantagineum*, *Trifolium* spp. and *Plantago lanceolata*.

Floristic composition varies from north to south and on different aspects and soil types. Occurs between 300 - 600 m altitude in the 500 - 700 mm rainfall zone, most of which falls in winter. The soils are mainly red-brown earths, red or yellow podsols with some brown and black earths. The soils are derived from a variety of lithologies including shale, limestone, fine grained metamorphic rocks, granite and basalt. Species composition appears not to vary greatly across these lithologies. Mainly occurs on hillslopes in low hill or hill landform patterns in the NSW South-western Slopes Bioregion overlapping into the South Eastern Highlands Bioregion. Most of this community has been cleared and most of the extent of ground cover has been replaced by exotic annual plant species. Sheet erosion has led to top soil loss on heavily grazed slopes. Small areas with an "intact" ground cover remain in cemeteries, roadsides and travelling stock reserves. While this community is poorly sampled in public reserves, some progress is being made in protecting remnants in non-reserve conservation measures. PCT 266 is a highly threatened plant community due to ground cover change and clearing.

The White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion PCT (PCT 266) is widely mapped in the surrounding locality by State Vegetation Type Map: Riverina Region Version v1.2 - VIS_ID 4469 (Department of Planning, Industry and Environment 2020). Areas of this PCT identified in and around the development site are scattered isolated remnants and paddocks trees and are not included in the State Vegetation Type Map 4469, however these areas are mapped as 'Grassy Box Gum Woodland' by the Extant Vegetation Map of Albury Shire VIS_ID 3926 (Department of Planning, Industry and Environment 2013).

Photograph 1: Plot 3 in Vegetation Zone 1 showing a small patch of White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion PCT (PCT 266) near the proposed access track.

The White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion PCT (PCT 266) has a classification confidence level in the VIS of High. Therefore, classification of this vegetation to the PCT 266 is relatively straightforward and the vegetation is not considered likely to be representative of any other PCT.

This vegetation within the study area is highly disturbed and in poor condition. Patches of woodland are characterised by remnant mature *Eucalyptus albens* (White Box) and *Acacia implexa* (Hickory Wattle) (Photograph 1). This PCT is also present as a derived native grassland, lacking any native canopy and dominated by exotic grass *Avena* sp. (Wild Oats) but also comprised diagnostic understorey species with a low abundance and cover of native grasses including *Themeda triandra* (Photograph 2 and Photograph 3). The vegetation is most likely to be PCT 266 for the following reasons:

- The upper stratum of the woodland patch contains typical species of PCT 266 including *Eucalyptus albens*
- The mid stratum of the woodland patch contains typical species of PCT 266 including *Acacia implexa*
- The ground cover of the woodland and derived native grassland contains typical species of PCT 266 including *Themeda triandra*, *Microlaena stipoides*, *Lomandra multiflora, Lomandra filiformis* and *Senecio quadridentatus.*

A summary of the vegetation structure and floristics of PCT 266 as it occurs in the study area is provided in the table below. The list of species recorded at each survey site is provided in Appendix A and reflects the local variation of species gathered from the survey.

Photograph 2: Plot 1 in Vegetation Zone 1 showing a derived native grassland variant of the White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion PCT (PCT 266)

Photograph 3: Plot 5 in Vegetation Zone 1 showing a derived native grassland variant of the White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion PCT (PCT 266)

This PCT forms part of the White Box Yellow Box Blakely's Red Gum Woodland which is listed as an endangered ecological community (EEC) under the BC Act. The condition of this PCT is such that it does not meet the condition criteria to be part of the Critically Endangered White Box- Yellow Box- Blakely's Red Gum Grassy Woodland and Derived Native Grassland under the EPBC Act as listed under the EPBC Act (refer to **Section 7.2** for discussion).

Table 4-2 Floristic and structural summary of PCT 266 within the development site

Vegetation layer	Dominant species
Tree canopy (upper stratum)	*Eucalyptus albens*
Midstorey (mid-stratum)	*Acacia implexa*
Groundcovers (ground stratum)	*Carex appressa, Carex inversa, Themeda triandra, Microlaena stipoides, Lomandra multiflora, Lomandra filiformis, Juncus australis and Senecio quadridentatus*
Exotic species	*Avena fatua, Hordeum* sp., *Cirsium vulgare, Briza maxima, Echium plantagineum, Plantago lanceolata, Galium aparine, Cerastium glomeratum, Trifolium angustifolium, Trifolium repens, Poa annua, Setaria parviflora, Cenchrus clandestinus, Sonchus asper, Prunus sp., Hypochaeris radicata, Verbena bonariensis, Trifolium repens, Trifolium campestre and Cirsium vulgare*
High Threat Weeds	*Rubus fruticosus* sp. agg., *Acetosella vulgaris, Holcus lanatus, Paspalum dilatatum, Phalaris aquatica, Ligustrum lucidum, Hypericum perforatum, Asparagus asparagoides, Vinca major*

4.1.2 River Red Gum herbaceous – grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the eastern Riverina Bioregion (PCT 5)

Vegetation formation: Forested Wetlands

Vegetation class: Inland Riverine Forests

Classification confidence level (BioNet): Medium

Vegetation zones / survey effort / extent in development site:

- Zone 3 (*Carex* wetland) / One plot (Plot 2) / 0.01 ha

River Red Gum herbaceous-grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the eastern Riverina Bioregion (PCT 5) is described in the BioNet Vegetation Classification database as a very tall open forest dominated by River Red Gum (*Eucalyptus camaldulensis* subsp. *camaldulensis*) with trees averaging about 25 metres high and a canopy cover of about 40 percent. The shrub layer is sparse or absent with Mountain Cedar Wattle (*Acacia dealbata*) sometimes present. The ground cover may be mid-dense or dense and is dominated by grass species such as *Poa labillardieri*, *Lachnagrostis filiformis* and *Hemarthria uncinata* var. *uncinata* along with sedges such as *Carex tereticaulis*, *Carex inversa* and *Carex appressa* and rushes such as *Juncus amablis* and *Juncus subsecundus*. Forb species include *Ranunculus* spp., *Persicaria prostrata*, *Wahlenbergia fluminalis*, *Lobelia concolor* and *Centipeda cunninghamii*. Weed species may be common and include *Bromus hordeaceus*, *Cirsium vulgare*, *Vulpia bromoides*, *Verbena officinalis*, *Hypochaeris radicata*, *Lolium perenne*, *Lolium rigidum* and *Cyperus eragrostis*. Occurs on silty-sandy loam-clay soils on levees or other raised landform elements adjacent to rivers and wetlands. Mainly distributed along the Murray and Murrumbidgee Rivers with small areas on the Lachlan River in the temperate (hot summer) and semi-arid (warm) climate regions of south-western NSW and Victoria. Most common east of Deniliquin and replaced by other River Red Gum floristic types to the west of there. The main threats are dieback from extended drought and lack of flooding regimes due to reduced water flows and flooding, weed invasion and over-logging. Tree dieback from drought has increased since 2000.

River Red Gum herbaceous-grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the eastern Riverina Bioregion (PCT 5) is widely mapped along the Murray River by State Vegetation Type Map: Riverina Region Version v1.2 - VIS_ID 4469 (Department of Planning, Industry and Environment 2020). Areas of this PCT identified in and around the development site consist of scattered isolated remnants trees and a small wetland dominated *Carex appressa* along a natural drainage line. These areas are not included in the State Vegetation Type Map 4469, however large areas of this PCT are mapped adjacent to the development site along the Murray River.

This vegetation is considered most likely representative of PCT 5 based on the species composition observed on site and the landscape position around the Murray River. River Red Gum herbaceous – grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the eastern Riverina Bioregion (PCT5) has a classification confidence level of 'medium' (BioNet). There are several other PCTs mapped in the region (VIS_ID 4469) that have similar floristic composition and landscape position (PCT 2, PCT 278, PCT 335, PCT 336), however the vegetation is considered most likely to be representative of PCT5 for the following reasons:

- The scattered remnant trees are *Eucalyptus camaldulensis* subsp. *camaldulensis*, being a typical canopy species for PCT 5, and occur in proximity to the Murray River. The landscape position discounts PCT 2 as it occurs in frequently flooded sites bordering river channels and in low-lying areas away from the river, and PCT 278 as it occurs in gullies and on creek flats in hilly terrain or along creeks on plateaux.
- The small wetland located along the drainage line is missing canopy trees, however the ground cover dominated by *Carex appressa,* which is a species typical of PCT 5. *Carex appressa* is also characteristic of PCT 335 and PCT 366. However, both these PCTs are described as occurring in drainage depressions and

valley flats along watercourses. In contrast the vegetation in the development site is located along a moderately steep drainage line that has been partially dammed at one end, creating an area of standing water. Considering the disturbed and modified nature of the vegetation in the development site and the proximity of vegetation mapped as PCT 5 around the Murray River, the most likely choice would be PCT 5.

Photograph 4: Plot 2 in Vegetation Zone 3 (looking back up the drainage line) showing the River Red Gum herbaceous – grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the eastern Riverina Bioregion (PCT 5).

A summary of the vegetation structure and floristics of PCT 5 as it occurs in the study area is provided in the table below. The list of species recorded at each survey site is provided in **Appendix A**.

There are no threatened ecological communities listed under the BC Act associated with this PCT. Furthermore, this vegetation is not listed as a threatened ecological community under the EPBC Act.

Table 4-3 Floristic and structural summary of PCT 5 within the development site

Vegetation layer	Dominant species
Tree canopy (upper stratum)	*Eucalyptus camaldulensis*
Midstorey (mid-stratum)	*Acacia implexa*
Groundcovers (ground stratum)	*Carex appressa, Baumea acuta*
Exotic species	*Aster subulatus, Avena fatua, Cenchrus clandestinus, Cirsium vulgare, Cyperus brevifolius, Galium aparine, Echium plantagineum, Rumex crispus, Verbena bonariensis, Solanum mauritianum, Sonchus asper and Taraxacum officinale*
High Threat Weeds	*Acetosella vulgaris, Holcus lanatus, Ligustrum lucidum, Paspalum dilatatum, Phalaris aquatica, Rubus fruticosus sp., Robinia pseudoacacia and Vinca major*

4.2 Vegetation zones and vegetation integrity score

A description of the vegetation zones identified within the development site and the corresponding vegetation integrity score developed from the Biodiversity Assessment Calculator is presented in **Table 4-4**. The vegetation integrity survey plot data is provided in **Appendix C**. Vegetation zone 4 is not within the development site.

Table 4-4 Vegetation zones and vegetation integrity scores for the South East Highlands bioregion

Vegetation zone	Plant community type ID No.	Plant community type name	Broad condition class	Vegetation zone area in development site (ha)	Vegetation integrity score
1	266	White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion	Poor	0.02	31.6
2			Derived grassland	0.41	3.2
3	5	River Red Gum herbaceous-grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the eastern Riverina Bioregion.	Carex wetland	0.01	21.9

4.3 Patch size

The native vegetation within the development footprint is all part of the same vegetation patch according to the definition of a patch as provided in the BAM. The White Box habitat to the West of the development site is connected as there is woody vegetation separated by less than or equal to 100 metres from the next area of intact native vegetation creating corridors. This patch of vegetation does not, however cross over the Murray River. The habitat towards the north and east of the development site is disconnected to any other habitat.

As the vegetation within the development site is connected to the habitat along the Murray River, the patch size is approximately 16 hectares. Therefore, for the purposes of the assessment, the patch size is in the five to 24-hectare size class.

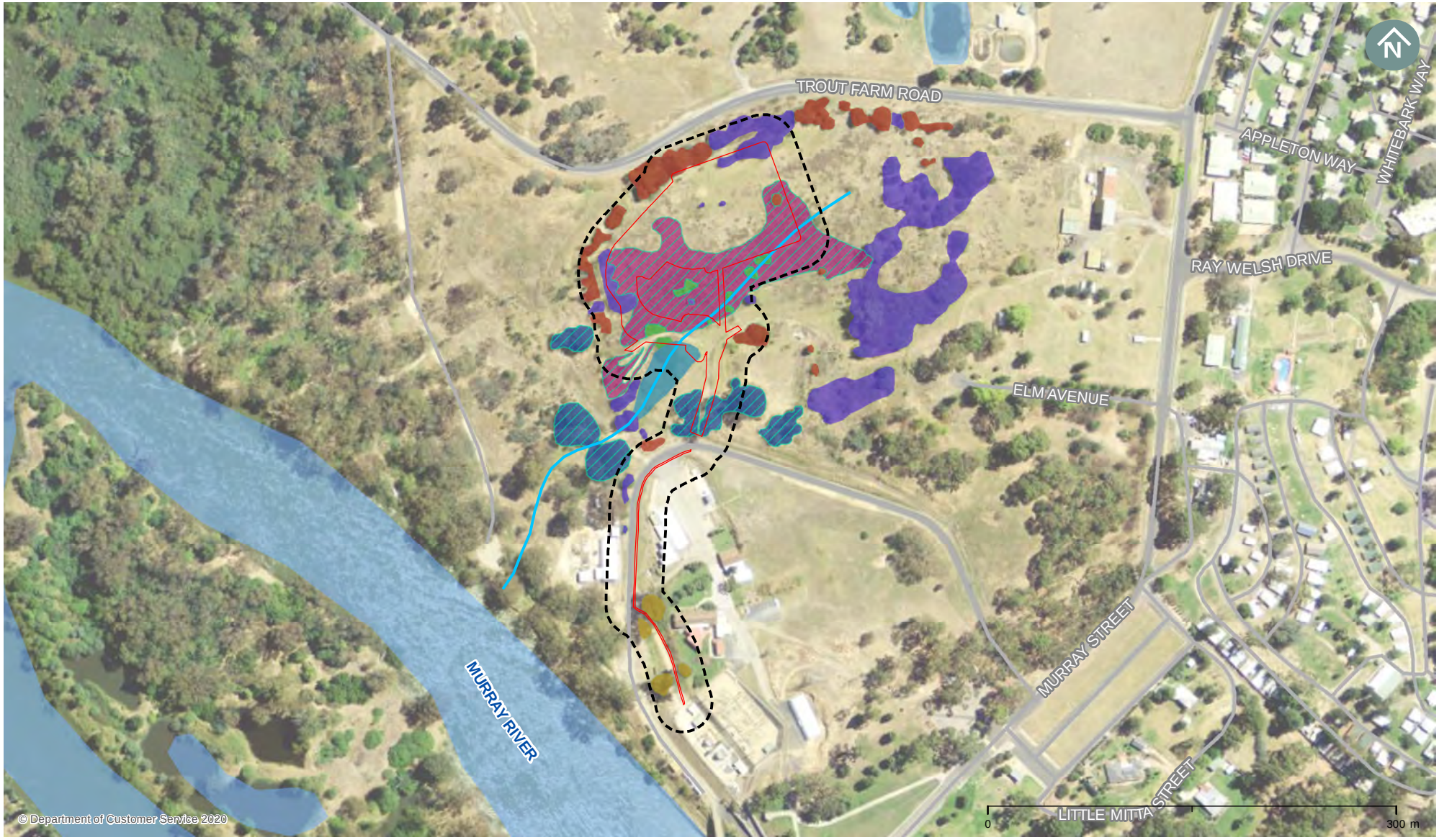
4.4 Threatened ecological communities

One Threatened Ecological Community (TEC) listed under the BC Act occurs in the development site (refer **Figure 4-2**):

- White Box Yellow Box Blakely's Red Gum Woodland (Endangered).

A detailed description of White Box Yellow Box Blakely's Red Gum Woodland is provided in the NSW Scientific Committee final determination (NSW Scientific Committee 2011). White Box Yellow Box Blakely's Red Gum Woodland includes those woodlands where the characteristic tree species include one or more of the following species in varying proportions and combinations - *Eucalyptus albens* (White Box), *Eucalyptus melliodora* (Yellow Box) or *Eucalyptus blakelyi* (Blakely's Red Gum). Grass and herbaceous species generally characterise the ground layer. In some locations, the tree overstorey may be absent as a result of past clearing or thinning and at these locations only an understorey may be present. Shrubs are generally sparse or absent, though they may be locally common.

This description corresponds to PCT 266 in the study area and development site. The areas of this TEC in the study area are mostly in poor condition, represented by scattered remnant *Eucalyptus albens* and regrowth native species amongst plantings and weed growth. Historically, the development site is likely to have been covered by PCT 266, however has been cleared and now currently consists of grassland dominated by exotic species. Native groundcover species are present with low cover, including *Themeda triandra*, *Microlaena stipoides* and *Lomandra filiformis*. According to the final determination (NSW Scientific Committee 2011), these areas would still meet the description of this TEC as a derived grassland. This derived grassland represents the largest occurrence of the TEC in the development site.



Study area
Development site
Drainage line
Waterbodies

BC Act
White Box Yellow Box Blakely's Red Gum Woodland (Endangered BC Act)

Plant community types
Blackberry
Exotic Trees and Shrubs
Planted Native Trees and Shrubs
River Red Gum herbaceous-grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the eastern Riverina Bioregion (PCT 5) - Carex appressa wetland
River Red Gum herbaceous-grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the eastern Riverina Bioregion (PCT 5) - Poor
White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion (PCT 266) - Derived grassland
White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion (PCT 266) - Poor

Figure 4-2 Map of threatened ecological communities

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Created by : AA | QA by : LC

4.5 Groundwater dependent ecosystems

The level of groundwater dependence of vegetation communities in the development site has been identified using the *Atlas of Groundwater Dependent Ecosystems* (GDEs) (Bureau of Meteorology, 2017) and the *Risk Assessment Guidelines for Groundwater Dependent Ecosystems* released by the former NSW Department of Primary Industries (Kuginis et al., 2012). The mapping of GDEs provided by the Atlas of GDEs provides an indication whether a GDE may be present but the mapping is based on a coarse regional vegetation mapping dataset and does not accurately reflect on-ground conditions.

Three aquatic GDEs and three terrestrial GDEs were identified in the 1,500-metre landscape buffer on the Atlas of GDEs (refer **Table 4-5**). The three aquatic GDEs listed in **Table 4-5** refer to the Murray River (Connector) and two wetlands associated with low-lying areas around the river; one on the south bank near the Murray River Reserve and one along a modified semi-artificial offshoot of the Murray River north of the development site.

Table 4-5 Groundwater Dependent Ecosystems (Atlas of GDEs)

Type of GDE	Supplied ecosystem type	GDE potential
Aquatic	Connector (Murray River)	High – from national assessment
	Floodplain water body (Wetland)	High – from national assessment
	Palustrine: Temporary freshwater swamps (Wetland)	Low – from regional studies
Terrestrial	River Red Gum herbaceous-grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion	High – from regional studies
	Plains Grassy Woodland	Moderate – from national assessment
	White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion	Low – from regional studies

Based on the results of the field surveys undertaken for this BDAR and examination of the *State Vegetation Type Map: Riverina Region Version v1.2 - VIS_ID 4469* (Department of Planning, Industry and Environment 2020), there is potential for groundwater dependent vegetation types to be present. The following plant community types were identified during field surveys:

- White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion PCT (PCT 266)
- River Red Gum herbaceous-grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion (PCT 5)

These PCTs are considered with a low to high likelihood to be terrestrial GDEs. However, these PCTs are not obligate GDEs (i.e. they are not entirely dependent on groundwater). These PCTs are likely to be opportunistic facultative GDEs that may depend on the subsurface presence of groundwater (often accessed via the capillary fringe – subsurface water just above the water table) in some locations but not in others. This capillary water may be accessed by the plants where an alternative source of water (i.e. rainfall) cannot be accessed to maintain ecological function. As the plants within these PCTs may at times rely on capillary water in the soil that rises from the water table, any lowering of the water table may result in a reduction in groundwater availability and declining vegetation health during low rainfall periods.

However, if the groundwater table is shallow where the potential GDE occurs, and there is no perched aquifer above the water table (separated from the water table by a layer of impermeable rock or sediment), then impacts on vegetation health may occur.

5. Habitat suitability for threatened species

The Biodiversity Assessment Calculator was used to derive the list of candidate species for this assessment, but the results were also supplemented with database searches, including a review of the Threatened Biodiversity Data Collection, to identify the threatened species that have been recorded by previous surveys or are considered likely to occur in the broader locality and development site. This section provides the results of the habitat suitability assessment for threatened species as outlined in Section 6 of the BAM.

5.1 Habitat suitability for species that can be predicted by habitat surrogates (ecosystem credit species)

Ecosystem credit species are those threatened species where the likelihood of occurrence of a species or elements of the species' habitat can be predicted by vegetation surrogates and landscape features, or for which targeted survey has a low probability of detection. Ecosystem credit threatened species have been assessed in conjunction with information about site context (**Section 4.3** and **subsection 5.3.2** of the BAM), PCTs and vegetation integrity attributes (Chapter 5 of the BAM), and data from the Threatened Biodiversity Data Collection (Section 6.1 of the BAM).

The Biodiversity Assessment Calculator was used to generate a list of the predicted threatened species that met the criteria outlined in Section 6.4.1.3 of the BAM. The results of the BioNet search and the federal Department of the Agriculture, Water and the Environment and the PMST were also used to inform development of the species list.

The initial list of predicted ecosystem credit species is provided in . The full threatened species habitat suitability assessment is provided in **Appendix A**. Once the initial list of predicted ecosystem credit species was generated, the geographic limitations of each species (where applicable) were examined to see if they were met. Geographic limitations usually relate to altitude or topographic features. Where the development site is not within the geographic limitation described for a species, the species was removed from the predicted list of threatened species and no further assessment was undertaken.

In accordance with paragraphs 6.4.1.9 – 6.4.1.16 (Step 2) of the BAM, an onsite assessment was undertaken to determine the presence of any habitat constraints or microhabitats for the threatened species predicted to occur on the development site. Some species do not have any identified habitat constraints, in which case this step was not undertaken. The justification for including or excluding ecosystem credit species from the assessment is provided in **Table 5-1**.

The remainder of the ecosystem credit species outlined in **Appendix A** do have suitable habitat within and adjacent to the proposed development footprint, albeit limited in size, and would therefore need to be addressed in future assessment under the BAM. Under the BAM, targeted survey is not required for ecosystem credit species. However, in some circumstances, the Threatened Biodiversity Data Collection may identify that a species requires assessment for ecosystem credits and species credits (a dual credit species). This occurs where part of the habitat is assessed as a species credit (e.g. breeding habitat, or mapped locations identified as important area that is used by a species). The remaining part of the habitat is assessed as an ecosystem credit (e.g. foraging habitat, unmapped locations used by a species). Therefore, some species are listed in both **Table 5-1** and **Table 5-2** as an ecosystem credit species and a species credit species.

Table 5-1 Summary of predicted ecosystem credit species that were assessed

Species name	Common name	EPBC Act *	BC Act *	Justification for inclusion / exclusion	Sensitivity to gain class
Birds					
Anthochaera phrygia	Regent Honeyeater (foraging)	CE	CE	Included. This species may occasionally forage in nectar producing *Eucalyptus camaldulensis* and *Eucalyptus albens* during flowering periods.	High
Artamus cyanopterus cyanopterus	Dusky Woodswallow	-	V	Included. This species is commonly seen in the locality and may forage in or over the vegetation in and adjacent to the development site.	Moderate
Callocephalon fimbriatum	Gang-gang Cockatoo (foraging)	-	V	Included. May occur in study area on occasion in winter. No breeding habitat in development site.	High
Calyptorhynchus lathami	Glossy Black Cockatoo	-	V	Excluded. There is no suitable foraging habitat within the Development site.	High
Chthonicola sagittata	Speckled Warbler	-	V	Included. This species may pass through the study area on occasion.	High
Circus assimilis	Spotted Harrier	-	V	Included. This species may forage over the study area.	Moderate
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	-	V	Included. This species is known to occur around riparian vegetation and may come up into the development site on occasion.	High
Daphoenositta chrysoptera	Varied Sittella	-	V	Included. This species is commonly seen in the locality and may forage in or over the vegetation in and adjacent to the development site.	Moderate
Glossopsitta porphyrocephala	Purple-crowned Lorikeet	-	V	Included. This species is commonly seen in the locality and may forage in or over the vegetation in and adjacent to the development site.	High
Glossopsitta pusilla	Little Lorikeet	-	V	Included. This species is commonly seen in the locality and may forage in or over the vegetation in and adjacent to the development site.	High
Grantiella picta	Painted Honeyeater	V	V	Included. This species may forage in trees and the fruits of mistletoe in the development site on occasion.	Moderate
Haliaeetus leucogaster	White-bellied Sea-Eagle (foraging)	M	V	Included. This species may fly over and perch in the development site on occasion. There is unlikely to be any suitable breeding habitat present.	High
Hieraaetus morphnoides	Little Eagle (foraging)	-	V	Included. This species may fly over and perch in the development site on occasion. There is unlikely to be any suitable breeding habitat present.	Moderate
Lathamus discolor	Swift Parrot (foraging)	CE	E	Included. The vegetation in the development site does not represent any significant foraging or nesting opportunities for this species. While this species is unlikely to use the development site on a permanent basis, temporary foraging cannot be discounted.	Moderate

Species name	Common name	EPBC Act *	BC Act *	Justification for inclusion / exclusion	Sensitivity to gain class
Lophoictinia isura	Square-tailed Kite (foraging)	-	V	Included. This species may fly over and perch in the development site on occasion. There is unlikely to be any suitable breeding habitat present.	Moderate
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	-	V	Excluded from the assessment as there is no habitat in the development site considered suitable for this species. There are some records of this species in the locality.	Moderate
Melithreptus gularis Gularis	Black-chinned Honeyeater (eastern subspecies)	-	V	Included. There is potential foraging habitat within the development site for this species. Vagrant birds may appear on occasion.	Moderate
Neophema pulchella	Turquoise Parrot	-	V	Included. There is potential foraging habitat within the development site for this species.	High
Ninox strenua	Powerful Owl (foraging)	-	V	Included. This species may fly over and perch in the development site on occasion. There is no suitable breeding habitat present.	High
Pachycephala inornata	Gilbert's Whistler	-	V	Included. Although there are no records of this species in the locality, it is known from River Red Gum woodland along the Murray River. May occur in the development site on occasion.	Moderate
Petroica boodang	Scarlet Robin	-	V	Included. This species may occur in higher-quality vegetation around the development site and pass through it on occasion. However, there is no habitat in the development site considered suitable for this species.	Moderate
Petroica phoenicea	Flame Robin	-	V	Excluded from assessment. This species may occur in higher-quality vegetation around the development site and pass through it on occasion. However, there is no habitat in the development site considered suitable for this species.	Moderate
Polytelis swainsonii	Superb Parrot	V	V	Included. There is potential foraging habitat within the development site for this species.	High
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	-	V	Included. This species is uncommon in the locality however suitable habitat is present.	Moderate
Rostratula australis	Australian Painted Snipe	E	E	Excluded. There is no habitat in the development site considered suitable for this species. This species may occur in the river habitat near the development site on occasion, however the likelihood is considered low.	Moderate
Stagonopleura guttata	Diamond Firetail	-	V	Included. The species may inhabit and forage on the grassy woodlands, including the Box-Gum woodland, in the development area. However, as the development site is of low quality and unlikely to provide important habitat.	Moderate
Stictonetta naevosa	Freckled Duck	-	V	Excluded. No suitable habitat in the development site for this species.	Moderate

Species name	Common name	EPBC Act *	BC Act *	Justification for inclusion / exclusion	Sensitivity to gain class
Tyto novaehollandiae	Masked Owl (foraging)	-	V	Included. This species may fly over and perch in the development site on occasion. There is unlikely to be any suitable breeding habitat present.	High
Mammals					
Chalinolobus picatus	Little Pied Bat	-	V	Included. This species is most likely to forage in the woodland, depressions and moist areas in the development site as it flies around. However, there is no high-quality foraging habitat or breeding habitat in the development site.	High
Dasyurus maculatus	Spotted-tailed Quoll	E	V	Excluded from the assessment. The development site does not provide optimal habitat for this species. There is one record of this species from the locality, but it hasn't been recorded since 2002 and is unlikely to use the habitats in the development site.	High
Miniopterus orianae oceanensis	Large Bent-winged Bat (foraging)	-	V	Included. This species is most likely to forage in the woodland, depressions and moist areas in the development site as it flies around. However, there is no high-quality foraging habitat or breeding habitat in the development site.	High
Nyctophilus corbeni	Corben's Long-eared Bat	V	V	Included. This species is most likely to forage in the woodland, depressions and moist areas in the development site as it flies around. However, there is no high-quality foraging habitat or breeding habitat in the development site.	High
Phascolarctos cinereus	Koala (foraging)	V	V	Excluded from the assessment. *Eucalyptus camaldulensis* and *E. albens* are a primary and secondary food tree species. However, the known occurrence of this species within the locality is very rare. This species may pass through the development site on occasion, however the likelihood is considered low.	High
Pteropus poliocephalus	Grey-headed Flying-fox (foraging)	V	V	Included. This species is assumed to occur based on the presence of suitable foraging habitat and the proximity of several camps around Albury. There are no camps within the development site.	High
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	-	V	Included. There is potential foraging habitat within the development site. There are no suitable hollow-bearing trees within the development site, however some roosting habitat may be present. There is unlikely to be any breeding habitat in the development site.	High

*Key: CE = critically endangered, E = endangered, V = vulnerable, M = migratory

5.2 Habitat suitability for species that cannot be predicted by habitat surrogates (species credit species)

Habitat suitability is identified as the degree to which the habitat needs of threatened species are present at a particular site. Species credit species have been assessed in conjunction with information collected about the site context of the development site (Section 4.3 of the BAM), on PCTs and vegetation integrity attributes in

(Section 5 of the BAM), and data obtained from the Threatened Biodiversity Data Collection (Section 6.1 of the BAM).

Species credit species are threatened species or components of species habitat that are identified in the Threatened Biodiversity Data Collection as requiring assessment for species credits. Species credit species are those species for which the likelihood of occurrence, or elements of suitable habitat, cannot be confidently predicted by vegetation surrogates or landscape features. Species credit species can be reliably detected by survey. Based on the assessment of habitat in the development site, and review of databases and published information, the species credit species as outlined in **Table 5-2** are considered 'candidate species' for the assessment. The full threatened species habitat suitability assessment is provided in **Appendix A**.

Table 5-2 Summary of candidate species credit species returned by the BAM-Calculator

Species name	Common name	EPBC Act*	BC Act*	Sensitivity to gain class
Plants				
Acacia ausfeldii	Ausfeld's Wattle		V	High
Ammobium craspedioides	Yass Daisy	V	V	High
Cullen parvum	Small Scurf-pea		E	High
Euphrasia arguta	Euphrasia arguta	CE	CE	High
Grevillea wilkinsonii	Tumut Grevillea	E	CE	High
Swainsona recta	Small Purple-pea	E	E	Moderate
Swainsona sericea	Silky Swainson-pea		V	High
Birds				
Anthochaera phrygia	Regent Honeyeater (breeding)	CE	CE	High
Burhinus grallarius	Bush Stone-curlew	-	E	High
Callocephalon fimbriatum	Gang-gang Cockatoo (breeding)	-	V	High
Calyptorhynchus lathami	Glossy Black-Cockatoo	-	V	High
Haliaeetus leucogaster	White-bellied Sea-Eagle (breeding)	M	V	High
Hieraaetus morphnoides	Little Eagle (breeding)	-	V	Moderate
Lathamus discolor	Swift Parrot (breeding)	CE	E	Moderate
Lophoictinia isura	Square-tailed Kite (breeding)	-	V	Moderate
Ninox strenua	Powerful Owl (breeding)	-	V	High
Polytelis swainsonii	Superb Parrot	V	V	High
Tyto novaehollandiae	Masked Owl (breeding)	-	V	High
Mammals				
Miniopterus orianae oceanensis	Large Bent-winged Bat (breeding)	-	V	Very High
Myotis macropus	Southern Myotis	-	V	High
Petaurus norfolcensis	Squirrel Glider	-	V	High
Petrogale penicillata	Brush-tailed Rock-wallaby	V	E	Very High
Phascogale tapoatafa	Brush-tailed Phascogale		V	High
Phascolarctos cinereus	Koala (breeding)	V	V	High

Species name	Common name	EPBC Act*	BC Act*	Sensitivity to gain class
Pteropus poliocephalus	Grey-headed Flying-fox (breeding)	V	V	High
Frogs				
Crinia sloanei	Sloane's Froglet	E	V	Moderate
Reptiles				
Aprasia parapulchella	Pink-tailed Legless Lizard	V	V	High
Invertebrates				
Synemon plana	Golden Sun Moth	CE	E	Moderate

Key: CE = critically endangered, E = endangered, EP = endangered population, V = vulnerable, M = migratory

5.2.1 Identifying geographic and habitat constraints

Once the initial list of predicted candidate species credit species was generated, the geographic limitations of each species (where applicable) were examined to see if they were met. Where the development site is not within the geographic limitation described for a species, the species was removed from the predicted list of threatened species and no further assessment was undertaken. In accordance with paragraphs 6.4.1.9 – 6.4.1.16 (Step 2) of the BAM, an onsite assessment was undertaken to determine the presence of any habitat constraints or microhabitats for the threatened species predicted to occur on the development site. Some species do not have any identified habitat constraints, in which case this step was not undertaken. The species included or excluded based on habitat constraints or geographic limitations are outlined below in **Table 5-3.**

Table 5-3 Summary of candidate species credit species with geographic or habitat constraints

Species name	Common name	EPBC Act	BC Act	Habitat constraint	Geographic limitation	Justification for inclusion / exclusion
Plants						
Acacia ausfeldii	Ausfeld's Wattle	-	V	Footslopes and low rises on sandstone.	-	Excluded. The development site does not contain footslopes or low rises on sandstone.
Ammobium craspedioides	Yass Daisy	V	V	-	South of Cowra	Included. The development site contains disturbed box gum woodland and derived grassland.
Cullen parvum	Small Scurf-pea	-	E	-	-	Included. The development site contains disturbed woodland and derived grassland.
Euphrasia arguta	Euphrasia arguta	CE	CE	-	-	Included. The development site contains disturbed woodland and derived grassland.
Grevillea wilkinsonii	Tumut Grevillea	E	E	-	-	Excluded. This species is restricted to the Goobarragandra River.
Swainsona recta	Small Purple-pea	E	E	-	-	Included. The development site contains disturbed woodland and derived grassland.

Swainsona sericea	Silky Swainson-pea	-	V	-	-	Included. The development site contains disturbed woodland and derived grassland.
Birds						
Anthochaera phrygia	Regent Honeyeater (breeding)	CE	CE	As per mapped areas.	-	Excluded. The development site does not contain mapped Regent Honeyeater important habitat.
Callocephalon fimbriatum	Gang-gang Cockatoo (breeding)	-	V	Hollow bearing trees. Eucalypt tree species with hollows greater than 9 cm.	-	Excluded. No trees with hollows greater than 9 cm were identified in the development site.
Calyptorhynchus lathami	Glossy Black-Cockatoo (Breeding)	-	V	Hollow bearing trees. Living or dead tree with hollows greater than 15 cm diameter and greater than 5 m above ground.	-	Excluded. No trees with hollows greater than 15 cm or greater than 5 m above ground were identified in the development site.
Haliaeetus leucogaster	White-bellied Sea-Eagle (breeding)	M	V	Living or dead mature trees within suitable vegetation within 1 km of a rivers, lakes, large dams or creeks, wetlands and coastlines.	-	Excluded. The development site is within 1 km of the Hume Dam, however it lacks large emergent trees and the vegetation is generally in poor and disturbed condition.
Hieraaetus morphnoides	Little Eagle (breeding)	-	V	Nest trees - live (occasionally dead) large old trees within vegetation).	-	Excluded. The development site lacks large emergent trees and the vegetation is generally in poor and disturbed condition.
Lathamus discolor	Swift Parrot (breeding)	CE	E	As per mapped areas.		Excluded. There is no breeding habitat in the development footprint.
Lophoictinia isura	Square-tailed Kite (breeding)	-	V	Nest trees.	-	Excluded. The development site lacks large emergent trees and the vegetation is generally in poor and disturbed condition.
Ninox strenua	Powerful Owl (breeding)	-	V	Hollow bearing trees. Living or dead trees with hollow greater than 20 cm diameter.	-	Excluded. No trees with hollows greater than 20 cm were identified in the development site.
Polytelis swainsonii	Superb Parrot (Breeding)	V	V	Hollow bearing trees. Living or dead E. blakelyi, E. melliodora, E. albens, E. camaldulensis, E. microcarpa, E. polyanthemos, E. mannifera, E. intertexta with hollows greater than 5 cm diameter. Greater than 4m above ground or trees with a	-	Excluded. No trees with hollows greater than 5 cm or greater than 4 m above ground and DBH >30 cm identified within the development site.

				DBH of greater than 30 cm.		
Tyto novaehollandiae	Masked Owl (breeding)	-	V	Hollow bearing trees. Living or dead trees with hollows greater than 20 cm diameter.	-	Excluded. No trees with hollows greater than 20 cm were identified in the development site.
Mammals						
Miniopterus orianae oceanensis	Large Bent-winged Bat (breeding)	-	V	Cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding including species records with microhabitat code 'IC - in cave' observation type code 'E nest-roost' with numbers of individuals >500.	-	Excluded. The Development site does not contain any caves, tunnel, mine, culvert or other structures known to be used for breeding. There are no records of any type in the locality.
Myotis macropus	Southern Myotis	-	V	Hollow bearing trees. Within 200m of riparian zone. Bridges, caves or artificial structures within 200 m of riparian zone. Waterbodies: This includes rivers, creeks, billabongs, lagoons, dams and other waterbodies on or within 200m of the site.	-	Excluded. This species is rarely known more than 100m inland from the coast, except along major rivers. The species is likely to occur in areas around the Murray River, however the vegetation on the site is on the edge of the 200m buffer. The single hollow-bearing tree is not expected to be impacted by the development.
Petaurus norfolcensis	Squirrel Glider	-	V	-	-	Include. There are numerous records within and surrounding the development site from the local volunteer association. Foraging, movement and breeding habitat are also present in the development site.
Petrogale penicillata	Brush-tailed Rock-wallaby	V	E	-	-	Excluded. There are no rocky escarpments, outcrops or cliffs with caves and ledges found within the development site.
Phascogale tapoatafa	Brush-tailed Phascogale	-	V	-	-	Excluded. The Development site does not contain suitable habitat for this species including dry sclerophyll open forest with sparse ground cover.
Phascolarctos cinereus	Koala (breeding)	V	V	Areas identified via survey as important habitat. ('Important' habitat (however this is not a mapped important habitat area)	-	Excluded. The development site does not contain any important habitat.

				is defined by the density of koalas and quality of habitat determined by on-site survey).		
Pteropus poliocephalus	Grey-headed Flying-fox (breeding)	V	V	Breeding camps.	-	Excluded. There are no breeding camps on the development site.
Frogs						
Crinia sloanei	Sloane's Froglet	E	V	Semi-permanent/ephemeral wet areas. Containing relatively shallow sections with submergent and emergent vegetation, or within 500 m of wet area/Swamps. Within 500 m of swamps/Waterbodies. Within 500 m of waterbody.	-	Included as the development site is within 500m of the Murray River and contains a small disturbed *Carex appressa* wetland. There are 61 records in the locality (only including NSW).
Invertebrates						
Synemon plana	Golden Sun Moth	CE	E	Wallaby grass (*Rytidosperma* sp.), Chilean needlegrass (*Nassella neesiana*) or Serrated Tussock (*Nassella trichotoma*).	-	Excluded. The Project site does not contain any suitable habitat of Natural Temperate Grassland.
Reptiles						
Aprasia parapulchella	Pink-tailed Legless Lizard	V	V	Rocky areas or within 50m of rocky areas.	-	Excluded. The Development site does not contain any rocky areas or is within 50m of rocky areas.

Key: CE = critically endangered, E = endangered, EP = endangered population, V = vulnerable

5.2.2 Identifying candidate species for further assessment

In accordance with paragraphs 6.4.1.17 – 6.4.1.19 (Step 3) of the BAM, a field assessment was undertaken to determine whether the habitats within the development site were substantially degraded to the point that a candidate species is unlikely to utilise the development site (or specific vegetation zones). There were a number of threatened species returned from the calculator that are species credit species if breeding habitat would be impacted. The development site does not contain breeding habitat for any of these identified species as follows:

- The Regent Honeyeater does not breed in the Albury urban area. There are only four known key breeding regions remaining for the Regent Honeyeater: north-east Victoria (Chiltern-Albury), and in NSW at Capertee Valley, Hunter Valley and the Bundarra-Barraba region. Therefore, the Regent Honeyeater was removed from the candidate species list.
- The Swift Parrot breeds in Tasmania. As such, it was removed from the candidate species list.

- The Bush Stone-curlew is known from the locality, however habitats on the development site are in poor condition and do not contain any areas of fallen-standing dead timber and logs. As such, the Bush Stone-curlew was removed from the candidate species list.
- The Gang-gang Cockatoo requires hollow-bearing Eucalypt trees with hollows greater than 9 cm in diameter for breeding. No hollows greater than 9 cm were identified in the development site. As such, the Gang-gang Cockatoo and Endangered Populations were removed from the candidate species list.
- The Glossy Black-Cockatoo requires hollow bearing trees, living or dead trees with hollows greater than 15 cm diameters and greater than 5m above the ground. There were no suitable hollow bearing trees fund within the development site, therefore the Glossy Black-Cockatoo was removed from the candidate species list.
- Little Eagle breeding habitat is specified as live (occasionally dead) large old trees within suitable vegetation AND the presence of a male and female; or female with nesting material; or an individual on a large stick nest in the top half of the tree canopy. There are no live large old trees within the development site that contain large stick nests. The habitats within the development site contain relatively small to moderate sized *Eucalyptus* spp. trees that are not suitable as nesting sites for the Little Eagle. Consequently, the Little Eagle was removed from the candidate species list.
- The Square-tailed Kite also requires nest trees for breeding. It is difficult to identify a Kite nest (there are lots of comparable sized stick nests built by other species), especially given Kites have large territories and other stick nesters will undoubtedly also be nesting where Kites might be recorded. Kites will need to be in attendance to confirm breeding sites. As discussed, there are no large old trees site that contain large stick nests. Consequently, the Square-tailed Kite was removed from the candidate species list.
- The Powerful Owl and Masked Owl both require living or dead trees with hollow greater than 20 cm diameter. The are no trees with hollows greater than 20 cm in the development site. As such, these three species were removed from the candidate species list.
- Breeding habitat for the Large Bent-winged Bat is highly specific and is restricted to cave systems. There are only five Little Bent-winged Bat nursery sites /maternity colonies known in Australia and a single maternity colony in NSW which is in close association with a large maternity colony of Large Bent-winged bats. The breeding colonies of the Large Bent-winged Bat are not in the Albury area and would not be affected. As such, this species were removed from the candidate species list.
- There are no hollow bearing trees within 200 m of a riparian zone which is required for the Southern Myotis Bat. Additionally, there are no bridges, caves or artificial structures within 200 m of a riparian zone. Therefore, the Southern Myotis Bat has been excluded from the candidate species list.
- The Brush-tailed Rock-wallaby requires rocky escarpments, outcrops and cliffs, caves and ledges and native grasses and forbs habitat. The development site does not meet the habitat or breeding requirements of the Bruch-tailed Rock-wallaby, therefore, has been excluded from the candidate species list.
- The Brush-tailed Phascogale prefers dry sclerophyll open forests with sparse groundcover of herbs, grasses, shrubs or leaf litter. There is no suitable habitat within the development site for the Brush-tailed Phascogale, therefore has been removed from the candidate species list.
- There are no Koala breeding colonies in or near the development site. Consequently, the Koala was removed from the candidate species list.
- There are no Grey-headed Flying-fox camps in the development site. Consequently, the Grey-headed Flying-fox was removed from the candidate species list.
- The Golden Sun Moth requires suitable habitat of Natural Temperate Grassland including Wallaby Grass, Chilean Needlegrass or Serrated Tussock, which are not present within the development site. The Golden Sun Moth, therefore, was excluded from the candidate species list.
- The Pink-tailed Legless Lizard requires habitat in rocky areas or within 50 m of rocky habitat. As there is no suitable habitat within the development site, this species was excluded from the candidate species list.

Within and surrounding the development site, there is some foraging and sheltering habitat for the Squirrel Glider, present in the form of scattered remnant eucalypts and planted native trees and shrubs. There are large flowering *Eucalyptus* trees and numerous mistletoe (*Amyema* sp.) suitable for the Squirrel Glider to forage on. There is a single hollow bearing tree (White Box) containing multiple hollows on the edge of the development site (proposed access track) and several moderate sized River Red Gums. These trees may provide important nesting and roosting habitat. Numerous records of nesting surrounding the development site from work undertaken by the local volunteer group Friends of the Lake Hume Squirrel Glider is evidence of a local population. There are foraging, movement and breeding habitats present within the development site.

An ephemeral *Carex appressa* dominated wetland occurs within the study area containing native tree and shrub plantings on the edge. This wetland is potential habitat for Sloane's Froglet listed vulnerable under BC Act and endangered under the EPBC Act. There are numerous records of this species in the locality, with the closest located 2.6 kilometres to the north of the development site along the edge of Riverina Highway.

The development site is largely composed of a highly modified landscape, with areas of native vegetation existing as disturbed remnant, regrowth and revegetation. Although historical and current disturbance regimes have resulted in existing vegetation that is likely to be unsuitable habitat for many of the candidate threatened flora species identified by the BAM-Calculator, some are known from disturbed areas. As such the following list of candidate flora species was selected for survey:

- *Acacia ausfeldii* (Ausfeld's Wattle)
- *Ammobium craspedioides* (Yass Daisy)
- *Cullen parvum* (Small Scurf-pea)
- *Euphrasia arguta* (Euphrasia arguta)
- *Swainsona recta* (Small Purple-pea)
- *Swainsona sericea* (Silky Swainson-pea)

Grevillea wilkinsonii was excluded from the assessment as it is only known from a very restricted distribution along the Goobarragandra River.

The list of species retained for further assessment is shown in **Table 5-4**.

Table 5-4 Summary of candidate species credit species for further assessment

Species name	Common name	EPBC Act	BC Act	Sensitivity to gain class	SAII*	Relevant habitat in development site
Plants						
Acacia ausfeldii	Ausfeld's Wattle	-	V	Moderate	No	PCT 266 remnant woodland near the proposed access track.
Ammobium craspedioides	Yass Daisy	V	V	Moderate	No	PCT 266 remnant woodland and derived grassland
Cullen parvum	Small Scurf-pea	-	E	High	No	PCT 266 remnant woodland and derived grassland
Euphrasia arguta	-	CE	CE	Very High	Yes	PCT 266 remnant woodland and derived grassland

Species name	Common name	EPBC Act	BC Act	Sensitivity to gain class	SAII*	Relevant habitat in development site
Swainsona recta	Small Purple-pea	E	E	High	No	PCT 266 remnant woodland and derived grassland
Swainsona sericea	Silky Swainson-pea	-	V	Moderate	No	PCT 266 remnant woodland and derived grassland
Mammals						
Petaurus norfolcensis	Squirrel Glider	-	V	High	No	Potential habitat is around the edges of the development site in the form of poor condition remnant woodland and planted native trees and shrubs.
Frogs						
Crinia sloanei	Sloane's Froglet	E	V	Moderate	No	*Carex appressa* dominated drainage line wetland (PCT 5)

Note: SAII* = Serious and Irreversible Impact Entity.

5.3 Threatened species survey results

5.3.1 Threatened plant species

Six threatened plant species were targeted during surveys of the development site (refer to **Table 2-2** and **Table 5-4**). No threatened plant species were found in the development site during the surveys.

In general, habitat for threatened plant species was very marginal. Derived grasslands (PCT 266) within the development site were mapped based on the presence of any cover of native ground cover species. This ranged from a maximum of six percent native cover (Plot 1), but more common across the distribution native grass species (*Microlaena stipoides*) comprised less than one percent, with ground cover dominated by exotics. The low quality of derived grasslands within the development footprint is evidenced by the very low Vegetation Integrity score of 3.2 for this vegetation zone. Poor condition woodland also contained a very high cover of exotic ground cover (Plot 3 recorded over 85% exotic). Despite this, areas of highest native ground cover were targeted with parallel transects in August 2019 and June 2020. Although these surveys were conducted outside of the recommended survey period for most of the species identified in **Table 2-2** and **Table 5-4**, survey confidence is still relatively high due to the limited area of suitable habitat.

5.3.2 Threatened animal species

Surveys were undertaken for *Petaurus norfolcensis* (Squirrel Glider) and *Crinia sloanei* (Sloane's Froglet) in August 2019. The habitat-based assessment of these species suggested the existence of suitable habitat and therefore required further assessment.

Squirrel Glider

The Squirrel Glider was not identified from targeted surveys undertaken as part of this assessment. However, this species is known to occur commonly in the locality from BioNet Atlas records and, more specific to the study area, from survey data collected by the local conservation group *Friends of the Lake Hume Squirrel Glider*. Gliders have been observed around the Dam spillway area for many years (decades) with regular sightings at The

Trout Farm (Management) and Water NSW residences, however glider sightings have reduced in recent years and may be caused by local clearing/lopping in the caravan park and spillway (pers. comm., Stuart Lucas, June 2020). The conservation group has been operating since 2013 with an aim to "improve and extend the safe range, and food source, of gliders in the Lake Hume Spillway area". The group has since undertaken planting of native trees and shrubs around the Lake Hume Spillway site for foraging and to improve habitat connectivity, and installed 20 nest boxes along identified movement corridors in the Lake Hume area (refer **Figure 5-1**). Nest box monitoring undertaken by the group between 2013-2020 has found:

- Leaves/glider nests have been observed in all the Lake Hume Village nest boxes during entire survey period (2013-2020)
- Squirrel Gliders have been observed in all but three nest boxes during systematic annual surveys (gliders have been observed in 2 of these boxes outside annual surveys)
- Squirrel Gliders have been observed moving between trees during two social evenings held by the group.

Considering these data, it is highly likely that the development site occurs within a landscape that supports a viable Squirrel Glider population and that native vegetation both within and surrounding the site provides an important movement corridor and refuse habitat. Only one tree with hollows suitable for denning was identified within the study area, which is located along the spillway access road (refer **Figure 5-1**), although outside of the project development footprint. A species polygon has been developed for the Squirrel Glider, which includes areas of PCT 266 with an intact canopy (excluding derived grasslands). This species is also likely to use planted native vegetation along west and northern boundary of the spillway site, however as this cannot be assigned to a PCT, is was not included in the species polygon.

Photograph 5 – Hollow-bearing *Eucalyptus albens* with numerous hollows suitable for Squirrel Glider

Photograph 6 – Planted native trees and shrubs in the Travelling Stock Route between the development site and Trout Farm Road offers important habitat connectivity

Sloane's Froglet

Targeted surveys for Sloane's Froglet within and surrounding the development site did not identify this species, or any other. Surveys of known Sloane's Froglet reference sites also did not identify this species calling and active during the surveys, however other common species were calling from the reference sites including *Crinia parinsignifera* and *Crinia signifera*.

The targeted surveys were undertaken in August 2019 (winter) over two nights and two days, following some rain (9.8 millimetres in 24 hours), however rainfall was not heavy during the time of the surveys. Despite the small amount of rain, there was no standing water in the *Carex appressa* wetland. Midday inspections of the wetland were also undertaken in June 2019 and June 2020 during vegetation surveys. In summary, surveys were undertaken during suitable weather conditions and seasonal timing requirements over 4 days and 2 nights within 0.13 hectares of potential habitat in and around the development site.

Known habitat characteristics of Sloane's Froglet is detailed in the *Sloane's Froglet Interim Habitat Guide and Management Recommendations* (Knight, 2014) and listed in **Table 5-5**, along with an assessment of the *Carex appressa* wetland in the development site. The conclusions from this comparative assessment indicate that the *Carex appressa* wetland in the development site contains suitable vegetation characteristics, however it is likely too small in size and ephemeral (temporary) for Sloane's Froglet, and lack connectivity to similar habitats. The drainage line that feeds the wetland only drains water from a catchment of around three hectares in size, so inundation is likely to be uncommon, irregular and temporary, as the outflow is a narrow channel designed to move the water down int the Murray River. The dense cover of *Carex appressa* suggests that standing water is not a common feature.

The Albury population of Sloane's Froglet is relatively well surveyed, with most sites occurring in "peri-urban" areas (Knight, 2013). This includes numerous small and inter-connected sites. Figure 11 in Knight (2014) shows the distribution of survey locations across the Albury population where this species has been surveyed and recorded. The closest sites are around Thurgoona about four to six kilometres from the site. The closest record of Sloane's Froglet to the development site is from 2013, around 2.6 kilometres to the north west, from the side of the Riverina Highway, near an artificially diverted arm of the Murray River. There are not many records located along the Murray River itself, with most in connected wetland areas.

Therefore, considering the results of the targeted surveys and habitat assessment, the Sloane's Froglet is considered to have a low likelihood of occurring in the *Carex appressa* wetland. The connectivity of the site to the Murray River is poor but present, therefore there is low potential that this species could occur at some point in time.

Photograph 7: A small (0.13 hectares) area of *Carex appressa* dominated wetland where targeted surveys for Sloane's Froglet were undertaken, which is located on a lower slope section of a highly ephemeral drainage line

Table 5-5 Site assessment against Sloane's Froglet habitat characteristics

Habitat characteristic	Description (Knight, 2014)	Assessment of *Carex appressa* wetland in the development site
Water depth	Calling male Sloane's Froglets have only been found within shallow areas ranging in depth from 1 to 31 cm, with 50% of those measured sitting in water less than 5 cm deep and 80% in water less than 8 cm deep.	The wetland was dry during all surveys. Rainfall preceding the survey in August 2019 included 9.8 mm in 24 hours.
Length and season of inundation	It is important that waterbodies contain water from mid to late autumn, through the winter months, and into late spring/early summer. Water needs to lie in wetlands for a minimum of 3 months after a winter breeding event to allow the tadpoles sufficient time to reach metamorphosis – at least until November.	The length of time that the wetland holds water is unknown, however it is likely to be short. The wetland is located in low sloping section of a drainage line, which drains rainfall from the immediate land to the north east (around 3 hectares). Considering the slope at the outflow that travels down to the Murray River, the wetland is likely only able to a maximum of 5 cm during heavy rainfall before it drains out and dries up.
Water quality	There has been no significant difference detected between the water quality parameters at sites which Sloane's Froglet uses and doesn't use. While frogs may occur in	Water quality of the wetland is unknown. It is apparent that efforts to control thickets of *Rubus fruticosus* agg. in the wetland have included spraying with pesticide.

Habitat characteristic	Description (Knight, 2014)	Assessment of *Carex appressa* wetland in the development site
	areas with poor water quality, many studies have shown that their health may be affected by toxins including pesticides, herbicides and fertilisers.	
Flow rates	Generally, Sloane's Froglet is found in waterbodies where the water is still.	The water was relatively still on the date of the survey, however considering the steep slope of the drainage line up slope from the wetland, it is likely to experience temporary high flows during periods of high rainfall.
Vegetation species	Vegetation available in the wetlands is very important for all life stages of Sloane's Froglet. Associated vegetation recorded from wetlands occupied by Sloane's Froglet includes shallow wetlands with large areas of emergent *Eleocharis acuta* (Common spikerush) and *Cynodon dactylon* (Common couch), inundated grazed areas containing Ryegrass and native grasses such as Wallaby grasses, and other species including *Juncus usitatus*, *Carex* species, *Paspalum distichum*, *Poa species*, *Potamogeton ochreatus*, and *Myriophyllum* species. Wetlands occupied by Sloane's Froglet in the Albury area are often fringed by *Carex* species.	The wetland is dominated by *Carex appressa* (75 %), which is consistent with known habitat. Other dominant species include *Phalaris aquatica*, *Avena fatua*, *Paspalum dilatatum* and *Holcus lanatus*. The wetland also contains sprawling thickets of *Rubus fruticosus* agg.
Vegetation structure	Vegetation structure is important. Calling male Sloane's Froglets often perch in areas which contain vegetation with an average maximum emergent height (height above the surface of the water) of 42 cm and moderate cover (the vegetated part of the wetland has 30 to 70 % cover). It is likely that females also lay eggs in these areas.	Vegetated cover of the wetland close to 100 %. There were no areas of open water during the surveys and it did not appear that these would be a feature any other time. *Carex appressa* was up to 100 cm tall.
Vegetation on the edges	Most wetlands that Sloane's Froglet occur in have edges well vegetated with grasses, reeds, and sedges during winter and spring.	The extent Carex appressa marks the outlines of the wetland, which area lined with primarily exotic grasses. An access track runs along the eastern and northern boundary.
Shading	Around Thurgoona most of the wetlands that Sloane's Froglet use have little shading (<5 % canopy cover). Direct sunlight is likely to be important for productivity and thermal properties of wetlands, which is often important for egg and tadpole development and adult breeding activity.	There is some remnant woodland to the south of the wetland and planted exotics (*Salix* sp.) to the west downstream. One small E*ucalyptus* species has been planted in the centre. Overall, shaded cover is likely to be <5 %.
Wetland shape and slope	Sloane's Froglet use waterbodies of all shapes. In some cases, they are found in constructed drains. The slope of the bed of the waterbody	The general slope of the wetland is likely to be around 10%. The wetland has a small 50% sloped bank on one side where the

Habitat characteristic	Description (Knight, 2014)	Assessment of *Carex appressa* wetland in the development site
	from the edge of the water to the point where Sloane's Froglet was perching in the water was measured at 52 sites within 12 wetlands. 50% of sites measured had a slope of less than 1% and 80% had a slope less than 4%. The remaining sites had a slope less than 18%. Steep bank slopes are unsuitable for Sloane's Froglet.	slope has been retained for an access track.
Wetland size	For populations of Sloane's Froglet to be viable into the future, habitat that can support larger numbers of froglets (>100 calling males) and which has a variety of depths with suitable vegetation is essential. Many sites within the Thurgoona area contain only a small number of Sloane's Froglets (<20 calling males). These waterbodies are a vital part of the complex mosaic of habitat that will support Sloane's Froglet into the future.	The wetland is 0.13 hectares, with a likely consistently shallow depth (though dry during surveys) and no areas of open water.
Wetland complexity	Sloane's Froglet is a dynamic species and moves between waterbodies within and between seasons. The viability of the Thurgoona Sloane's Froglet population is dependant not just on individual wetland characteristics, but also on broader habitat features including the proximity and abundance of breeding and refuge habitat and the variety and availability of dispersal routes across the landscape. Many of the areas where Sloane's Froglet occur within the Albury area are part of complex wetland systems that include multiple ponds of varying depths as well as drains and creek overflows.	Downstream the drainage line becomes a steeper and narrow channel through woodland with no wetland vegetation, before reaching the Murray River around 150 metres to the south west. The connectivity to the Murray River is poor.

5.3.3 Serious and irreversible impact entities

The concept of serious and irreversible impacts (SAII) is fundamentally about protecting threatened entities that are most at risk of extinction from potential development. The Biodiversity Offsets Scheme recognises that there are some types of serious and irreversible impacts that the community expects will not occur except where the consent authority considers that this type of impact is outweighed by the social and economic benefits that a development will deliver to the State.

Two plant species which have been identified by the BAM-C as requiring assessment are listed as SAII entities; *Cullen parvum* and *Euphrasia arguta*. The site is considered to contain marginal potential habitat for these two species and as such surveys have been undertaken. These species were not identified in the development site or study area and in its current state, the development site is not considered likely to contain these species. As such it is unlikely that these two SAII entities would be impacted by the development.

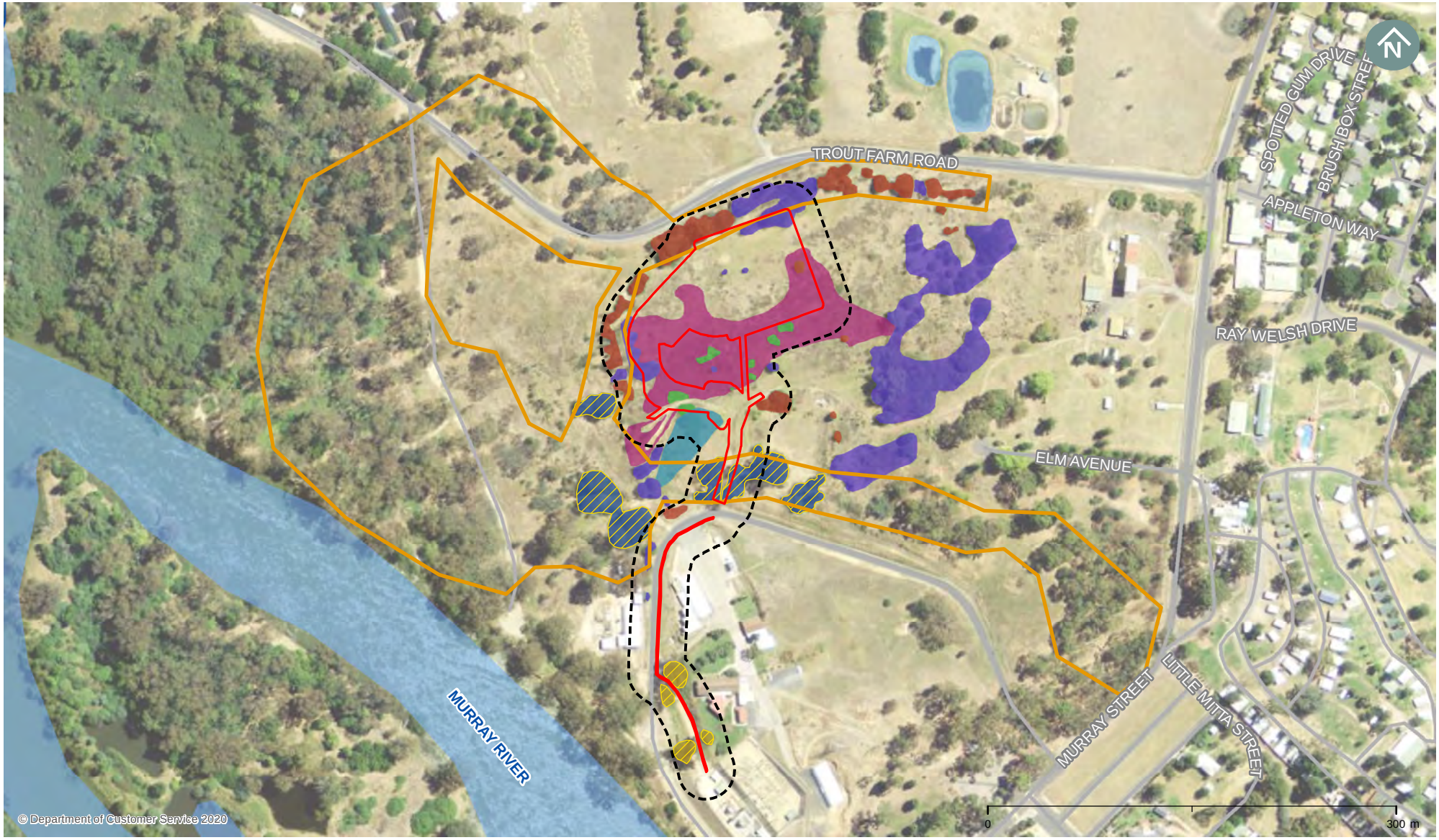

Figure 5-1 Threatened species polygon for Squirrel Glider

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Created by : AA | QA by : LC

6. Aquatic assessment

Aquatic habitats within the development site and broader locality were assessed against the *Policy and guidelines for fish habitat conservation and management – Update 2013* (NSW Department of Primary Industries, 2013) and *Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (Fairfull and Witheridge, 2003). The Aquatic Ecology in Environmental Impact Assessment – EIA Guideline (Lincoln Smith, 2003) was used to guide the level of aquatic assessment required. There is enough existing information to describe the existing aquatic environment and to assess the quality and importance of the aquatic environments to be impacted by the development. As such, this assessment was based on a review of existing information and a habitat assessment.

Searches of databases, existing mapping and other literature were used to identify the locations of sensitive receptors. Sources included:

- Fisheries Spatial Data Portal – (accessed July 2020)
- Protected Matters Search Tool – (searched 12 June 2020)
- SEED - NSW Wetlands mapping – (accessed July 2020)
- SEPP (Coastal Management) 2018 – Interactive map viewer – (accessed July 2020)
- Australian Wetlands Database (Department of the Environment and Energy, 2019) – (accessed July 2020).

6.1 Existing environment

The development site is located entirely within the Murray Riverina catchment. The catchment area around the development site is highly modified from its original state, being cleared for rural, and recreational land use, including the existing Hume Dam hydro station infrastructure. This includes offices, the Hume Dam Hydro Power Station and spillway, and a switchyard. Transmission lines also extend from the switchyard to Albury in NSW and Wodonga in Victoria. These land uses influence the water quality and quantity/velocity of flows within the catchment.

Three waterways have been identified surrounding the development site and are discussed below. There are four threatened species listed under the *Fisheries Management Act 1994* (FM Act) which have the Murray River watercourse included in their modelled indicative (i.e. known or expected to occur) distribution maps. There is no coastal land listed under the State Environmental Planning Policy (Coastal Management) 2018 (Coastal Management SEPP), close to the development site.

The aquatic habitat within the 1,500-metre landscape buffer includes a section of the Murray River downstream of the dam wall and spillway (including some unnamed tributaries), Lake Hume and the *Carex appressa* wetland drainage line within the development site (see Error! Reference source not found. and **Figure 6-1**).

6.1.1 Murray River

The Murray River is Australia's longest River, travelling for approximately 2,530 km from the Snowy Mountains, generally flowing west through NSW, Victoria and SA before reaching its confluence with the Indian Ocean. The closest section of the Murray River is located approximately 65 metres west of the development site (trenching work along the existing access road). Here, the Murray River is a ninth order stream (Strahler) and being located immediately downstream of the dam wall is subject to almost entirely regulated flows (600 ML/day).

The study area is situated in a predominately cleared rural landscape that has highly modified vegetation and habitat. Less modified native vegetation is situated along the riparian edges of the Murray River to the south west. The proposal will not directly impact any part of the Murray River or its riparian vegetation, however there is potential for indirect impacts by contaminated run-off flowing into the drainage line.

6.1.2 Lake Hume

Lake Hume is located approximately 500 metres east of the development site, where it is separated from the Murray River by the Hume Dam wall and spillway located approximately 300 metres south of the development site. Lake Hume is a man-made reservoir on the Murray River and the lowest elevation in the lake bed, the old river channel, is the border of Victoria and NSW. The catchment of Lake Hume encompasses the upper Murray, the NSW Southern Mountain and South-West Slopes regions, and the Victorian Eastern Highlands and High Plains (Birch, 2003). This region has a complex geological history of deposition, deformation of strata and volcanic intrusions (Doughty 2003). This history and the weathering of these geological formations has resulted in a diverse topography that includes plateaus, mountains, dissected terrain and valleys, as well as incision features and sedimentary and volcanic fill features in the valleys (Rosengren and White 1997). The proposal will not directly impact any part of Lake Hume or its riparian vegetation. Indirect impacts are also unlikely considering the landscape position of the development site in context to the lake.

6.1.3 Carex wetland drainage line

The assessment area for the proposed works are located in a broad gully which runs from north east to south west before emptying into the Murray River. The catchment area of this drain is approximately three hectares. The landform has been partially modified in areas to accommodate infrastructure and the subsequent removal of vegetation has resulted in the formation of the moderately sloped broad drainage line. Where the drainage line flattens near the development site, an ephemeral *Carex appressa* dominated wetland has formed. Past this point, the drain narrows into an eroded channel before dispersing across woodland into the Murray River. Considering the small catchment area and slope, the *Carex appressa* wetland is unlikely to hold open water. The wetland contains marginal aquatic habitat, and may be suitable for common frog species (refer **Section 5.3.2**). Potential impacts to the *Carex appressa* wetland are discussed in **Section 9.4**.

6.2 Aquatic biota

No fish surveys or site inspections for aquatic ecology were conducted for the Project. An assessment of the aquatic habitat around the development site against the basic 'Class' system (Fairfull and Witheridge, 2003) is provided in **Table 6-1**. The Murray River and Lake Hume is mapped as 'Key Fish Habitat' by the NSW Department of Primary Industries (2007), which are outside of the directly impacted area. Most of the study area is included within the extent of Key Fish Habitat mapping (NSW Department of Primary Industries,2007), however the mapping is modelled and includes the "highest astronomical tide level (that reached by 'king' tides)". In the context of the site, which is located on a modified landscape subject to regulated flows from the Hume dam, this area is not considered accurate. An assessment of Key Fish Habitat within the development site, study area and 1,500-matre landscape buffer is provided in **Table 6-1**. There is no Key Fish Habitat within development site.

Table 6-1 Fish habitat classification

Class	Characteristics	Habitat in the study area
Class 1 Major fish habitat	Major permanently or intermittently flowing waterway (e.g. river or major creek); habitat of a threatened fish species.	Not present in the development site, however is present in within the 1,500-metre landscape buffer. The Murray River and Lake Hume are both considered to be Class 1 waterways.
Class 2 Moderate fish habitat	Named permanent or intermittent stream, creek or waterway with clearly defined bed and banks with semi-permanent to permanent waters in pools or in connected wetland areas. Marine or freshwater aquatic vegetation is present. Known fish habitat and/or fish observed inhabiting the area.	Not present in the development site or 1,500-metre landscape buffer.

Class	Characteristics	Habitat in the study area
Class 3 Minimal fish habitat	Named or unnamed waterway with intermittent flow and potential refuge, breeding or feeding areas for some aquatic fauna (e.g. fish, yabbies). Semi- permanent pools form within the waterway or adjacent wetlands after a rain event. Otherwise, any minor waterway that interconnects with wetlands or recognised aquatic habitats.	Not present in the development site. Several first and second order unnamed tributaries of the Murray River in the 1,500-metre landscape buffer may qualify as Class 3.
Class 4 Unlikely fish habitat	Named or unnamed waterway with intermittent flow following rain events only, little or no defined drainage channel, little or no flow or free-standing water or pools after rain events (e.g. dry gullies or shallow floodplain depressions with no permanent aquatic flora present).	Present within the development site as the *Carex appressa* wetland, which is located on an unnamed and un-mapped drainage line.

6.3 Threatened fish

A review of threatened freshwater fish habitat maps (DPI identified four threatened fish species, including the Flathead Galaxias, Murray Crayfish, Trout Cod and Southern Pygmy Perch, as having the Murray River watercourse included in their modelled indicative (i.e. known or expected to occur) distribution maps (NSW Department of Primary Industries, 2016).

The Flathead Galaxias (*Galaxias rostratus*) is known to occur within the southern extent of the Murray darling Basin. Flathead Galaxias are found in still or slow-moving water bodies such as wetlands and lowland streams. They have been associated with a range of habitats including rock and sandy bottoms and aquatic vegetation.

The Murray Crayfish (*Euastacus armatus*) is endemic to the southern tributaries of the Murray Darling Basin. They can be found in a variety of habitats, ranging from pasture-lands to sclerophyll forest, in a range of stream sizes and throughout a broad altitude range. The Murray Crayfish can be found in the Murray River upstream of Mildura in the Murrumbidgee River and in some dams.

The Trout Cod (*Maccullochella macquariensis*) is usually associated with deeper water and instream cover such as logs and boulders. In the Murray River it occupies slightly faster-flowing locations. There are now only three populations remaining, the largest being in the Murray River between Yarrawonga and Barmah.

The Southern Pygmy Perch (*Nannoperca australis*) prefers slow flowing or still waters, usually with dense aquatic vegetation and plenty of cover. It has been recorded from small streams, well-vegetated lakes, billabongs and irrigation channels. The Southern Pygmy Perch is formerly found in the Murray and lower Murrumbidgee catchments; however, it has now disappeared from most locations in NSW. In NSW, only two populations are currently known, from near Holbrook and Albury.

An additional two threatened fish species were also identified by the Protected Matters Search Tool based on the presence of modelled suitable habitat. These include the Murray Cod (*Maccullochella peelii*) and the Macquarie Perch (*Macquaria australasica*).

Importantly, the Hume Hydro Dam is a total barrier to fish passage. The section of the Murray River within the 1,500-metre landscape buffer is located directly below the dam wall and spillway and subject to regulated flows (600ML/day). Therefore, any threatened fish present would have to travel upstream against heavy flows. The likelihood of these species occurring in this section of the Hume Dam is low and they are unlikely to be impacted by the project development.

An assessment of the likelihood of occurrence of all threatened species and endangered populations were undertaken to determine the potential for these species to occur within the development site (see **Appendix A**).

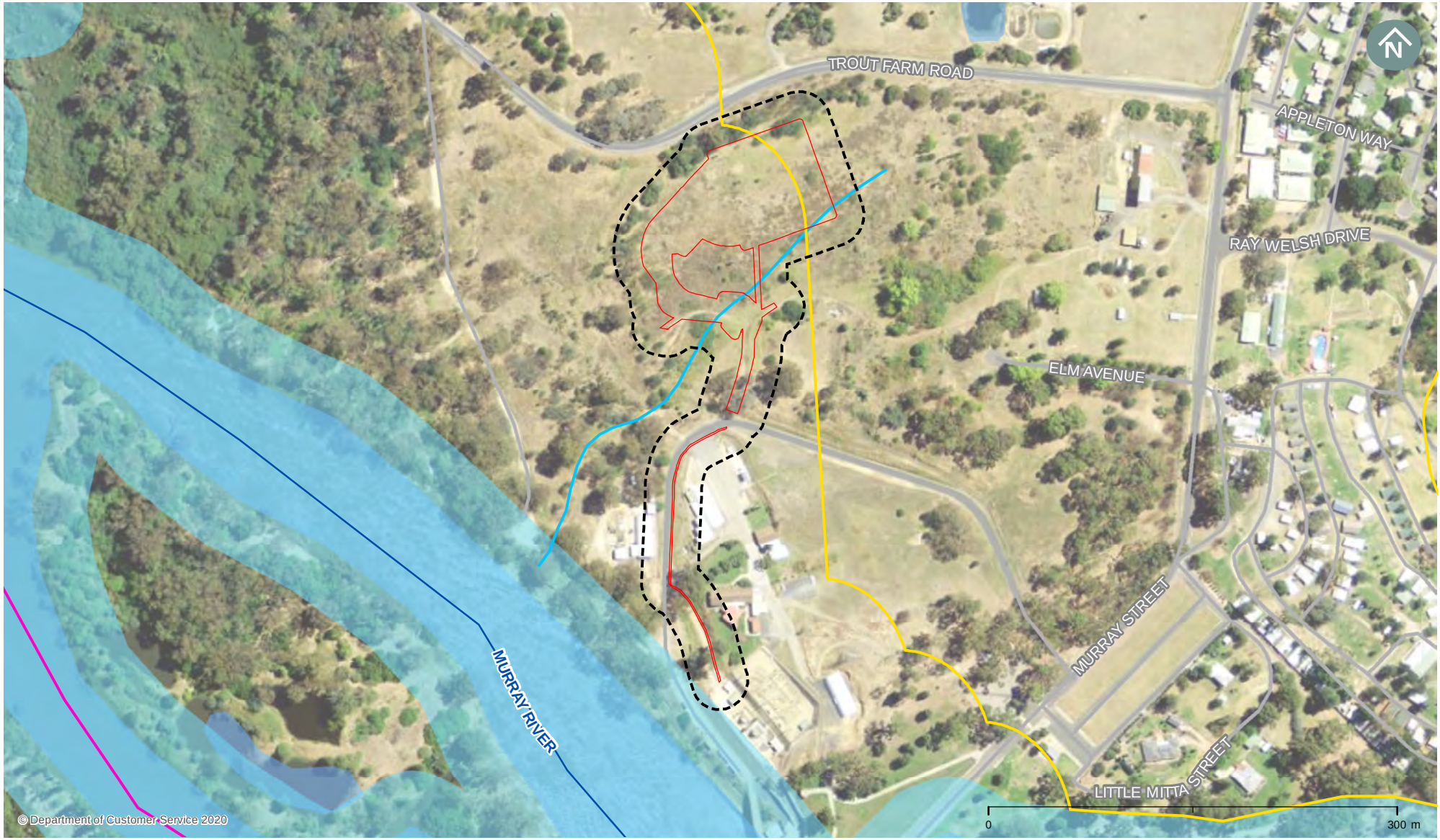

Figure 5-1 Threatened species polygon for Squirrel Glider

7. Matters of National Environmental Significance

The EPBC Act provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places – defined as matters of national environmental significance. Matters relevant and applicable to this assessment include:

- Wetlands of international importance (often called 'Ramsar' wetlands after the international treaty under which such wetlands are listed)
- Nationally threatened species and ecological communities
- Migratory species.

For threatened biodiversity and migratory species listed under the EPBC Act, significance assessments have been completed in accordance with the *EPBC Act Policy Statement 1.1 Significant Impact Guidelines* (Department of Environment, 2013) (see Appendix D). Whether or not an action is likely to have a significant impact depends upon the sensitivity, value, and quality of the environment that is affected, and upon the intensity, duration, magnitude and geographic extent of the impacts (Department of Environment, 2013). Importantly, for a 'significant impact' to be 'likely', it is not necessary for a significant impact to have a greater than 50 percent chance of happening; it is sufficient if a significant impact on the environment is a real or not a remote chance or possibility (Department of Environment, 2013). This advice has been considered while undertaking the assessments.

The following information is informed by data downloaded from the Protected Matters Search Tool (PMST) in a 10-kilometre radius around the development site, which was accessed on 12 June 2020.

7.1 Wetlands of international and national importance

Seven wetlands of international or national importance have been identified in the locality from the PMST. These include Banrock station wetland complex, Barmah Forest, Gunbower Forest, Hattah-Kulkyne Lakes, NSW Central Murray State Forests, Riverland and the Coorong, and Lakes Alexandrina and Albert Wetland. These Wetlands of International Importance are not within the 1,500-metre landscape buffer and are likely to be too far away to be affected by the development.

7.2 Nationally listed threatened ecological communities

According to the Protected Matters Search Tool (PMST) three EPBC Act listed TECs are known to occur, likely to occur, or may occur in the development site. An assessment of the likely occurrence of these TECs in the 1,500-metre landscape buffer is shown in Extant **Vegetation Map of Albury** Shire. VIS_ID *3926* (Department of Planning, Industry and Environment 2013). and has been undertaken using regional vegetation mapping, including:

- *State Vegetation Type Map: Riverina Region Version v1.2 - VIS_ID 4469* (Department of Planning, Industry and Environment 2020), and
- *Extant Vegetation Map of Albury Shire. VIS_ID 3926* (Department of Planning, Industry and Environment 2013).

Table 7-1 EPBC Act listed TECs returned from the Protected Matters Search Tool, their predicted occurrence (based on PMST assessment) and an assessment of their actual occurrence in the 1,500m landscape buffer

Threatened ecological community	Predicted occurrence	Actual occurrence and mapped location
Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia (Endangered	Likely to occur	Not mapped in the 1,500-metre landscape buffer.

Threatened ecological community	Predicted occurrence	Actual occurrence and mapped location
Community)		
Weeping Myall Woodlands (Endangered Community)	May occur	Not mapped in the 1,500-metre landscape buffer.
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (Critically Endangered Community)	Likely to occur	This TEC generally corresponds to vegetation mapped as PCT 266, which is widely mapped in the 1,500-metre landscape buffer.

Assessment of TEC condition criteria

All the areas of PCT 266 in the development site are too small and degraded to meet the condition threshold criteria for the EPBC Act listed White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland TEC detailed in the listing and conservation advice (Threatened Species Scientific Committee, 2006). The Threatened Species Scientific Committee (2006) recognises three different states of this TEC:

- An overstorey of eucalypt trees exists, but there is no substantial native understorey
- A native understorey exists, but the trees have been cleared
- Both a native understorey and an overstorey of eucalypts exist in conjunction.

Vegetation in the study area may potentially qualify for two of these states, areas containing remnant *Eucalyptus albens* and areas mapped as derived native grasslands. According to the conservation advice, areas containing an overstorey must have a "predominately native understorey". Vegetation integrity plot data from Plot 3 (vegetation zone 1) demonstrates the groundcover of this zone is made up of 85 percent exotic species. Therefore, vegetation zone 1 does not qualify for listing under the TEC.

Derived native grasslands (vegetation zone 2) mapped within the study area must meet the following condition criteria:

The size and life-form of understorey species are such that viable populations can exist in very small areas (Prober & Thiele 1993). Therefore, in order to be the listed ecological community, an understorey patch, in the absence of overstorey trees, must have a high level of native floral species diversity, but only needs to be 0.1 hectares or greater in size. A patch in which the perennial vegetation of the ground layer is dominated by native species, and which contains at least 12 native, non-grass understorey species (such as forbs, shrubs, ferns, grasses and sedges) is considered to have a sufficiently high level of native diversity to be the listed ecological community. At least one of the understorey species should be an important species (e.g. grazing-sensitive, regionally significant or uncommon species; such as Kangaroo Grass or orchids) in order to indicate a reasonable condition.

Vegetation integrity plot data from Plot 1 and Plot 5 (vegetation zone 2) demonstrates the groundcover of this zone is made up of around six percent native species, which does not qualify for listing under the TEC.

Therefore, none of the PCTs within the development site correspond to EPBC Act listed TECs. There would be no direct impacts to TECs listed under the EPBC Act.

7.3 Threatened plants

Six EPBC Act listed threatened plant species were considered potentially likely to occur based on the presence of broadly associated habitat and nearby records. Refer to **Appendix A** for a list of all EPBC Act listed species included in this assessment. The development site is largely composed of a highly modified landscape, with areas of native vegetation existing as disturbed remnant, regrowth and revegetation. Historical and current disturbance regimes have resulted in existing vegetation that is likely to be unsuitable habitat for many of these threatened flora species. Only one species, *Swainsona recta*, was identified as moderately likely to occur in

suitable habitat in the study area and was targeted during surveys and is unlikely to be impacted by the development (refer **Section 2.7.1** and **Section 5.3.1** for more details).

7.4 Threatened animals

Targeted surveys for EPBC Act listed threatened animals were undertaken during the surveys for this BDAR. This included the Sloane's Froglet (*Crinia sloanei*), listed endangered under the EPBC Act. Refer to **Section 2.7.2** for details of survey effort undertaken to **Section 5.3.2** for the results of the surveys.

In summary, Sloane's Froglet was not identified from the development site or immediate surrounds during targeted surveys. Habitat assessment of the potential habitat in the study area against known habitat characteristics concluded that the *Carex appressa* wetland in the study area does not represent high-quality habitat. Considering the distribution of records of known habitat requirements of the Albury population, Sloane's Froglet is considered to have a low likelihood of occurring in the *Carex appressa* wetland.

The development site also provides some limited foraging habitat for three other EPBC Act listed species. The Grey-headed Flying-fox, Swift Parrot and Regent Honeyeater are considered moderately likely to forage in the native vegetation (including planted) within the development site. Impacts to foraging habitat would be of low magnitude, so impacts to these species will be negligible. Significance assessments have been completed for these species in accordance with the EPBC Act *Policy Statement 1.1 Significant Impact Guidelines* (Department of Environment, 2013) (see **Appendix D**). The White-throated Needletail and Fork-tailed Swift (migratory species) may fly over the site on occasion but would not use the habitats and would not be impacted.

The estimated direct impacts to native vegetation that provides habitat for threatened species is outlined in **Table 7-2**. There is unlikely to be a significant impact to any threatened species (see **Appendix D**).

Table 7-2 Summary of direct impact to EPBC Act listed threatened species habitat (native vegetation) within the development site

Species	Associated plant community types	Area (ha) in development site
Grey-headed Flying-fox Regent Honeyeater Swift Parrot	White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion (266) - Poor Planted native trees and shrubs	0.43

7.5 Migratory species

Based on the results of the PMST, 13 listed migratory species may occur in the broader locality (see **Appendix A**). An additional two species were recorded from the BioNet search. Suitable habitat does not exist within the development footprint for most migratory species identified by the database searches. The following species are considered moderately likely to occur in, or adjacent to, the development site based on the presence of suitable habitats:

- Migratory marine birds – Fork-tailed Swift
- Migratory terrestrial species – White-throated Needletail

'Important habitat' for a migratory species is defined as (Department of Environment, 2013):

- Habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species
- Habitat that is of critical importance to the species at particular life-cycle stages
- Habitat utilised by a migratory species which is at the limit of the species range
- Habitat within an area where the species is declining.

According to the guidance provided in the EPBC Act Policy Statement 3.21—Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species (Department of the Environment, 2015), important habitats in Australia for migratory shorebirds under the EPBC Act include those recognised as nationally or internationally important. A wetland habitat should be considered internationally important if it regularly supports one percent of the individuals in a population of one species or subspecies of waterbird, or a total abundance of at least 20,000 waterbirds. Nationally important wetland habitat includes wetlands that regularly support 0.1 percent of the flyway population of a single species of migratory shorebird, or 2,000 migratory shorebirds, or 15 migratory shorebird species. The habitats in the development site are not important habitats for migratory birds.

An assessment of the likely occurrence of these species and the presence of important habitat is included in **Appendix A**. While some migratory species of bird are likely to use the development site and locality, the development site would not be classed as an 'important habitat'. A nationally significant proportion of a population would not be supported by the habitats in the development site. The development would not substantially modify, destroy or isolate an area of important habitat for the migratory species and it would not seriously disrupt the lifecycle of an ecologically significant proportion of a population of migratory birds.

8. Impact avoidance and minimisation

This section of the BDAR demonstrates the efforts taken to avoid and minimise impacts on biodiversity values in accordance with Section 8 of the BAM. Combined with safeguards during construction (as outlined in **Chapter 10**), the following process is likely to demonstrate the requirements to avoid and minimise impacts on biodiversity values as set out in Section 8 of the BAM are met.

Chapter 4 (Strategic context and project need) of the Environmental Impact Statement outlines the need for the development and alternatives considered. Meridian has reviewed options regarding BESS technology and location. Two areas within the WaterNSW site were considered in the Scoping Report as part of the preliminary environmental assessment. The preferred location was selected as it is a permissible land use within the zone, while other areas of the WaterNSW landholding are constrained by the presence of transmission easements, subterranean infrastructure, existing operational uses, unfavourable topography or at elevated risk of containing items of heritage significance.

8.1 Avoiding and minimising impacts on native vegetation and habitat

The development site is located within predominately cleared land that does not possess large expanses of intact native vegetation with high biodiversity value. The development would result in minimal disturbance of native vegetation. Where this disturbance cannot be avoided, the vegetation is of poor quality and generally provides limited habitat for threatened species.

No areas of land declared as an area of outstanding biodiversity value in accordance with Section 3.1 of the BC Act would be affected. Importantly, opportunities to further minimise native vegetation clearance would be refined during detailed design and reviewed as part of the pre-clearing process.

As the design process for the Project has progressed, it has been informed by stakeholder feedback and the outcome of early environmental and engineering investigations. As a result, various aspects of the design have been developed and refined. **Table 8-1** shows an excerpt of some of the refinements and design changes considered in Chapter 2 of the EIS, that relate to avoiding and minimising impacts to biodiversity.

Table 8-1 Design refinements noted to avoid impacts to native vegetation

Design aspect	Rational for design refinement
BESS compound location	The BESS compound would be located on the ridgeline to the north of the WaterNSW land. The area consists of a gently sloping landform that is largely free of woody vegetation.
Access track	An access track from the WaterNSW internal access road would be constructed and maintained as a permanent BESS access. The existing track would be upgrade and new track installed to provide an eight-metre-wide track with associated permanent drainage and batters to achieve necessary grade. The track has been positioned so that it will generally follow the existing dirt track to the extent possible, minimising impact to the *Carex appressa* wetland and White Box Grassy Woodland.

8.2 Avoiding and minimising prescribed biodiversity impacts

Some types of projects may have impacts on biodiversity values (as defined in the BC Act and Biodiversity Conservation Regulation 2017) in addition to, or instead of, impacts from clearing vegetation and/or loss of habitat. For many of these impacts, the biodiversity values may be difficult to quantify, replace or offset, making avoiding and minimising impacts critical. Clause 6.1 of the Biodiversity Conservation Regulation 2017 identifies actions that are prescribed as impacts to be assessed under the biodiversity offsets scheme as follows:

a) impacts of development on the habitat of threatened species or ecological communities associated with:

i. karst, caves, crevices, cliffs and other geological features of significance, or

ii. rocks, or

iii. human made structures, or

iv. non-native vegetation

b) impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range

c) impacts of development on movement of threatened species that maintains their life cycle

d) impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities (including from subsidence or upsidence resulting from underground mining)

e) impacts of wind turbine strikes on protected animals

f) impacts of vehicle strikes on threatened species or on animals that are part of a TEC.

Importantly, the Project would have negligible impact on prescribed biodiversity values as:

- There would be no impacts to Karst, caves, crevices, cliffs and other geological features of significance
- There would be no impacts to Rocks that provide habitat for threatened species
- The development is not a wind farm development so turbine strike is not an issue
- While there would be some additional construction vehicle movements on existing roads and likely increased vehicle movements when the development is operational due to the newly constructed access road. The site is already fenced off, therefore, impacts of vehicle strike due to the development is unlikely to be substantially increased from current levels.

8.2.1 Squirrel Glider movement

Considering the presence of recognised movement corridors for a local Squirrel Glider population along the western, northern and southern boundaries of the development site (Stuart Lucas – Friends of the Lake Hume Squirrel Glider, pers. comm., June 2020), there is potential that any fencing or infrastructure associated with the development may affect this species ability to move through the area.

Barbed wire fencing, in particular, is a well-documented hazard to wildlife, particularly gliding mammals (Van der Ree, 1999), and is listed as a threat to the Squirrel Glider under the BC Act. This potential impact has been discussed in more detail in **Section 9.2.5**.

This issue will be considered through further design of the development, with fence height reduced and barbed-wire avoided where possible. Where this is not possible, connectivity measures should be considered in locations where fencing has the potential for result in barriers to movement and injury mortality. Retaining and improving safe habitat connectivity for the Squirrel Glider may involve crossing structures (e.g. rope crossings and glider poles) and improvement of habitat corridors elsewhere around the development site (e.g. planting within current gaps).

Measures may also be taken to improve visibility of barbed wire where it cannot be avoided. Options may include adding visible (and often audible) objects to the fence, such as tape, plastic flags and metal tags (Booth, 2007).

9. Assessment of impacts

The potential for direct impacts to biodiversity is limited to clearing of native vegetation and habitat. Indirect and other impacts are identified below in **Section 9.2**. Potential aquatic biodiversity impacts are discussed in **Section 9.3**.

9.1 Impacts on native vegetation and habitat

Despite avoidance and minimisation measures (see **Section 8.1**), the development site will result in the direct removal of some native vegetation. The estimated clearing is approximately 0.44 hectares (4,421 square metres) consisting of the following PCTs:

- White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion (PCT 266) – 0.42 hectares (4,225 square metres)
- River Red Gum herbaceous-grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the eastern Riverina Bioregion (PCT 5) – 0.01 hectares (105 square metres)
- Planted native trees and shrubs – 0.009 hectares (91 square metres).

Table 9-1 provides a summary of the native vegetation clearing that would occur within the development site including the corresponding TEC where applicable and the vegetation integrity loss. The biodiversity credit requirements for these impacts are outlined in **Chapter 12**.

The direct impacts on species credit threatened species habitat associated with the clearing of native vegetation are outlined in **Table 9-2**. Other potential impacts to threatened species habitat including impacts to connectivity and species movement, impacts to non-native vegetation and disturbed areas, and impacts to water quality and hydrology are discussed in **Section 9.2**.

Indirect impacts to vegetation retained directly adjacent to the areas of direct impact are expected to be negligible. The development site does not contain any large areas of native vegetation that will be broken up by the development. The vegetation that will remain is already adjacent to the existing infrastructure and subject to edge effects. No further loss of vegetation integrity is expected in these areas as a result of the development so indirect impacts have not been calculated.

Table 9-1 Summary of native vegetation clearing within the development site

Zone	Plant community type ID No.	Plant community type name	Vegetation formation	PCT percent cleared (historically across range)	Corresponding Threatened Ecological Community (TEC)	Area (ha) in development site	Vegetation integrity loss
1	266	White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion - Poor	Grassy Woodlands	94 %	White Box Yellow Box Blakely's Red Gum Woodland (Endangered)	0.02 (164 m^2)	31.6

Zone	Plant community type ID No.	Plant community type name	Vegetation formation	PCT percent cleared (historically across range)	Corresponding Threatened Ecological Community (TEC)	Area (ha) in development site	Vegetation integrity loss
2		White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion – Derived native grasslands				0.41 (4,061 m^2)	3.2
3	5	River Red Gum herbaceous-grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the eastern Riverina Bioregion	Forested Wetlands	40 %	-	0.01 (105 m^2)	21.9

Table 9-2 Summary of direct impacts on threatened species credit species habitat associated with the loss of native vegetation

Species name	Common name	EPBC Act	BC Act	Sensitivity to gain class	SAII	Area (ha) in development site
Petaurus norfolcensis	Squirrel Glider	-	V	High	No	0.02 (164 m^2)

9.2 Prescribed biodiversity impacts

This section identifies the potential prescribed biodiversity impacts on threatened species associated with the development in accordance with Section 6.7 of the BAM. These are impacts that are in addition to, or instead of, impacts from clearing vegetation and/or loss of habitat.

9.2.1 Impacts on the habitat of threatened species or ecological communities associated with karst, caves, crevices, cliffs and other features of geological significance

There are no occurrences of karst, caves, crevices and cliffs or other geological features of significance within the development site, or threatened species or ecological communities associated with these features. As such, this prescribed impact has not been considered further.

9.2.2 Impacts on the habitat of threatened species or ecological communities associated with rocks

There are no occurrences of rocks or rocky habitats within the development site or threatened species or ecological communities associated with rocks. As such, this prescribed impact has not been considered further.

9.2.3 Impacts on the habitat of threatened species or ecological communities associated with human made structures

There are four threatened species that can use human made structures as habitat that may be affected by the development which are:

- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)
- Little Pied Bat (*Chalinolobus picatus*)
- Large Bent-winged Bat (*Miniopterus orianae oceanensis*)
- Corben's Long-eared Bat (*Nyctophilus corbeni*)
- Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*).

The Little Pied Bat and Large Bent-winged Bat are known to roost in cave-like human made structures including mine shafts, storm water channels, buildings, and under bridges. The Eastern False Pipistrelle, Corben's Long-eared Bat and Yellow-bellied Sheathtail-bat roost mainly in tree hollows but will also roost under bark or in man-made structures. There are no human made structures in the development site that would be suitable for these bats to use as roosting habitat. It is unlikely that the development would detrimentally affect the bioregional persistence of these species.

9.2.4 Impacts on the habitat of threatened species or ecological communities associated with non-native vegetation

Up to 0.07 hectares (682 square metres) of exotic and 0.009 hectares (91 square metres) planted native trees and shrubs would be impacted by the development.

Twelve threatened species may utilise the non-native vegetation, including both native and exotic planted trees and shrubs, that are found within the development sites.

Planted native trees and shrubs surrounding the development site (particularly along Trout Farm Road) are known to be used by the Squirrel Glider as a movement corridor (refer to **Figure 5-1**) and for nesting in nest boxes that have been installed by a local conservation group (Stuart Lucas – Friends of the Lake Hume Squirrel Glider, pers. comm., June 2020). Although it has not been confirmed, exotic vegetation also likely facilitates movement for this species.

The Grey-headed Flying-fox and Little Lorikeet are considered likely to forage on the flowers and/or fruit of both planted and exotic trees within the development site. The Dusky Woodswallow, Diamond Firetail, Grey-crowned Babbler and Speckled Warbler may forage insects around the planted trees and non-native vegetation and may use the vegetation for perching. The Little Pied Bat, Eastern False Pipistrelle, Large Bent-winged Bat, Corben's Long-eared Bat and Yellow-bellied Sheathtail-bat may forage in the air spaces around areas of non-native vegetation, feeding on the insects attracted to the vegetation. No hollow-bearing trees were identified in planted and non-native vegetation within the development site that would provide roosting habitat for these species.

Due to the marginal, revegetated, structure of the vegetation present, it is unlikely to be used as breeding habitat by any threatened species. It is unlikely that the development would detrimentally affect the bioregional persistence of these species. Any impacts to movement corridors used by the Squirrel Glider can be mitigated by planting in these areas.

9.2.5 Impacts on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range

Habitat connectivity is identified as the degree to which a particular site connects different areas of habitat of threatened species to facilitate the movement of those species across their range. Threatened species movement is identified as the degree to which a particular site contributes to the movement of threatened species to maintain their lifecycle.

In terms of habitat connectivity, the development site is located within a highly disturbed landscape where the majority of habitats have been cleared. The habitats that do remain are fragmented and highly isolated.

As previously mentioned, the development site occurs within a landscape that supports a viable Squirrel Glider population and that native vegetation both within and surrounding the site provides an important movement corridor (refer to **Figure 5-1**) and refuse habitat (Stuart Lucas – Friends of the Lake Hume Squirrel Glider, pers. comm., June 2020). The development will result in the removal of 0.02 hectares (164 m^2) of PCT 266 and 0.009 hectares (91 square metres) planted native trees and shrubs provide movement, foraging and refuge habitat for the Squirrel Glider. There is potential that any fencing or infrastructure associated with the development may affect this species ability to move through the area, particularly around the proposed access track that goes through a small patch of PCT 266. Barbed wire fencing, in particular, is a well-documented hazard to wildlife, particularly gliding mammals (Van der Ree, 1999), and is listed as a threat to the Squirrel Glider under the BC Act. Barbed-wire has the potential to cause injury or death to Squirrel Glider moving though the habitat if they run into fencing while gliding or climbing.

This issue will be considered through further design of the development, with fence height reduced and barbed-wire avoided where possible. Where this is not possible, connectivity measures should be considered in locations where fencing has the potential for result in barriers to movement and injury mortality. Retaining and improving safe habitat connectivity for the Squirrel Glider may involve crossing structures (e.g. rope crossings and glider poles) and improvement of habitat corridors elsewhere around the development site (e.g. planting within current gaps). Measures may also be taken to improve visibility of barbed wire where it cannot be avoided. Options may include adding visible (and often audible) objects to the fence, such as tape, plastic flags and metal tags (Booth, 2007).

The vegetation on the development site may also facilitate movement between the corridors for other highly mobile species. Flying animals such as birds and bats use the airspace to move between natural habitats and the patchy vegetation within the development site is likely to be used as a foraging or perching resource as part of daily movements. Threatened species known from the locality including the Grey-headed Flying-fox and other threatened bats are powerful flyers capable of covering large distances between habitat patches. The landscape of the locality in its current form is permeable to these species and habitat connectivity for these species would not be detrimentally affected, and the bioregional persistence of these species would not be detrimentally affected by the development.

9.2.6 Impacts on movement of threatened species that maintains their life cycle

The known Squirrel Glider movement corridors around the development site (refer to **Figure 5-1**) allow this species to pass through the area in search of foraging resources and during mating season. Nesting has been confirmed in numerous locations in the Hume Village area (refer to **Figure 5-1**) by the Friends of the Lake Hume Squirrel Glider (Stuart Lucas, pers. comm., June 2020). The biggest threat to the life cycle if the Squirrel Glider is the installation of barbed wire fenced through these corridors, such as around the proposed access track, which may result in injury or death to this species. Proposed measures to deal with this potential impact are listed in **Section 9.2.5**.

The life cycle of threatened species known from the locality including the Grey-headed Flying-fox are unlikely to be dependent on the habitats to be affected by the development site. The habitats to be affected are marginal foraging habitat and no breeding habitat is likely to be impacted. The development site is not part of a recognised movement corridor between breeding grounds, foraging grounds, or other habitats important for the lifecycle of these species such as staging points for migration. The movement of these species between foraging and breeding grounds would not be affected, and the bioregional persistence of these species would not be detrimentally affected by the development.

9.2.7 Impacts on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities

The development does not include any direct impacts to mapped waterways or waterbodies. The development is unlikely to directly impact on any areas that will affect the water quality and hydrological processes that sustain threatened species and threatened ecological communities.

There is potential for indirect impacts to surrounding habitats from erosion and contaminated run-off from the site and the existing and proposed roadways. The main risk would be to the Murray River as the development site will traverse an unnamed and unmapped drainage line, which drains run-off from the immediate slope into the Murray River. Construction activities adjacent to the Murray River, are most likely to have an impact on water quality (if not mitigated). This may affect downstream environments due to potential changes in water quality and geomorphology associated with the construction of the development. The implementation of standard mitigation measures (i.e. sediment control, spill control) would be implemented to control sediment and pollutants from any significant runoff events.

Indirect impacts such as those from groundwater drawdown are not expected to impact any threatened ecological communities or threatened species habitat. Some terrestrial GDEs that are BC Act listed TECs may be indirectly impacted by a level of groundwater drawdown, but they are not obligate GDEs (meaning they are not entirely dependent on groundwater). These terrestrial GDEs that are TECs are likely to be opportunistic facultative GDEs that depend on the subsurface presence of groundwater (often accessed via the capillary fringe – subsurface water just above the water table) in some locations but not in others, particularly where an alternative source of water (i.e. rainfall) cannot be accessed to maintain ecological function. The TECs that may be impacted by groundwater drawdown are outlined in **Table 9-3**.

Table 9-3 Threatened ecological communities that may be impacted by groundwater drawdown

Threatened Ecological Community	Location
White Box Yellow Box Blakely's Red Gum Woodland (BC Act)	This TEC is represented by poor condition remnant woodland and derived native grasslands in the development site (refer **Figure 4-2**)

9.2.8 Impacts of wind turbine strikes on protected animals

This prescribed impact is not applicable to the development.

9.2.9 Impacts of vehicle strikes on threatened species of animals or on animals that are part of a TEC

Vehicle collision is a direct impact that reduces local population numbers and is a common occurrence in Australia. Mammals, reptiles, amphibians and birds are all at risk of vehicle strike, particularly those common species (e.g. birds) that are tolerant of disturbance and remain in the development site. The risk of an increase in the frequency of vehicle strike due to the development is low and would generally be limited to vehicle movements to and from the construction site through the entrance off Murray Street. After the completion of the development, there may be a minor increase in traffic coming into the existing access road if the completed development requires more personnel, however the increase is likely to be negligible to current traffic levels, of which speed limits are generally low. Vehicle strike associated with the development is unlikely to affect any threatened species of animals or animals that are part of a TEC.

9.3 Contribution to Key Threatening Processes

A Key Threatening Process (KTP) is a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or an ecological community. KTPs are listed under the BC Act and EPBC Act. At present, there are currently 39 listed KTPs under the BC Act. There are eight KTPs listed under the *Fisheries Management Act 1994*. There are 21 KTPs listed under the EPBC Act. Of the listed KTPs, the development may directly or indirectly contribute to the following KTPs as outlined in **Table 9-4**. Aside from direct impacts to native vegetation, the potential for contribution to these KTPs can be minimised and avoided

through the implementation of mitigation and management measures during construction of the development. These measures are outlined in **Chapter 10**.

Table 9-4 Summary of Key Threatening Processes that the development will directly or indirectly contribute to

Key Threatening Process	BC Act, FM Act or EPBC Act	Likelihood of the development directly or indirectly contributing to the KTP
Clearing of native vegetation	BC Act	High – clearing of native vegetation would occur. However, the magnitude of clearing is small (0.44 hectares).
Land clearance	EPBC Act	High – clearing of native vegetation would occur. However, the magnitude of clearing is small (0.44 hectares).
Infection of frogs by amphibian chytrid causing the disease chytridiomycosis	BC Act	Low – mitigation measures would be implemented to prevent the spread or introduction of amphibian chytrid fungus.
Infection of amphibians with chytrid fungus resulting in chytridiomycosis	EPBC Act	Low – mitigation measures would be implemented to prevent the spread or introduction of amphibian chytrid fungus.
Infection of native plants by *Phytophthora cinnamomi*	BC Act	Low – mitigation measures would be implemented to prevent the spread or introduction of *Phytophthora cinnamomi*.
Dieback caused by the root-rot fungus (*Phytophthora cinnamomi*)	EPBC Act	Low – mitigation measures would be implemented to prevent the spread or introduction of *Phytophthora cinnamomi*.
Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae	BC Act	Low – mitigation measures would be implemented to prevent the spread or introduction of Exotic Rust Fungi.
Invasion and establishment of exotic vines and scrambler	BC Act	Low – mitigation measures would be implemented to prevent the spread of weeds.
Invasion of native plant communities by African Olive *Olea europaea* subsp. *cuspidata* (Wall. ex G. Don) Cif.	BC Act	Low – mitigation measures would be implemented to prevent the spread of weeds.
Invasion of native plant communities by exotic perennial grasses	BC Act	Low – mitigation measures would be implemented to prevent the spread of weeds.
Degradation of native riparian vegetation along New South Wales water courses	FM Act	Low – mitigation measures would be implemented to avoid inadvertent impacts to vegetation outside of the development site associated with the Murray River.

9.4 Aquatic impacts

The development does would not result in any direct impacts to aquatic habitats or threatened fish species.

Unmitigated impacts to aquatic habitats may arise from construction activities. There is potential for indirect impacts to surrounding habitats from erosion and contaminated run-off from the development site and the existing and proposed roadways. The main risk would be to the Murray River as the development site will traverse an unnamed and unmapped drainage line, which drains run-off from the immediate slope into the Murray River. Construction activities adjacent to the Murray River are most likely to have an impact on water

quality (if not mitigated). This may affect downstream environments due to potential changes in water quality and geomorphology associated with the construction of the development. The implementation of standard mitigation measures (i.e. sediment control, spill control) would be implemented to control sediment and pollutants from any significant runoff events.

9.5 Cumulative biodiversity impacts

Potential cumulative impacts were considered for assessment based on the likely interactions of the development with other projects and plans that met the adopted screening criteria.

The cumulative impacts of historic vegetation clearing for agriculture, urban development, and development and maintenance of infrastructure will likely include continued loss of biodiversity in the region. It is estimated that 56 percent of the Murray Channels and Floodplains landscape has been cleared.

There have not been a large number of developments in recent history or planned in the future, that have publicly available documentation of potential biodiversity impacts. This assessment found a recent impact assessment for a quarry in Table Top (Habitat Planning, 2019), which also references plans for an industrial development and rail hub planned in Ettamogah (Nexus). These developments combined have a potential impact on native vegetation of over 200 hectares, though the actual impact is not known. While data from all recent projects in the locality is not freely available, some information on recent projects with biodiversity impacts are listed in **Table 9-5**.

While predominately rural and agricultural in land use, remnant vegetation across the Murray Channels and Floodplains landscape is likely important for maintaining biodiversity linkages. Continued reduction in vegetation cover will lead to the cumulative degradation of these links. Further impacts to biodiversity are likely to result in this region in the future. While this development will contribute to the cumulative impact on biodiversity in the region, no significant increase to cumulative impacts would occur.

Table 9-5 Past, present and future projects

Project	Impacts
Extractive Industry ('Rockwood Quarry') and Crushing of Recycled Concrete, Table Top – Environmental Impact Statement (Habitat Planning, 2019)	This project would result in the following impacts: • Removal of 6.04 hectares of native vegetation consisting of 1.25 hectares of PCT 266 and 4.79 hectares of PCT 1000 • The removal of 1.25 hectares of vegetation that meets the listing criteria as the Box Gum Woodlands threatened ecological community • Impacts to potential Swift Parrot and Pink-tailed Worm Lizard habitat
Nexus Industrial Precinct and Ettamogah Rail Hub	There is no environmental impact assessment available for this development. A review of regional vegetation mapping within the 450-hectare site includes around 220 ha of native vegetation, including: • White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion (PCT 266) – 12 hectares The impact of this development not known.

10. Mitigating and managing impacts on biodiversity values

Once all practicable steps to avoid or minimise impacts have been implemented at the detailed design phase, mitigation and management measures would be implemented to further lessen the potential ecological impacts of the Hume Battery Energy Storage System development.

Mitigation and management measures to be carried out during the construction are outlined in the EIS. This includes (but is not limited to) the following biodiversity specific measures provided in **Table 10-1**.

Table 10-1 Recommended mitigation measures during pre-construction and construction

Reference	Potential impact	Environmental management measures	Timing
B01	Impact to surrounding vegetation and threatened ecological communities	The limits of the work zone, areas for parking and turning of vehicles and plant equipment would be accurately and clearly marked out prior to commencement of works. These areas would be located so that vegetation disturbance is minimised as much as possible and the drip-line of trees avoided.	Pre-construction
B02		Exclusion zones would be established around high-quality vegetation in the west of the proposal site. Periodic monitoring would be undertaken to ensure all controls are in place and no inadvertent impacts are occurring.	Pre-construction
B03		Materials, plant, equipment, work vehicles and stockpiles would be placed to avoid damage to surrounding vegetation and will be outside tree drip-lines.	Pre-construction
B04		If any damage occurs to vegetation outside of the nominated work area, the appropriate environmental representative will be notified so that appropriate remediation strategies can be developed.	Construction
B05		Erosion and sediment measures would be implemented in accordance with the principles and requirements in Managing Urban Stormwater – Soils and Construction, Volume 1 (Landcom, 2004) and Volume 2D (NSW Department of Environment, Climate Change and Water, 2008c), commonly referred to as the 'Blue Book'.	Pre-construction
B06		Construction personnel are to be informed of the environmentally sensitive aspects of the site, including plans for impacted and adjoining areas showing vegetation communities; important flora and fauna habitat areas; and locations where threatened species, populations or ecological communities have been recorded.	All stages

Reference	Potential impact	Environmental management measures	Timing
B07	Impact to native plants and animals including threatened species	A pre-clearing inspection would be undertaken 48 hours prior to any native vegetation clearing by a suitable qualified ecologist and the Contractor's Environmental Manager (or delegate). The pre-clearing inspection would include, as a minimum: • Identification of hollow bearing trees or other habitat features; • Identification of any threatened flora and fauna; • A check on the physical demarcation of the limit of clearing; • An approved erosion and sediment control plan for the worksite; and • The completion of any other pre-clearing requirements required by any project approvals, permits or licences.	Construction
B08		Construction crews would be made aware that any native fauna species encountered must be allowed to leave site without being harassed and a local wildlife rescue organisation must be called for assistance where necessary.	Construction
B09		A procedure for dealing with unexpected EEC threatened species would be identified during construction, including cessation of work and notification of the Department, determination of appropriate mitigation measures in consultation with the DPIE (including relevant relocation measures) and updating of ecological monitoring or off-set requirements.	Construction
B10	Impacts to the Squirrel Glider connectivity	Barbed wire fencing is to be avoided wherever possible. Fencing should be lowered to a minimum required height where possible.	All stages
B11		Where barbed wire fencing cannot be avoided, it should be located away from retained vegetation and have improved visibility measures installed, such as adding visible (and often audible) objects to the fence, such as tape, plastic flags and metal tags (Booth, 2007).	All stages
B12		All fencing containing barbed wire that is erected during the construction of the project is to be monitored daily in areas around known Squirrel Glider movement corridors.	Construction
B13		Permanent barbed wire fencing required by the development in identified movement corridors should implement alternative connectivity structures such as rope crossing and glide poles.	Construction

Reference	Potential impact	Environmental management measures	Timing
B14		Planting of native trees and shrubs through identified movement corridors would be undertaken with the agreement of WaterNSW to improve the connectivity of habitat for the Squirrel Glider and reduce the potential for impact.	Any stages
B15	Impacts from introduction and spread of weeds	Weed control would be undertaken by suitably qualified and/or experienced personnel. This may include: • Manual weed removal in preference to herbicides • Replacing non-target species removed/killed as a result of weed control activities • Protecting non-target species from spray drift • Using only herbicides registered for use within or near waterways for the specific target weed • Applying herbicides during drier times when the waterway level is below the high-water mark • Not applying herbicide if it is raining or if rain is expected • Mixing and loading herbicides, and cleaning equipment away from waterways and drains	Construction and Post-construction
B16		Weed management is to be undertaken in areas affected by construction prior to any clearing works in accordance with the *Biosecurity Act 2015* to ensure they are not spread to the surrounding environment; including during transport disposal off-site to a licenced waste disposal facility.	Construction and Post-construction
B17		All weeds, propagules, other plant parts and/or excavated topsoil material that is likely to be infested with weed propagules that are likely to regenerate would be treated on site or bagged, removed from site and disposed of at a licensed waste disposal facility.	Construction and Post-construction
B18	Impacts from introduction and spread of plant pathogens	All vehicles driving to and from site would follow a protocol to prevent the spread or introduction of phytophthora, namely vehicles should be clean, including the tyres and any equipment.	All stages

11. Thresholds for the assessment and offsetting of impacts of development

This section of the BDAR identifies the impact thresholds that the assessor must apply including:

- impacts on a potential entity that are serious and irreversible impacts
- impacts for which the assessor is required to determine an offset requirement
- impacts that do not require further assessment by the assessor.

11.1 Impacts on a potential entity that are serious and irreversible impacts

There would be no impacts to any SAII entities. As such, the additional impact assessment provision outlined in subsection 10.2.3 of the BAM has not been completed.

11.2 Impacts for which the assessor is required to determine an offset requirement

The determination of impacts on the development site which require an offset was undertaken in accordance with Section 10.3 of the BAM.

11.2.1 Impacts on native vegetation (ecosystem credits)

An offset is required for the impacts to most of the native vegetation in the development site as outlined in **Table 11-1**. Complete removal of the vegetation within the development site would occur. The location of the vegetation zones that will be impacted is shown in **Figure 11-1**.

Table 11-1 Impacts to PCTs which require an offset

Veg zone	PCT	TEC	Area (ha)	Vegetation Integrity score
1	White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion - Poor	Yes	0.02 (164 m^2)	31.6
3	River Red Gum herbaceous-grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the eastern Riverina Bioregion - Poor	No	0.01 (105 m^2)	21.9

11.2.2 Impacts on threatened species

An offset is required for impacts to threatened species as outlined in **Table 11-2**. The location of this habitat is shown in **Figure 11-1**.

Table 11-2 Impacts to threatened species which require an offset

Veg zone	PCT	Area of species polygon (ha)	Vegetation Integrity score
Squirrel Glider (*Petaurus norfolcensis*)			
1	White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion - Poor	0.02 (164 m^2)	31.6

11.3 Impacts for which the assessor is not required to determine an offset requirement

An offset is not required for impacts where the vegetation integrity score is below those set out in paragraph 10.3.1.1 of the BAM for impacts on native vegetation and paragraph 10.3.2.1 of the BAM for impacts on threatened species. Impacts not requiring offset are described in **Table 11-3**. The vegetation integrity score for the White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion (PCT 849) – Derived native grasslands is 3.2. As the vegetation integrity score for this vegetation zone is below 15 an offset is not required for this impact to native vegetation. The location of this vegetation zone is shown in **Figure 11-1**.

Table 11-3 Impacts which do not require an offset

Veg zone	PCT	Area (ha)	Vegetation Integrity (VI) score	VI score threshold*	Offset required
Native vegetation					
2	White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion – Derived native grasslands	0.41 (4,061 m^2)	3.2	≥15	No

*Note: Vegetation integrity score thresholds as set out by section 10.3 of the BAM

11.4 Impacts that do not require further assessment by the assessor

Areas of land on the development site without native vegetation do not need to be assessed for credits under Section 4 or Section 5 of the BAM. As such, areas of the development site that do not possess PCTs have not been assessed and credits have not been generated.

Figure 11-1 Impacts requiring offsets and impacts not requiring offsets

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12. Biodiversity credit requirements

A summary of the biodiversity credit requirements for the development are provided below in **Table 12-1** and **Table 12-2**. The credit report is provided in **Appendix E**.

Table 12-1 Ecosystem credits required

Veg zone	PCT	TEC	Credits
1	White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion - Poor	Yes	1
3	River Red Gum herbaceous-grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the eastern Riverina Bioregion - Poor	No	1
		Total	**2**

Due to the very minor impact for Squirrel Glider, no credits were generated by the BAM-Calculator.

Table 12-2 Species credits required

Species	Credits
Squirrel Glider (*Petaurus norfolcensis*)	0

The proponent is considering options to address the offset obligation identified in this BDAR which may include sourcing credits from the biodiversity stewardship public register and retiring these through negotiation with the credit holder, or paying directly into the Biodiversity Conservation Fund.

13. Conclusions

The Hume Battery Energy Storage System development is located within a highly disturbed landscape that does not possess large expanses of intact native vegetation with high biodiversity value. As most of the development site has been located within existing cleared areas and tracks, direct impacts to terrestrial biodiversity has been avoided and/or minimised as much as feasible. The limited amount of native vegetation that would be disturbed is of poor quality and threatened species habitats are generally limited. No areas of land that the Minister for Energy and Environment has declared as an area of outstanding biodiversity value in accordance with section 3.1 of the BC Act would be affected. Importantly, the areas proposed for clearing would be refined during detailed design and reviewed as part of the pre-clearing process.

The direct impacts to biodiversity values that would occur as a result of the development construction includes 0.44 hectares of native vegetation, which includes the following PCTs:

- White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion (PCT 266) – 0.43 hectares (4,225 square metres)
    - Poor condition – 0.02 hectares (164 square metres)
    - Derived native grasslands - 0.41 hectares (4,061 square metres)
- River Red Gum herbaceous-grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the eastern Riverina Bioregion (PCT 5) – 0.01 hectares (105 square metres)

One Threatened Ecological Community (TEC) listed under the BC Act will be impacted by the development:

- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland – 0.43 hectares (4,225 square metres) comprising PCT 266 noted above

All the areas of PCT 266 in the development site are too small and degraded to meet the condition threshold criteria for the EPBC Act listed White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland TEC detailed in the listing and conservation advice.

This vegetation is likely to provide foraging habitat for a range of mobile threatened fauna species including the Grey-headed Flying Fox, Swift Parrot and a number of insectivorous bat species. The impact to these species would be limited to foraging habitat only.

A known local Squirrel Glider population be directly impacted by the development. This species was not recorded from targeted surveys, though is known to occur from nest box monitoring that has been undertaken on and around the development site since 2013. The extent of impact to this species is limited to a very small area of habitat 0.02 hectares (164 square metres), which represents foraging and connectivity habitat. The one hollow-bearing tree within this habitat would be retained, however may require some trimming for the proposed access track.

The Squirrel Glider may also be indirectly impacted by fencing and infrastructure associated with the development that is constructed within or close to known movement corridors around the development site. This includes injury and mortality caused by collision with barbed-wire fences. Measures to minimise the potential for impact have been discussed in this report.

Targeted surveys for the Sloane's Froglet did not record this species within or adjacent to the development site. An assessment of the *Carex appressa* wetland on the development site against known habitat characteristics described from the Albury population demonstrate that the habitat is marginal due to its inability to retain water. The habitat is connected to the Murray River by an unmapped drainage line, though there are no records of the Sloane's Froglet along the Murray River near the site. Therefore, the likelihood of Sloane's Froglet occurring in habitat on the development site is considered to be low.

The development may also result in prescribed biodiversity impacts, including removal of planted native and non-native vegetation that may be used by threatened species for foraging and connectivity. However, the impact is negligible and not expected to affect the lifecycle of these species. Measures to maintain connectivity for the Squirrel Glider have been discussed.

Considering the highly disturbed nature of the landscape within which the development sits, no indirect impacts are expected to adversely affect areas of vegetation that will be retained. There is potential for indirect impacts to surrounding aquatic habitats (e.g. Murray River) from erosion and contaminated run-off from construction and operation. The implementation of standard mitigation measures (i.e. sediment control, spill control) would be implemented to control sediment and pollutants from any significant runoff events.

Once all practicable steps to avoid or minimise impacts have been implemented at the detailed design phase, mitigation and management measures would be implemented to further lessen the potential ecological impacts of the development. Mitigation and management measures that would be implemented during the development are outlined in this report.

An offset would be required for the impacts to native vegetation the credit requirement has been calculated using the BAM Calculator. Offsets were identified as being required for the Squirrel Glider, however the impact area is so small that no credits were generated by the calculator.

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Appendix A. Habitat assessment

State and nationally listed threatened species identified from the literature review, database searches (BioNet and PMST) and Biodiversity Assessment Method Calculator (BAM-C), were considered in terms of their likelihood to occur in the habitats present within the survey area based on identified habitat requirements. The habitat suitability assessment for threatened species is provided in Table A-1 and Table A-2.

Table A-14-1 Habitat suitability assessment for threatened plant species

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
Acacia ausfeldii (Ausfeld's Wattle)	V	-	Found to the east of Dubbo in the Mudgee-Ulan-Gulgong area of the NSW South Western Slopes bioregion, with some records in the adjoining Brigalow Belt South, South Eastern Highlands and the Sydney Basin bioregions. In New South Wales it grows in alluvial gullies, on flats or low hills. Grows in eucalypt woodland in sandy soil; often in remnant roadside patches of woodland.	BAM-C	Low in development site. There is no habitat considered suitable for this species in the development site. Surveys did not identify this species.
Ammobium craspedioides (Yass Daisy)	V	V	Found from near Crookwell on the Southern Tablelands to near Wagga Wagga on the South Western Slopes. Most populations are in the Yass region. Found in moist or dry forest communities, Box-Gum Woodland and secondary grassland derived from clearing of these communities. Grows in association with a large range of eucalypts (Eucalyptus blakelyi, E. bridgesiana, E. dives, E. goniocalyx, E. macrorhyncha, E. mannifera, E. melliodora, E. polyanthemos, E. rubida).	BAM-C	Low in development site. There is no habitat considered suitable for this species in the development site. Surveys did not identify this species.
Amphibromus fluitans (River Swamp Wallaby-grass)	V	V	It has been recorded recently in lagoons beside the Murray River near Cooks Lagoon. River Swamp Wallaby Grass grows mostly in permanent swamps. The species needs wetlands which are at least moderately fertile and which have some bare ground, conditions which are produced by seasonally-fluctuating water levels.	33 – BioNet PMST	Low in development site. Species was recorded within 20 km of the development site. Surveys did not identify this species.

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
Caladenia concolor (Crimson Spider Orchid)	E	V	One population is known near the study area from the Nail Can Hill Crown Reserve near Albury. Habitat is regrowth woodland on granite ridge country that has retained a high diversity of plant species, including other orchids. The dominant trees are Blakely's Red Gum (Eucalyptus blakelyi), Red Stringybark (E. macrorhyncha), Red Box (E. polyanthemos) and White Box (E. albens); the diverse understorey includes Silver Wattle (Acacia dealbata), Hop Bitter-pea (Daviesia latifolia), Common Beard-heath (Leucopogon virgatus), Spreading Flax-lily (Dianella revoluta) and Poa Tussock (Poa sieberiana).	18 – BioNet PMST	Low in development site. Species was recorded within 20 km of the development site. Surveys did not identify this species.
Caladenia rosella (Rosella Spider Orchid)	V	E	The single NSW collection of the Rosella Spider Orchid, located in Albury, is undated, but is estimated to have been collected before 1896. Today the species is found near Melbourne in Victoria but is listed as endangered because less than 200 plants are known to exist.	1 – BioNet	Unlikely to be present in the development site. Habitat in the development site is too degraded for this species.
Caladenia tensa (Greencomb Spider-orchid)	-	E	The species is also known from eastern and south-east South Australia where it is considered widespread but uncommon. The species grows on red-brown sandy loams on rises in open woodland dominated by Yellow Gum (Eucalyptus leucoxylon sens. lat.) and Rottnest Island Pine (Callitris preissii).	PMST	Low in development site. There is no habitat considered suitable for this species in the development site. Surveys did not identify this species.
Cullen parvum (Small Scurf-pea)	E	-	A small population was recently reported from near Jerilderie (although it has not been relocated). In recent years, two populations have been recorded in travelling stock reserves south-west of Wagga Wagga, and a population reputedly exists on a roadside near Galong. Another population has recently been discovered on private land near Young. Large populations have been recorded in grassy gaps in the Red Gum Woodlands of Barmah State Park, just across the border in Victoria. Extensive suitable habitat probably occurs across the border in NSW.	BAM-C	Low in development site. There is no habitat considered suitable for this species in the development site. Surveys did not identify this species.

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
Euphrasia arguta (Euphrasia arguta)	CE	CE	Historically, Euphrasia arguta has only been recorded from relatively few places within an area extending from Sydney to Bathurst and north to Walcha. Was rediscovered in the Nundle area of the NSW north western slopes and tablelands in 2008. Historic records of the species noted the following habitats: 'in the open forest country around Bathurst in sub humid places', 'on the grassy country near Bathurst', and 'in meadows near rivers'. Plants from the Nundle area have been reported from eucalypt forest with a mixed grass and shrub understorey; here, plants were most dense in an open disturbed area and along the roadside, indicating the species had regenerated following disturbance.	BAM-C	Low in development site. There is no habitat considered suitable for this species in the development site. Surveys did not identify this species.
Grevillea wilkinsonii (Tumut Grevillea)	CE	E	The Tumut Grevillea has a highly restricted distribution in the NSW South-west Slopes region. Flowers from mid-September to mid October, with individual flower clusters lasting for about two weeks from when the first individual flowers in the cluster open. Fruits mature during December and split longitudinally down one side to release the seed. The seed in this species has a lengthy dormancy, with germination usually taking between one and two years after sowing.	BAM-C	Low in development site. There is no habitat considered suitable for this species in the development site. Surveys did not identify this species.
Leucochrysum albicans var. tricolor (Hoary Sunray)	-	E	Endemic to south-eastern Australia, where it is currently known from three geographically separate areas in Tasmania, Victoria and south-eastern NSW and ACT. In NSW it currently occurs on the Southern Tablelands adjacent areas in an area roughly bounded by Albury, Bega and Goulburn, with a few scattered localities know from beyond this region. Occurs in a wide variety of grassland, woodland and forest habitats, generally on relatively heavy soils. Can occur in modified habitats such as semi-urban areas and roadsides. Highly dependent on the presence of bare ground for germination.	1 - BioNet	Low in development site. Species was recorded within 20 km of the development site. Surveys did not identify this species.
Pilularia novae-hollandiae (Austral Pilwort)	E	-	In NSW, Austral Pilwort has been recorded from suburban Sydney, Khancoban, the Riverina between Albury and Urana (including Henty, Walbundrie, Balldale and Howlong) and at Lake Cowal near West Wyalong. The population at Lake Cowal is the only known extant population in NSW. The species has also been recorded in the Australian Capital Territory, Victoria, Tasmania, South Australia and Western Australia. Austral Pillwort grows in shallow swamps and waterways, often among grasses and sedges. It is most often recorded in drying mud as this is when it is most conspicuous. Most of the records in the Albury-Urana area were from table drains on the sides of roads.	1 – BioNet	Low in development site. Species was recorded within 20 km of the development site. Surveys did not identify this species. Habitat quality for this species is low.

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
Prasophyllum petilum (Tarengo Leek Orchid)	E	E	Natural populations are known from a total of five sites in NSW. These area at Boorowa, Captains Flat, Ilford, Delegate and a newly recognised population c.10 k SE of Muswellbrook. Grows in open sites within Natural Temperate Grassland at the Boorowa and Delegate sites. Also grows in grassy woodland in association with River Tussock Poa labillardieri, Black Gum Eucalyptus aggregata and tea-trees Leptospermum spp. at Captains Flat and within the grassy groundlayer dominated by Kangaroo Grass under Box-Gum Woodland at Ilford (and Hall, ACT).	PMST	Unlikely to occur in the development area. There is no habitat considered suitable for this species in the development site. This species has not been recorded in the locality.
Prasophyllum validum (Sturdy Leek-orchid)	-	V	The Sturdy Leek-orchid Prasophyllum validum is a tall, slender, deciduous terrestrial orchid endemic to south-eastern Australia, where it occurs in Victoria and South Australia. Little is known of the ecology or biology of the species, although it seems to prefer relatively dry woodland habitats. Currently 18 populations containing about 3,200 plants are known. There is no information on previous distribution or abundance, although substantial areas of woodland habitats have been cleared.	PMST	Unlikely to occur in the development area. There is no habitat considered suitable for this species in the development site. This species has not been recorded in the locality.
Senecio garlandii (Woolly Ragwort)	V	-	This daisy is found between Temora, Bethungra and Albury and possibly Burrinjuck near Yass. The largest populations are at The Rock and Mt Tabletop (and surrounds). Woolly Ragwort occurs on sheltered slopes of rocky outcrops.	5 – BioNet	Unlikely to occur in the development area. There is no habitat considered suitable for this species in the development site. This species has not been recorded in the locality.
Swainsona recta (Small Purple-pea)	E	E	Small Purple-pea was recorded historically from places such as Carcoar, Culcairn and Wagga Wagga where it is probably now extinct. Populations still exist in the Queanbeyan and Wellington-Mudgee areas. Over 80% of the southern population grows on a railway easement. Before European settlement Small Purple-pea occurred in the grassy understorey of woodlands and open-forests dominated by Blakely's Red Gum Eucalyptus blakelyi, Yellow Box E. melliodora, Candlebark Gum E. rubida and Long-leaf Box E. goniocalyx. Grows in association with understorey dominants that include Kangaroo Grass Themeda australis, poa tussocks Poa spp. and spear-grasses Austrostipa spp.	PMST BAM-C	Low in development site. Species was recorded within 20 km of the development site. Surveys did not identify this species.

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
Swainsona sericea (Silky Swainson-pea)	V	-	Found from the Northern Tablelands to the Southern Tablelands, as well as inland slopes and plains of NSW. It is also found in South Australia, Victoria and Queensland. Its stronghold population grows in Natural Temperate Grasslands and Snow Gum Woodland on the Monaro.	2 – BioNet BAM-C	Low in development area. Species was recorded There is no habitat considered suitable for this species in the development site. Surveys did not identify this species.

* Distribution and habitat requirement information adapted from: Australian Government Department of the Environment http://www.environment.gov.au/biodiversity/threatened/index.html, NSW Office of Environment and Heritage http://www.environment.nsw.gov.au/threatenedspecies/

Key:

CE = critically endangered

E = endangered

EP = endangered population

Ex = extinct

V = vulnerable

Table A-14-2 Habitat suitability assessment for threatened animal species

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
Birds					
Anseranas semipalmata (Magpie Goose)	V	-	Mainly found in shallow wetlands (less than 1 m deep) with dense growth of rushes or sedges. Equally at home in aquatic or terrestrial habitats; often seen walking and grazing on land; feeds on grasses, bulbs and rhizomes. Activities are centred on wetlands, mainly those on floodplains of rivers and large shallow wetlands formed by run-off; breeding can occur in both summer and winter dominated rainfall sites and is strongly influenced by water level; most breeding now occurs in monsoonal sites; nests are formed in trees over deep water; breeding is unlikely in south-eastern NSW.	2- BioNet	Low in development footprint. Species was recorded within 20 km of the development site. There is no habitat in the development site considered suitable for this species.
Anthochaera Phrygia (Regent Honeyeater)	CE	CE	The Regent Honeyeater that has a patchy distribution between south-east Queensland and central Victoria. It mostly inhabits inland slopes of the Great Dividing Range, in sites of low to moderate relief with moist, fertile soils. It is most commonly associated with box-ironbark eucalypt woodland and dry sclerophyll forest, but also inhabits riparian vegetation such as sheoak (Casuarina spp) where it feeds on needle-leaved mistletoe and sometimes breeds. It sometimes utilises lowland coastal forest, which may act as a refuge when its usual habitat is affected by drought. It also uses a range of disturbed habitats within these landscapes including remnant patches in farmland and urban sites and roadside vegetation. It feeds primarily on the nectar of eucalypts and mistletoes and, to a lesser extent, lerps and honeydew; it prefers taller and larger diameter trees for foraging. It is nomadic and partly migratory with its movement through the landscape being governed by the flowering of select eucalypt species. There are four known key breeding sites: three in NSW and one in Victoria. Breeding varies between regions and corresponds with flowering of key eucalypt and mistletoe species. It usually nests in horizontal branches or forks in tall mature eucalypts and Sheoaks.	44 – BioNet PMST BAM-C	Moderate in development site. There is no breeding habitat present within the development site. However, there is potential foraging habitat in nectar producing River Red Gum and White Box trees during flowering periods.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
Artamus cyanopterus cyanopterus (Dusky Woodswallow)	V	-	The Dusky Woodswallow has two separate populations. The eastern population is found from Atherton Tableland, Queensland south to Tasmania and west to Eyre Peninsula, South Australia. The other population is found in south-west Western Australia. The Dusky Woodswallow is found in open forests and woodlands and may be seen along roadsides and on golf courses.	40 – BioNet	Moderate. May forage over the development site and perch on trees.
Botaurus poiciloptilus (Australasian Bittern)	E	E	Occurs from south-east Queensland to south-east South Australia, Tasmania and the south-west of Western Australia. The Australasian Bittern's preferred habitat is comprised of wetlands with tall dense vegetation, where it forages in still, shallow water up to 0.3 m deep, often at the edges of pools or waterways, or from platforms or mats of vegetation over deep water. It favours permanent and seasonal freshwater habitats, particularly those dominated by sedges, rushes and reeds (e.g. Phragmites, Cyperus, Eleocharis, Juncus, Typha, Baumea, Bolboschoenus) or cutting grass (Gahnia) growing over a muddy or peaty substrate.	1 – BioNet PMST	Unlikely to occur in the development site. There is no habitat in the development site considered suitable for this species.
Burhinus grallarius (Bush Stone-curlew)	E	-	Open forests and woodlands with a sparse grassy ground layer and fallen timber. Largely nocturnal, being especially active on moonlit nights. Feed on insects and small vertebrates, such as frogs, lizards and snakes. Nest on the ground in a scrape or small bare patch.	8 – BioNet BAM-C	Low in development site. There is no habitat in the development site considered suitable for this species.
Calidris ferruginea (Curlew Sandpiper)	E	CE, M	In Australia, Curlew Sandpipers occur around the coasts of all states and are also quite widespread inland, though in smaller numbers. They occur in Australia mainly during the non-breeding period but also during the breeding season when many non-breeding one-year old birds remain. Curlew Sandpipers mainly occur on intertidal mudflats in sheltered coastal sites, 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 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 and in mangroves.	PMST	Low in development site. There is no habitat in the development site considered suitable for this species. There are no records of this species in the locality.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
Callocephalon fimbriatum (Gang-gang Cockatoo)	V	-	In summer, occupies tall montane forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests with an acacia understorey. Also occur in subalpine Snow Gum woodland and occasionally in temperate or regenerating forest. In winter, occurs at lower altitudes in drier, more open eucalypt forests and woodlands, particularly in box ironbark assemblages, or in dry forest in coastal sites, occasionally feeding on exotic plant species on urban fringe sites. Favours old growth forest and woodland attributes for nesting and roosting. Nesting occurs in Spring and Summer with nests located in hollows that are 10 cm in diameter or larger and at least 9 m above the ground in eucalypts.	12 – BioNet BAM-C	Moderate. May occur in study site on occasion in winter with potential foraging habitat available in the development site. No breeding habitat in development site.
Calyptorhynchus lathami (Glossy-black Cockatoo (Breeding))	V	-	The species is uncommon although widespread throughout suitable forest and woodland habitats, from the central Queensland coast to East Gippsland in Victoria, and inland to the southern tablelands and central western plains of NSW, with a small population in the Riverina. An isolated population exists on Kangaroo Island, South Australia. Inhabits open forest and woodlands of the coast and the Great Dividing Range where stands of Sheoak occur. Black Sheoak (Allocasuarina littoralis) and Forest Sheoak (A. torulosa) are important foods. Inland populations feed on a wide range of Sheoaks, including Drooping Sheoak, Allocasuarina diminuta, and A. gymnanthera. Belah is also utilised and may be a critical food source for some populations. In the Riverina, birds are associated with hills and rocky rises supporting Drooping Sheoak, but also recorded in open woodlands dominated by Belah (Casuarina cristata).	BAM-C	Low in development site. There is no habitat in the development site considered suitable for this species. There are no *Allocasuarina* spp in the development site.
Chrysococcyx osculans (Black-eared Cuckoo)	-	M	The Black-eared Cuckoo is widespread on mainland Australia, but avoids the wet, heavily forested sites on the east coast and the south-west corner of Western Australia. It is an occasional vagrant to offshore islands and Tasmania. The Black-eared Cuckoo is found in drier country where species such as mulga and mallee form open woodlands and shrublands. It is often found in vegetation along creek beds.	PMST	Low in development site. There is no habitat in the development site considered suitable for this species. There are no records of this species in the locality.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
Chthonicola sagittata (Speckled Warbler)	V	-	The Speckled Warbler lives in a wide range of Eucalyptus dominated communities that have a grassy understorey, often on rocky ridges or in gullies. Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt re-growth and an open canopy. Large, relatively undisturbed remnants are required for the species to persist in an site. Pairs are sedentary and occupy a breeding territory of about ten hectares, with a slightly larger home-range when not breeding. The rounded, domed, roughly built nest of dry grass and strips of bark is located in a slight hollow in the ground or the base of a low dense plant, often among fallen branches and other litter. A side entrance allows the bird to walk directly inside.	32 – BioNet BAM-C	Low in development site. The habitat in the development site is considered to be low quality. There are no rocky ridges or gullies within the development site.
Circus assimilis (Spotted Harrier)	V	-	The Spotted Harrier occurs throughout the Australian mainland, except in densely forested or wooded habitats of the coast, escarpment and ranges, and rarely in Tasmania. Individuals disperse widely in NSW and comprise a single population. Occurs in grassy open woodland including Acacia and mallee remnants, inland riparian woodland, grassland and shrub steppe. It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands.	1 - BioNet	Low in development site. There is no habitat in the development site considered suitable for this species.
Climacteris picumnus victoriae (Brown Treecreeper (eastern subspecies))	V	-	Endemic to eastern Australia and occurs in eucalypt forests and woodlands of inland plains and slopes of the Great Dividing Range. It is less commonly found on coastal plains and ranges. Found in eucalypt woodlands (including Box-Gum Woodland) and dry open forest of the inland slopes and plains inland of the Great Dividing Range; mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species; also found in mallee and River Red Gum (Eucalyptus camaldulensis) Forest bordering wetlands with an open understorey of acacias, saltbush, lignum, cumbungi and grasses; usually not found in woodlands with a dense shrub layer; fallen timber is an important habitat component for foraging; also recorded, though less commonly, in similar woodland habitats on the coastal ranges and plains. Hollows in standing dead or live trees and tree stumps are essential for nesting.	32 - BioNet	Low in development site. There is no habitat in the development site considered suitable for this species. The habitat in the development site is considered to be low quality.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
Daphoenositta chrysoptera (Varied Sittella)	V	-	The Varied Sittella is sedentary and inhabits most of mainland Australia except the treeless deserts and open grasslands. Distribution in NSW is nearly continuous from the coast to the far west. Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. Feeds on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees and small branches and twigs in the tree canopy. Nests in an upright tree fork high in the living tree canopy.	9 – BioNet	Moderate. This species may forage and fly through the development site.
Falco hypoleucos (Grey Falcon)	E	-	Sparsely distributed in NSW, chiefly throughout the Murray-Darling Basin, with the occasional vagrant east of the Great Dividing Range. Usually restricted to shrubland, grassland and wooded watercourses of arid and semi-arid regions, although it is occasionally found in open woodlands near the coast.	2 - BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.
Falco subniger (Black Falcon)	V	-	Widely, but sparsely, distributed in New South Wales, mostly occurring in inland regions. Some reports of 'Black Falcons' on the tablelands and coast of New South Wales are likely to be referrable to the Brown Falcon. In New South Wales there is assumed to be a single population that is continuous with a broader continental population, given that falcons are highly mobile, commonly travelling hundreds of kilometres. The Black Falcon occurs as solitary individuals, in pairs, or in family groups of parents and offspring.	1 - BioNet	Low in development site. There is no habitat in the development site considered suitable for this species.
Glossopsitta porphyrocephala (Purple-crowned Lorikeet)	V	-	The Purple-crowned Lorikeet occurs across the southern parts of the continent from Victoria to south-west Western Australia. It is uncommon in NSW, with records scattered across the box-ironbark woodlands of the Riverina and south west slopes, the River Red Gum forests and mallee of the Murray Valley as far west as the South Australian border, and, more rarely, the forests of the South Coast. The species is nomadic and most, if not all, records from NSW are associated with flowering events. Found in open forests and woodlands, particularly where there are large flowering eucalypts. Also recorded from mallee habitats.	3 - BioNet	Moderate. This species may forage in trees in the development site on occasion.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
Glossopsitta pusilla (Little Lorikeet)	V	-	In NSW it is found from the coast to the western slopes of the Great Dividing Range, extending westwards to the vicinity of Albury, Parkes, Dubbo and Narrabri. The species forages primarily in the canopy of dry open eucalypt forest and woodland but also utilises paperbark (Melaleuca sp.) dominated forests. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity. Isolated flowering trees in open country (e.g. paddocks, roadside remnants) and urban trees also help sustain viable populations of the species. Nests in proximity to feeding sites if possible, most typically selecting hollows in the limb or trunk of smooth-barked eucalypts. Entrance is small (3 cm) and usually high above the ground (2–15 m). These nest sites are often used repeatedly for decades, suggesting that preferred sites are limited; riparian trees are often chosen, including non-eucalypt species such as she-oaks.	23 – BioNet	Moderate. This species may forage in trees in the development site on occasion.
Grantiella picta (Painted Honeyeater)	V	V	The Painted Honeyeater is nomadic and occurs at low densities throughout its range. The greatest concentrations of birds, and almost all breeding, occur on the inland slopes of the Great Dividing Range in NSW, Victoria and southern Queensland. During the winter it is more likely to be found in the north of its distribution. Inhabits Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests. A specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Prefers mistletoes of the genus Amyema.	1 - BioNet PMST	Low in development site. This species may forage in trees, being a specialist feeder on the fruits of mistletoe, in the development site on occasion.
Haliaeetus leucogaster (White-bellied Sea-Eagle)	V	M	Distributed along the coastline (including offshore islands) of mainland Australia and Tasmania. Found in coastal habitats (especially those close to the sea-shore) and around terrestrial wetlands in tropical and temperate regions of mainland Australia and its offshore islands. Habitats occupied by the sea-eagle are characterised by the presence of large sites of open water (larger rivers, swamps, lakes, and the sea). It feeds opportunistically on a variety of fish, birds, reptiles, mammals and crustaceans, and on carrion. It generally forages over large expanses of open water; this is particularly true of birds that occur in coastal environments close to the sea-shore. However, it will also forage over open terrestrial habitats (such as grasslands). Nests may be built in a variety of sites including tall trees (especially Eucalyptus species), bushes, mangroves, cliffs, rocky outcrops, crevices, on the ground or even on artificial structures.	11 – BioNet BAM-C	Moderate. This species may fly over and perch in the development site on occasion. There is unlikely to be any suitable breeding habitat present.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
Hieraaetus morphnoides (Little Eagle)	V	-	The Little Eagle is found throughout the Australian mainland excepting the most densely forested parts of the Dividing Range escarpment. It occurs as a single population throughout NSW. Occupies open eucalypt forest, woodland or open woodland. Sheoak or Acacia woodlands and riparian woodlands of interior NSW are also used.	4 – BioNet BAM-C	Moderate. This species may fly over and perch in the development site on occasion. There is unlikely to be any suitable breeding habitat present.
Hydroprogne caspia (Caspian Tern)	-	M	Within Australia, the Caspian Tern has a widespread occurrence and can be found in both coastal and inland habitat. The Caspian Tern breeds on variable types of sites including low islands, cays, spits, banks, ridges, beaches of sand or shell, terrestrial wetlands and stony or rocky islets or banks. This species usually forages in open wetlands, including lakes and rivers.	1 – BioNet	Low in development site. There is no habitat in the development site considered suitable for this species. There are no rocky islets or banks within the development site.
Lathamus discolor (Swift Parrot)	E	CE	The swift parrot breeds in Tasmania during the summer and the entire population migrates north to mainland Australia for the winter. Whilst on the mainland the swift parrot disperses widely to forage on flowers and psyllid lerps in eucalypt species, with the majority being found in Victoria and NSW. In NSW they forage in forests and woodlands throughout the coastal and western slopes regions each year. Coastal regions tend to support larger numbers of birds when inland habitats are subjected to drought. Non-breeding birds preferentially feed in inland box-ironbark and grassy woodlands, and coastal swamp mahogany (*E. robusta*) and spotted gum (*Corymbia maculata*) woodland when in flower; otherwise often in coastal forests. On the mainland they occur in sites where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as *Eucalyptus robusta, Corymbia maculata, C. gummifera, E. sideroxylon,* and *E. albens*. Commonly used lerp infested trees include *E. microcarpa, E. moluccana* and *E. pilularis*.	15 – BioNet PMST BAM-C	Moderate. This species is known to forage in winter from flowering White Box. However, the vegetation in the site is not important habitat and the likelihood of birds using the trees within the development site as a continual source of habitat is low.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
Lophochroa leadbeateri (Major Mitchell's Cockatoo)	V	-	Found across the arid and semi-arid inland, from south-western Queensland south to north-west Victoria, through most of South Australia, north into the south-west Northern Territory and across to the west coast between Shark Bay and about Jurien. In NSW it is found regularly as far east as about Bourke and Griffith, and sporadically further east than that. Inhabits a wide range of treed and treeless inland habitats, always within easy reach of water. Nesting, in tree hollows, occurs throughout the second half of the year; nests are at least 1 km apart, with no more than one pair every 30 square kilometres.	1 – BioNet	Low in development site. There is no habitat in the development site considered suitable for this species. There are no nesting tree hollows suitable in the development site.
Lophoictinia isura (Square-tailed Kite)	V	-	Typically inhabits coastal forested and wooded lands of tropical and temperate Australia. In NSW it is often associated with ridge and gully forests dominated by *Eucalyptus longifolia, Corymbia maculata, E. elata, or E. smithii*. Individuals appear to occupy large hunting ranges of more than 100 square kilometres. They require large living trees for breeding, particularly near water with surrounding woodland /forest close by for foraging habitat. Nest sites are generally located along or near watercourses, in a tree fork or on large horizontal limbs.	BAM-C	Moderate. This species may fly over and perch in the development site on occasion. There is unlikely to be any suitable breeding habitat present.
Melanodryas cucullata cucullata (Hooded Robin (south-eastern form))	V	-	The Hooded Robin is widespread, found across Australia, except for the driest deserts and the wetter coastal sites - northern and eastern coastal Queensland and Tasmania. However, it is common in few places, and rarely found on the coast. Prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open sites. Requires structurally diverse habitats featuring mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses. The nest is a small, neat cup of bark and grasses bound with webs, in a tree fork or crevice, from less than 1 m to 5 m above the ground.	10 – BioNet	Low in development site. There is no habitat considered suitable for this species. Vagrant birds may appear on occasion. There are some records of this species in the locality.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
Melithreptus gularis gularis (Black-chinned Honeyeater (eastern subsp.))	V	-	Extends south from central Queensland, through NSW, Victoria into south-eastern South Australia, though it is very rare in the last state. In NSW it is widespread, with records from the tablelands and western slopes of the Great Dividing Range to the north-west and central-west plains and the Riverina. Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark (Eucalyptus sideroxylon), White Box (E. albens), Inland Grey Box (E. microcarpa), Yellow Box (E. melliodora), Blakely's Red Gum (E. blakelyi) and Forest Red Gum (E. tereticornis). Also inhabits open forests of smooth-barked gums, stringybarks, ironbarks, river sheoaks (nesting habitat) and tea-trees.	30 – BioNet	Moderate. There is potential foraging habitat within the development site for this species. Vagrant birds may appear on occasion.
Neophema pulchella (Turquoise Parrot)	V	-	Range extends from southern Queensland through to northern Victoria, from the coastal plains to the western slopes of the Great Dividing Range. Lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland.	32 – BioNet	Moderate. This species may fly over, perch and forage in the development site on occasion.
Ninox connivens (Barking Owl)	V	-	Found throughout continental Australia except for the central arid regions. Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. It is flexible in its habitat use, and hunting can extend in to closed forest and more open sites.	16 – BioNet	Moderate. This species may fly over, perch and forage in the development site on occasion. There is no suitable breeding habitat present.
Ninox strenua (Powerful Owl)	V	-	In NSW, it is widely distributed throughout the eastern forests from the coast inland to tablelands, with scattered records on the western slopes and plains suggesting occupancy prior to land clearing. Now at low densities throughout most of its eastern range, rare along the Murray River and former inland populations may never recover. The Powerful Owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. The Powerful Owl requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It roosts by day in dense vegetation.	BAM-C	Moderate. This species may fly over, perch and forage in the development site on occasion. There is no suitable breeding habitat present.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
Oxyura australis (Blue-billed Duck)	V	-	Endemic to south-eastern and south-western Australia. It is widespread in NSW, but most common in the southern Murray-Darling Basin site. Birds disperse during the breeding season to deep swamps up to 300 km away. It is generally only during summer or in drier years that they are seen in coastal sites. Prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation. The species is completely aquatic, swimming low in the water along the edge of dense cover. It will fly if disturbed but prefers to dive if approached. Partly migratory, with short-distance movements between breeding swamps and overwintering lakes with some long-distance dispersal to breed during spring and early summer. Usually nest solitarily in Cumbungi over deep water between September and February. They will also nest in trampled vegetation in Lignum, sedges or Spike-rushes, where a bowl-shaped nest is constructed. The most common clutch size is five or six. Males take no part in nest-building or incubation.	3 – BioNet	Low in development site. There is no suitable breeding or foraging habitat present in the development site for the species.
Pachycephala inornata (Gilbert's Whistler)	-	V	The Gilbert's Whistler is sparsely distributed over much of the arid and semi-arid zone of inland southern Australia, from the western slopes of NSW to the Western Australian wheatbelt. The Gilbert's Whistler occurs in a range of habitats within NSW, though the shared feature appears to be a dense shrub layer. It is widely recorded in mallee shrublands, but also occurs in box-ironbark woodlands, Cypress Pine and Belah woodlands and River Red Gum forests, though at this stage it is only known to use this habitat along the Murray, Edwards and Wakool Rivers. Within the mallee the species is often found in association with an understorey of spinifex and low shrubs including wattles, hakeas, sennas and hop-bushes. In woodland habitats, the understorey comprises dense patches of shrubs, particularly thickets of regrowth Callitris pine. Parasitic 'cherries' (Exocarpus species) appear to be an important habitat component in Belah and Red Gum communities, though in the latter case other dense shrubs, such as Lignum and wattles, are also utilised.	BAM-C	Low in development site. There are no records of this species in the locality, though it is known from River Red Gum woodland along the Murray River and occur in the development site on occasion.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
Pedionomus torquatus (Plains-wanderer)	E	CE	The Plains-wanderer has declined greatly since European settlement. Sites where the species was formerly common and is now so reduced in numbers that it is effectively extinct include eastern NSW, south-western Victoria, and south-eastern South Australia. Its current stronghold is the western Riverina of southern NSW. Plains-wanderers live in semi-arid, lowland native grasslands that typically occur on hard red-brown soils. These grasslands support a high diversity of plant species, including a number of state and nationally threatened species. Habitat structure appears to play a more important role than plant species composition. Preferred habitat of the Plains-wanderer typically comprises 50% bare ground, 10% fallen litter, and 40% herbs, forbs and grasses. Most of the grassland habitat of the Plains-wanderer is <5 cm high, but some vegetation up to a maximum of 30 cm is important for concealment, as long as grass tussocks are spaced 10-20 cm apart. During prolonged drought, the denudation of preferred habitats may force birds into marginal denser and taller grassland habitats that become temporarily suitable.	PMST	Unlikely to occur in development site. There is no habitat in the development site considered suitable for this species.
Petroica boodang (Scarlet Robin)	V	-	The Scarlet Robin lives in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs. This species lives in both mature and re-growth vegetation. It occasionally occurs in mallee or wet forest communities, or in wetlands and tea-tree swamps. This species' nest is built in the fork of tree usually more than 2 metres above the ground; nests are often found in a dead branch in a live tree, or in a dead tree or shrub.	22 – BioNet	Moderate The species was observed in better quality Box Gum Woodland north of the study site. This species may occur in higher-quality vegetation around the development site and pass through it on occasion, with potential foraging habitat within the development site. However, there is no habitat in the development site considered suitable for this species.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
Petroica phoenicea (Flame Robin)	V	-	The Flame Robin ranges from near the Queensland border to south-east South Australia and also in Tasmania. In NSW, it breeds in upland sites and in winter, many birds move to the inland slopes and plains. It is likely that there are two separate populations in NSW, one in the Northern Tablelands, and another ranging from the Central to Southern Tablelands. Breeds in upland tall moist eucalypt forests and woodlands, often on ridges and slopes. Prefers clearings or sites with open understoreys. The ground layer of the breeding habitat is dominated by native grasses and the shrub layer may be either sparse or dense. Occasionally occurs in temperate rainforest, and also in herbfields, heathlands, shrublands and sedgelands at high altitudes.	11 – BioNet	Low in development site. This species may occur in higher-quality vegetation around the development site and pass through it on occasion. However, there is no habitat in the development site considered suitable for this species.
Plegadis falcinellus (Glossy Ibis)	-	M	Preferred habitat for foraging and breeding are fresh water marshes at the edges of lakes and rivers, lagoons, flood-plains, wet meadows, swamps, reservoirs, sewage ponds, rice-fields and cultivated sites under irrigation.	3 – BioNet	Low in development site. There is no habitat in the development site considered suitable for this species.
Polytelis swainsonii (Superb Parrot)	V	V	Found throughout eastern inland NSW. On the South-western Slopes their core breeding site is roughly bounded by Cowra and Yass in the east, and Grenfell, Cootamundra and Coolac in the west. Inhabit Box-Gum, Box-Cypress-pine and Boree Woodlands and River Red Gum Forest. In the Riverina the bird's nest in the hollows of large trees (dead or alive) mainly in tall riparian River Red Gum Forest or Woodland. On the South West Slopes nest trees can be in open Box-Gum Woodland or isolated paddock trees. Species known to be used are Blakely's Red Gum, Yellow Box, Apple Box and Red Box. Nest in small colonies, often with more than one nest in a single tree.	1 – BioNet BAM-C	Moderate. This species may fly over, perch and forage in the development site on occasion..

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
Pomatostomus temporalis temporalis (Grey-crowned Babbler (eastern subspecies))	V	-	In NSW, the eastern sub-species occurs on the western slopes of the Great Dividing Range, and on the western plains reaching as far as Louth and Balranald. It also occurs in woodlands in the Hunter Valley and in several locations on the north coast of NSW. It may be extinct in the southern, central and New England tablelands. Inhabits open Box-Gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains. Build and maintain several conspicuous, dome-shaped stick nests about the size of a football. A nest is used as a dormitory for roosting each night. Nests are usually located in shrubs or sapling eucalypts, although they may be built in the outermost leaves of low branches of large eucalypts. Nests are maintained year-round, and old nests are often dismantled to build new ones.	1 – BioNet	Moderate. This species is uncommon in the locality however suitable habitat is present.
Rostratula australis (Australian Painted Snipe)	E	E, M	Most records are from south-east Australia, particularly the Murray Darling Basin, with scattered records across northern Australia. They generally inhabit shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans. They also use inundated or waterlogged grassland or saltmarsh, dams, rice crops, sewage farms and bore drains. Typical sites include those with rank emergent tussocks of grass, sedges, rushes or reeds, or samphire; often with scattered clumps of lignum Muehlenbeckia or canegrass. Breeding habitat requirements may be quite specific; shallow wetlands with sites of bare wet mud and both low cover and canopy cover nearby; nest records nearly all from or near small islands in freshwater wetlands. Has also been recorded nesting in and near swamps, canegrass swamps, flooded sites including samphire, grazing land, among cumbungi, sedges and grasses; one nest has been found in the centre of a cow-pat in a clump of long grass.	PMST	Low in development site. There is no habitat in the development site considered suitable for this species. This species may occur in the river habitat near the development site on occasion, however the likelihood is considered low.
Stagonopleura guttata (Diamond Firetail)	V	-	Found in grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum (*Eucalyptus pauciflora*) Woodlands. Also occurs in open forest, mallee, Natural Temperate Grassland, and in secondary grassland derived from other communities. Often found in riparian sites (rivers and creeks), and sometimes in lightly wooded farmland. Nests are globular structures built either in the shrubby understorey, or higher up, especially under hawk's or raven's nests. Birds roost in dense shrubs or in smaller nests built especially for roosting.	32 – BioNet	Moderate. The species may inhabit and forage on the grassy woodlands, including the Box-Gum woodland, in the development area. However, as the development site is of low quality and unlikely to provide important habitat.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
Stictonetta naevosa (Freckled Duck)	V	-	Prefer permanent freshwater swamps and creeks with heavy growth of Cumbungi, Lignum or Tea-tree. During drier times they move from ephemeral breeding swamps to more permanent waters such as lakes, reservoirs, farm dams and sewage ponds.	2 – BioNet	Low in development site. There is no habitat in the development site considered suitable for this species.
Tyto novaehollandiae (Masked Owl)	V	-	Extends from the coast where it is most abundant to the western plains. Overall records for this species fall within approximately 90% of NSW, excluding the most arid north-western corner. There is no seasonal variation in its distribution. Dry eucalypt forests and woodland, typically prefers open forest with low shrub density. Requires old trees for roosting and nesting.	BAM-C	Moderate. This species may fly over, perch and forage in the development site on occasion. There is no suitable breeding habitat present.
Frogs					
Crinia sloanei (Sloane's Froglet)	V	E	Sloane's Froglet has been recorded from widely scattered sites in the floodplains of the Murray-Darling Basin, with the majority of records in the Darling Riverine Plains, NSW South Western Slopes and Riverina bioregions in New South Wales. It is typically associated with periodically inundated sites in grassland, woodland and disturbed habitats.	61 – BioNet PMST BAM-C	Low in development site. Targeted surveys for this species were undertaken as part of this assessment. There were no species identified during surveys. Habitat in the development site was assessed against known habitat requirement and found to be marginal. There is some connectivity to the Murray River, therefore the likelihood of this species occurring in the habitat on and around the development site is low.
Litoria raniformis (Southern Bell Frog)	E	V	The species is currently widespread throughout the Murray River valley and has been recorded from six Catchment Management Sites in NSW: Lower Murray Darling, Murrumbidgee, Murray, Lachlan, Central West and South East. Found mostly amongst emergent vegetation, including Typha sp. (bullrush), Phragmites sp. (reeds) and Eleocharis sp.(sedges), in or at the edges of still or slow-flowing water bodies such as lagoons, swamps, lakes, ponds and farm dams.	2 – BioNet PMST	Low in development site. There is no habitat in the development site considered suitable for this species.
Invertebrates					

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
Synemon plana (Golden Sun Moth)	E	CE	The Golden Sun Moth's NSW populations are found in the site between Queanbeyan, Gunning, Young and Tumut. The species' historical distribution extended from Bathurst (central NSW) through the NSW Southern Tablelands, through to central and western Victoria, to Bordertown in eastern South Australia. Occurs in Natural Temperate Grasslands and grassy Box-Gum Woodlands in which ground layer is dominated by wallaby grasses *Austrodanthonia* spp. Grasslands dominated by wallaby grasses are typically low and open - the bare ground between the tussocks is thought to be an important microhabitat feature for the Golden Sun Moth, as it is typically these sites on which the females are observed displaying to attract males. Habitat may contain several wallaby grass species, which are typically associated with other grasses particularly spear-grasses *Austrostipa* spp. or Kangaroo Grass *Themeda australis*.	PMST BAM-C	Unlikely to occur in the development site. There is no habitat in the development site considered suitable for this species. There are no records of this species in the locality.
Reptiles					
Aprasia parapulchella (Pink-tailed Legless Lizard)	V	V	The Pink-tailed Legless Lizard is only known from the Central and Southern Tablelands, and the South Western Slopes. There is a concentration of populations in the Canberra / Queanbeyan Region. Other populations have been recorded near Cooma, Yass, Bathurst, Albury and West Wyalong. This species is also found in the Australian Capital Territory. Inhabits sloping, open woodland sites with a predominantly native grassy groundlayer, particularly those dominated by Kangaroo Grass (*Themeda australis*). Sites are typically well-drained, with rocky outcrops or scattered, partially-buried rocks. Commonly found beneath small, partially-embedded rocks and appear to spend considerable time in burrows below these rocks; the burrows have been constructed by and are often still inhabited by small black ants and termites.	19 – BioNet BAM-C	Unlikely to occur in the development site. There is no habitat in the development site considered suitable for this species. There were no *Themeda australis* grass species recorded on site, being important habitat for this species.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
Delma impar (Striped Legless Lizard)	V	V	The Striped Legless Lizard occurs in the Southern Tablelands, the South West Slopes and possibly on the Riverina. Populations are known in the Goulburn, Yass, Queanbeyan, Cooma and Tumut sites. Also occurs in the ACT, Victoria and south-eastern South Australia. Found mainly in Natural Temperate Grassland but has also been captured in grasslands that have a high exotic component. Also found in secondary grassland near Natural Temperate Grassland and occasionally in open Box-Gum Woodland. Habitat is where grassland is dominated by perennial, tussock-forming grasses such as Kangaroo Grass *Themeda australis*, spear-grasses *Austrostipa* spp. and Poa tussocks *Poa* spp., and occasionally wallaby grasses *Austrodanthonia* spp. Sometimes present in modified grasslands with a significant content of exotic grasses. Sometimes found in grasslands with significant amounts of surface rocks, which are used for shelter.	PMST	Unlikely to occur in the development site. There is no habitat in the development site considered suitable for this species. There were no *Themeda australis* grass species recorded on site, being important habitat for this species.
Mammals					
Chalinolobus picatus (Little Pied Bat)	V	-	The Little-Pied Bat is found in inland Queensland and NSW (including Western Plains and slopes) extending slightly into South Australia and Victoria. Occurs in dry open forest, open woodland, mulga woodlands, chenopod shrublands, cypress pine forest and mallee and Bimbil box woodlands. Roosts in caves, rock outcrops, mine shafts, tunnels, tree hollows and buildings.	BAM-C	Moderate This species is most likely to forage in the woodland, depressions and moist areas in the development site as it flies around. However, there is no high-quality foraging habitat or breeding habitat in the development site.
Dasyurus maculatus (Spotted-tailed Quoll)	V	E	Wet and dry sclerophyll forests and rainforests, and adjacent open agricultural sites. Generally associated with large expansive sites of habitat to sustain territory size. Requires hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites.	1 – BioNet PMST	Low in development site. There is no habitat in the development site considered suitable for this species.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
Falsistrellus tasmaniensis (Eastern False Pipistrelle)	V	-	Prefers moist habitats, with trees taller than 20 m. Generally, roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings.	1 – BioNet	Moderate. The development site contains potential breeding and foraging habitat in depressions and moist areas. This species may also forage around trees within the development site. No suitable hollow-bearing trees were identified within the development site; however, some roosting habitat may be present. There is unlikely to be any breeding habitat in the development site.
Miniopterus orianae oceanensis (Large Bent-winged Bat)	V	-	Occurs on east and north-west coasts of Australia. Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other manmade structures.	BAM-C	High. This species is most likely to forage in the woodland, depressions and moist areas in the development site as it flies around. However, there is no high-quality foraging habitat or breeding habitat in the development site.
Nyctophilus corbeni (Southern-east Long-eared Bat)	V	V	Overall, the distribution of the south eastern form coincides approximately with the Murray Darling Basin with the Pilliga Scrub region being the distinct stronghold for this species. Inhabits a variety of vegetation types, including mallee, bulloke *Allocasuarina luehmannii* and box eucalypt dominated communities, but it is distinctly more common in box/ironbark/cypress-pine vegetation that occurs in a north-south belt along the western slopes and plains of NSW and southern Queensland. Roosts in tree hollows, crevices, and under loose bark.	PMST	Low in development site. There is no habitat in the development site considered suitable for this species.
Petaurus norfolcensis (Squirrel Glider)	V	-	The species is widely though sparsely distributed in eastern Australia, from northern Queensland to western Victoria. Inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal sites. Prefers mixed species stands with a shrub or Acacia midstorey.	210 – BioNet BAM-C	High. Spotlighting for this species were undertaken as part of this assessment. There were no species identified in the surveys. A local viable population has been recorded in vegetation in and around the development site through nest box monitoring by local conservation group Friends of the Lake Hume Squirrel Glider.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
Petrogale penicillata (Bruch-tailed Rock-wallaby)	E	V	This species prefers rocky habitats, including loose boulder-piles, rocky outcrops, steep rocky slopes, cliffs, gorges and isolated rock stacks. It also utilises tree limbs. While it appears that most Brush-tailed Rock-wallaby colonies are on north-facing slopes and cliff lines, colonies have been found on south-facing cliffs in Kangaroo Valley, in the Macleay River Gorge, in the Warrumbungles and at Mt Kaputar, although usually in lower densities. Rocky outcrops appear crucial to current habitat selection by rock-wallabies; however, vegetation structure and composition is also considered to be an important factor. In many parts of their range, including at the Warrumbungles, rock-wallabies are closely associated with dense arboreal cover, especially fig trees. The vegetation on and below the cliff appear to be important to this species as a source of food and shelter and in some cases may provide some protection from predation. A range of vegetation types are associated with Brush-tailed Rock-wallaby habitat, including dense rainforest, wet sclerophyll forest, vine thicket, dry sclerophyll forest, and open forest.	BAM-C	Low in development site. There is no habitat in the development site considered suitable for this species. There are no records of this species in the locality.
Phascogale tapoatafa (Brush-tailed Phascogale	V	-	Patchy distribution around the coast of Australia. Prefer dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter. Also inhabit heath, swamps, rainforest and wet sclerophyll forest.	BAM-C	Unlikely to occur in the development site. There is no habitat in the development site considered suitable for this species. There are no records of this species in the locality.
Phascolarctos cinereus (Koala) combined populations of Queensland, New South Wales and the Australian Capital Territory	V	V	In NSW it mainly occurs on the central and north coasts with some populations in the west of the Great Dividing Range. Inhabit eucalypt woodlands and forests. Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one site will select preferred browse species.	4 – BioNet PMST BAM-C	Low in the development site. *Eucalyptus camaldulensis* and *E. albens* are a primary and secondary food tree species. However, the known occurrence of this species within the locality is very rare. This species may pass through the development site on occasion, however the likelihood is considered low.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
Pteropus poliocephalus (Grey-headed Flying-fox)	V	V	Generally found within 200 km of the eastern coast of Australia, from Rockhampton in Queensland to Adelaide in South Australia. In times of natural resource shortages, they may be found in unusual locations. Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Individual camps may have tens of thousands of animals and are used for mating, and for giving birth and rearing young.	80 – BioNet PMST BAM-C	Moderate. This species is assumed to occur based on the presence of suitable foraging habitat and the proximity of several camps. There are no camps or breeding habitat within the development site.
Saccolaimus flaviventris (Yellow-bellied Sheathtail-bat)	V	-	Wide-ranging species found across northern and eastern Australia. Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless sites they are known to utilise mammal burrows.	1 – BioNet	Moderate. There is potential foraging habitat within the development site. No suitable hollow-bearing trees were identified within the development site; however, some roosting habitat may be present. There is unlikely to be any breeding habitat in the development site.
Fish					
Galaxias rostratus (Flathead Galaxias)	CE	CE	Flathead Galaxias, also known as Murray jollytail are a small native fish that are known from the southern part of the Murray Darling Basin. They have been recorded in the Macquarie, Lachlan, Murrumbidgee and Murray Rivers in NSW. Despite extensive scientific sampling over the past 15 years there have been very few recorded sightings of Flathead Galaxias. They have not been recorded and are considered locally extinct in the lower Murray, Murrumbidgee, Macquarie and Lachlan Rivers. The species is now only known from the upper Murray River near Tintaldra and wetland sites near Howlong. Flathead Galaxias are found in still or slow-moving water bodies such as wetlands and lowland streams. The species has been recorded forming shoals. They have been associated with a range of habitats including rock and sandy bottoms and aquatic vegetation.	PMST	Unlikely to occur in the development site. There is no habitat in the development site considered suitable for this species. There are no records of this species in the locality.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
Maccullochella peelii (Murray Cod)	-	V	The Murray Cod occurs naturally in the waterways of the Murray-Darling Basin (ACT, SA, NSW and Vic) and is known to live in a wide range of warm water habitats that range from clear, rocky streams to slow flowing turbid rivers and billabongs. The upper reaches of the Murray and Murrumbidgee Rivers are considered too cold to contain suitable habitat. Some translocated populations exist outside the species' natural distribution in impoundments and waterways in NSW and Vic which are maintained by the release of hatchery bred fish.	PMST	Unlikely to occur in the development site. There is no habitat in the development site considered suitable for this species. There are no records of this species in the locality.
Macquaria australasica (Macquarie Perch)	E	E	Macquarie Perch have declined considerably from their historical distribution within NSW and they are now considered isolated to the upper reaches of the Lachlan and Murrumbidgee Rivers in southern NSW. It is also found in low numbers in the Mongarlowe River, where the population is considered likely to be the result of a translocation from the Murray-Darling Basin. Other populations exist in Cataract Dam in the Nepean River catchment, as well as a 2008 record from Georges River near Campbelltown, the first record from the river since 1894. It persists in the Burrinjuck, Cotter (Murrumbidgee) and Wyangala impoundments. A breeding population in the Queanbeyan River upstream of the Googong Reservoir exists solely due to a translocation of individuals from the reservoir past a natural barrier. The Googong reservoir population is believed to be effectively extinct. Macquarie perch may occasionally become displaced downstream from the Queanbeyan River into Googong, but they do not form a population in the reservoir. The New South Wales Rivers Survey (1994–1996) demonstrated that the Macquarie Perch was present only in low numbers at three sites in streams above Lake Wyangala and Burrinjuck Dam. Hawkesbury and Shoalhaven River populations, including in large impoundments, seem abundant and generally occur upstream of Australian Bass (*Macquaria novemaculeata*) populations. The Macquarie Perch is a riverine, schooling species. It prefers clear water and deep, rocky holes with lots of cover. As well as aquatic vegetation, additional cover may comprise of large boulders, debris and overhanging banks. Spawning occurs just above riffles (shallow running water). Populations may survive in impoundments if able to access suitable spawning sites.	PMST	Unlikely to occur in the development site. There is no habitat in the development site considered suitable for this species. There are no records of this species in the locality.
Migratory species					

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
Actitis hypoleucos (Common Sandpiper)	-	M	Found along all coastlines of Australia and in many sites inland, the Common Sandpiper is widespread in small numbers. 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.	PMST	Low in development site. There is no habitat considered suitable for this species. There are no muddy margins or rocky shores within the development area.
Apus pacificus (Fork-tailed Swift)	-	M	Recorded in all regions of NSW. 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.	1-BioNet PMST	Moderate. May fly over the site on occasion but would not use the habitats and would not be impacted.
Calidris acuminata (Sharp-tailed Sandpiper)	-	M	The Sharp-tailed Sandpiper spends the non-breeding season in Australia with small numbers occurring regularly in New Zealand. Most of the population migrates to Australia, mostly to the south-east and are widespread in both inland and coastal locations and in both freshwater and saline habitats. Many inland records are of birds on passage. Prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation; this includes lagoons, swamps, lakes and pools near the coast, and dams, waterholes, soaks, bore drains and bore swamps, saltpans and hypersaline saltlakes inland. They also occur in saltworks and sewage farms. They use flooded paddocks, sedgelands and other ephemeral wetlands, but leave when they dry. They use intertidal mudflats in sheltered bays, inlets, estuaries or seashores, and also swamps and creeks lined with mangroves. They tend to occupy coastal mudflats mainly after ephemeral terrestrial wetlands have dried out, moving back during the wet season. Sometimes they occur on rocky shores and rarely on exposed reefs.	PMST	Low in development site. There is no habitat considered suitable for this species.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
Calidris ferruginea (Curlew Sandpiper)	E	CE, M	In Australia, Curlew Sandpipers occur around the coasts of all states and are also quite widespread inland, though in smaller numbers. They occur in Australia mainly during the non-breeding period but also during the breeding season when many non-breeding one-year old birds remain. Curlew Sandpipers mainly occur on intertidal mudflats in sheltered coastal sites, 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 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 and in mangroves.	PMST	Low in development site. There is no habitat considered suitable for this species.
Calidris melanotos (Pectoral Sandpiper)	-	M	In New South Wales (NSW), the Pectoral Sandpiper is widespread, but scattered. Records exist east of the Great Divide, from Casino and Ballina, south to Ulladulla. West of the Great Divide, the species is widespread in the Riverina and Lower Western regions. 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.	PMST	Low in development site. There is no habitat considered suitable for this species.
Gallinago hardwickii (Latham's Snipe)	-	M	Recorded along the east coast of Australia from Cape York Peninsula through to south-eastern South Australia. Occurs in permanent and ephemeral wetlands up to 2000 m above sea-level.	10-BioNet PMST	Low in development site. There is no habitat considered suitable for this species.
Hirundapus caudacutus (White-throated Needletail)	-	M	Widespread in eastern and south-eastern Australia. Almost exclusively aerial, from heights of less than 1 m up to more than 1000 m above the ground. They also commonly occur over heathland but less often over treeless sites, such as grassland or swamps.	1-BioNet PMST	Moderate. May fly over the site on occasion but would not use the habitats and would not be impacted.
Monarcha melanopsis (Black-faced Monarch)	-	M	Widespread in eastern Australia. Mainly occurs in rainforest ecosystems, including semi-deciduous vine-thickets, complex notophyll vine-forest, tropical (mesophyll) rainforest, subtropical (notophyll) rainforest, mesophyll (broadleaf) thicket/shrubland, warm temperate rainforest, dry (monsoon) rainforest and (occasionally) cool temperate rainforest.	PMST	Low in development site. There is no habitat considered suitable for this species.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
Motacilla flava (Yellow Wagtail)	-	M	Rare but regular visitor around Australian coast, especially in the NW coast Broome to Darwin. Found in open country near swamps, salt marshes, sewage ponds, grassed surrounds to airfields, bare ground; occasionally on drier inland plains.	PMST	Low in development site. There is no habitat considered suitable for this species.
Myiagra cyanoleuca (Satin Flycatcher)	-	M	Widespread in eastern Australia and vagrant to New Zealand. Inhabit heavily vegetated gullies in eucalypt-dominated forests and taller woodlands, and on migration, occur in coastal forests, woodlands, mangroves and drier woodlands and open forests.	PMST	Low in development site. There is no habitat considered suitable for this species.
Numenius madagascariensis (Eastern Curlew)	-	CE, M	Within Australia, the Eastern Curlew has a primarily coastal distribution. The species is found in all states, particularly the north, east, and south-east regions including Tasmania. The Eastern Curlew is most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sand flats, often with beds of seagrass.	PMST	Low in development site. There is no habitat in the development site considered suitable for this species. There are no records of this species in the locality.
Rhipidura rufifrons (Rufous Fantail)	-	M	Occurs in coastal and near coastal districts of northern and eastern Australia. In east and south-east Australia, the Rufous Fantail mainly inhabits wet sclerophyll forests, often in gullies dominated by eucalypts such as Tallow-wood (Eucalyptus microcorys), Mountain Grey Gum (E. cypellocarpa), Narrow-leaved Peppermint (E. radiata), Mountain Ash (E. regnans), Alpine Ash (E. delegatensis), Blackbutt (E. pilularis) or Red Mahogany (E. resinifera); usually with a dense shrubby understorey often including ferns.	PMST	Low in development site. There is no habitat considered suitable for this species.
Tringa nebularia (Common Greenshank)	-	M	The Common Greenshank does not breed in Australia, however, the species occurs in all types of wetlands and has the widest distribution of any shorebird in Australia.	PMST	Low in development site. There is no habitat considered suitable for this species.

Distribution and habitat requirement information adapted from: Australian Government Department of the Environment http://www.environment.gov.au/biodiversity/threatened/index.html NSW Office of Environment and Heritage http://www.environment.nsw.gov.au/threatenedspecies/ and IUCN red list https://www.iucnredlist.org/.

Key:

CE = critically endangered

E = endangered

V = vulnerable

M = migratory

Appendix B. Floristic survey composition and structure data

Table B-1 Species and estimated cover recorded in each of the Vegetation Integrity survey plots

Species	GF code	Cover (%)				
		Plot 1	Plot 2	Plot 3	Plot 4	Plot 5
Acacia implexa	SG		0.1	20		
Acetosella vulgaris	HT	0.2	0.1		0.2	0.5
Amyema miquelii	OG			1		
Asparagus asparagoides	HT			0.1		
Aster subulatus	EX		0.1			
Avena barbata	EX					10
Avena fatua	EX	35	5		35	50
Baumea acuta	GG		0.1			
Briza maxima	EX	0.1			0.1	1
Carex appressa	GG		75	0.1		
Carex inversa	GG	0.1			0.1	
Cenchrus clandestinus	EX	0.5	0.5	10	0.5	
Cerastium glomeratum	EX	0.1			0.1	
Cirsium vulgare	EX		0.1	0.1		0.1
Cyperus brevifolius	EX		0.1			
Echium plantagineum	EX	0.5	0.2		0.5	
Eucalyptus albens	TG			21		
Eucalyptus camaldulensis	TG		0.1			
Galium aparine	EX	0.1	1	1	0.1	
Holcus lanatus	HT	0.5	1		0.5	
Hordeum sp.	EX			50		
Hypericum perforatum	HT	0.1			0.1	
Hypochaeris radicata	EX	0.1			0.1	0.1
Juncus australis	GG	0.1			0.1	

Ligustrum lucidum	HT	1	0.1		1	
Lomandra filiformis	GG					3
Lomandra multiflora	GG	0.1			0.1	0.2
Microlaena stipoides	GG	1		0.1	1	3
Paspalum dilatatum	HT	0.2	1		0.2	2
Phalaris aquatica	HT	2	5	0.1	2	
Plantago lanceolata	EX	0.3			0.3	
Poa annua	EX	0.2			0.2	10
Prunus sp.	EX	0.1			0.1	
Robinia pseudoacacia	HT		0.1			
Rubus fruticosus agg.	HT	5	0.5		5	
Rumex crispus	EX		0.2			
Senecio quadridentatus	FG					0.5
Setaria parviflora	EX	0.2			0.2	
Solanum mauritianum	EX		0.1			
Sonchus asper	EX		0.5	0.1		
Taraxacum officinale	EX		0.1			
Themeda triandra	GG	5			5	
Trifolium angustifolium	EX	0.1			0.1	
Trifolium campestre	EX					0.1
Trifolium repens	EX	0.2			0.2	
Verbena bonariensis	EX	0.1	1		0.1	
Vinca major	HT		0.1	25		
**GF code: TG = Tree, SG = Shrub, GG = Grass and grass-like, FG = Forb, EG = Fern, OG = Other, HT = High Threat weed, EX = Exotic*						

Appendix C. Vegetation integrity assessment plot data

Table C-1: Vegetation integrity assessment plot data for vegetation zones

plot	PCT	Area	Patch size	Condition class	zone	easting	northing	bearing	compTree	compShrub	compGrass	compForbs	compFerns	compOther	strucTree	strucShrub	strucGrass	strucForbs	strucFerns	strucOther	funLargeTrees	funHollowtrees	funLitterCover	funLenFallenLogs	funTreeStem5to10	funTreeStem10to20	funTreeStem20to30	funTreeStem30to50	funTreeStem50to80	funTreeStem50to80	funTreeRegen	funHighThreatExotic
1	266	0.40	16	Derived_grassland	55	502931	6004671.0	246	0	0	5	0	0	0	0.0	0.0	6.3	0.0	0.0	0.0	0	0	3.0	0.0	0	0	0	0	0	0	0	9.0
5	266	0.4	16	Derived_grassland	55	502905.38	502905.38	200	0	0	3	1	0	0	0	0	6.2	0.5	0	0	0	0	10	0	0	0	0	0	0	0	0	2.5
3	266	0.20	16	Poor	55	502904	6004594.0	81	1	1	2	0	0	1	21.0	20.0	0.2	0.0	0.0	1.0	3	1	27.0	21.0	0	1	1	1	0	0	0	25.2
2	5	0.01	16	Carex_wetland	55	502880	6004606.0	31	1	1	2	0	0	0	0.1	0.1	75.1	0.0	0.0	0.0	0	0	15.0	7.0	0	1	0	0	0	1	0	7.9
4	N/A	N/A	N/A	Exotic grassland	55	502970.38	6004737.66	240	0	0	5	0	0	0	0	0	6.3	0	0	0	0	0	30	0.0	0	0	0	0	0	0	0	9

Appendix D. EPBC Act significance assessments

Assessment of significance have been conducted for threatened species, populations and communities that were recorded in the development site during field surveys or were identified as having a moderate or higher potential to occur in the development site based on the presence of habitat. For threatened biodiversity listed under the EPBC Act, significance assessments have been completed in accordance with the EPBC Act Policy Statement 1.1 Significant Impact Guidelines (Department of Environment, 2013). Whether or not an action is likely to have a significant impact depends upon the sensitivity, value, and quality of the environment that is affected, and upon the intensity, duration, magnitude and geographic extent of the impacts (Department of Environment, 2013). Importantly, for a 'significant impact' to be 'likely', it is not necessary for a significant impact to have a greater than 50 percent chance of happening; it is sufficient if a significant impact on the environment is a real or not a remote chance or possibility (Department of Environment, 2013). This advice has been considered while undertaking the assessments.

The EPBC Act listed species subject to this assessment include:

- Grey-headed Flying-fox
- Regent Honeyeater
- Swift Parrot
- Superb Parrot

The Sloane's Froglet was not assessed here as the species has not been confirmed on site from targeted surveys and based on assessment of the habitat on the development site, is considered to have a low likelihood of occurring.

When assessing Vulnerable species, the assessment centres around whether the population that would be impacted is an 'important population' or not. An 'important population' is a population that is necessary for a species' long-term survival and recovery (Department of Environment, 2013). This may include populations identified as such in recovery plans, and/or that are:

- key source populations either for breeding or dispersal
- populations that are necessary for maintaining genetic diversity, and/or
- populations that are near the limit of the species range.

This definition of what constitutes an 'important population' has guided the assessments for Vulnerable species.

The direct impact of the development is summarised below in Table D-1. The vegetation that would be impacted only provides potential foraging habitat these species.

Table D-1: Summary of direct impact to EPBC Act listed threatened species habitat (native vegetation) within the development site

Species	Plant community type name	Area (ha) in development site
Grey-headed Flying-fox Regent Honeyeater Swift Parrot Superb Parrot	White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion (266) - Poor	0.02 (164 m^2)
	Planted native trees and shrubs	0.009 (91 m^2)

Planted exotic species would also be impacted. These areas are unlikely to provide substantial foraging opportunities for these species.

D.1.1 Grey-headed Flying-fox

The Grey-headed Flying-fox (*Pteropus poliocephalus*) is known to forage widely throughout the NSW South Western Slopes region. No Grey-headed Flying-fox camps are located in the vicinity of the study area, with the nearest camp situated approximately 10 km west in the Albury Botanic Gardens. This species could potentially occur within the development site when trees are flowering. The Grey-headed Flying-fox exists as a single interconnected population in Australia. As such, it is considered an important population.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

1) lead to a long-term decrease in the size of an important population of a species

There would be no direct impact to any roost camp and no direct impacts to a known permanent roosting, breeding / maternity site would occur. Therefore, it is likely that the impacts of the development would be confined to a minor loss of feeding habitat caused by direct clearing or damage to 0.02 ha of PCTs and 0.009 hectares of planted native vegetation. However, this loss of foraging habitat would be negligible and unlikely to affect breeding success given the extent of similar habitat in the Lake Hume area and the wide-ranging nature of Grey-headed Flying-fox foraging movements. The development is considered unlikely to lead to a long-term decrease in the size of an important population of the Grey-headed Flying-fox.

2) reduce the area of occupancy of an important population

The area of occupancy of the Grey-headed Flying-fox is not known but the species exists as one interconnected population along the eastern Australian coastal belt from Rockhampton in central Queensland to Melbourne in Victoria. The area occupied by this species would remain the same after construction. No impact to area of occupancy is expected.

3) fragment an existing important population into two or more populations

The Grey-headed Flying-fox is particularly well adapted to accessing widely spaced habitat resources given its mobility and preference for seasonal fruits and blossom in differing parts of the landscape. The development would not fragment an important population of the Grey-headed Flying-fox. Individuals would still be able to disperse between roosts throughout the South Western Slopes region of NSW.

4) adversely affect habitat critical to the survival of a species

The draft recovery plan for the Grey-headed Flying-fox identifies critical habitat for this species as:

- Productive during winter and spring, when food bottlenecks have been identified
- Known to support populations of greater than 30,000 individuals, within an area of 50-kilometre radius of a camp site
- Productive during the final weeks of gestation, and during the weeks of birth, lactation and conception (Sept-May)
- Productive during the final stages of fruit development and ripening in commercial crops affected by Grey-headed Flying-foxes
- Known to be continuously occupied as a camp site.

There are no Nationally Important Flying-fox Camps in Albury / Lake Hume areas. Three other camps are located in Albury and nearby surrounds (approximately 10 km west of the study area). The development is located at a sufficient distance and would not result in disturbance to these camps. The foraging habitat to be impacted is a small area of poor and moderate condition woodland vegetation and does not constitute critical foraging habitat given the relative widespread nature of similar, and higher quality, vegetation in the locality and abundance of higher quality foraging habitat within the feeding range of regional populations. As such, the development is not expected to adversely affect foraging habitat critical to the survival of this species.

5) disrupt the breeding cycle of an important population

There are no Nationally Important Flying-fox Camps in Albury / Lake Hume areas. Three other camps are located in Albury and nearby surrounds (approximately 10 km west of the study area). The development is located at a sufficient distance and would not result in disturbance to these camps. There would be a negligible impact on foraging habitat that may be used during the breeding cycle of the species but a disruption to the breeding cycle of the Grey-headed Flying-fox is not likely.

6) modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The Grey-headed Flying-fox can cover large areas of its range seeking suitable flowering eucalypts and fruits for foraging. The species could potentially utilise vegetation in the study area and surrounds for foraging when the trees are in flower. The impact to foraging habitat from the development would be negligible and the development is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of foraging habitat to the extent that the species is likely to decline.

7) result in invasive species that are harmful to a vulnerable species becoming established in the Vulnerable species' habitat

The development is unlikely to result in an invasive species harmful to the Grey-headed Flying-fox becoming established in the habitat. Weeds are already well established in the habitat. The management of invasive species would be managed under the construction environmental management plan using best practice methods.

8) introduce disease that may cause the species to decline, or

There are no known disease issues affecting this species in relation to the project. The development would be unlikely to increase the potential for significant disease vectors to affect local populations.

9) interfere substantially with the recovery of the species.

The Draft National Recovery Plan for the Grey-headed Flying-fox (*Pteropus poliocephalus*) outlines the following actions:

- Identify and protect foraging habitat critical to the survival of Grey-headed Flying-foxes across their range
- Enhance winter and spring foraging habitat for Grey-headed Flying-foxes
- Identify, protect and enhance roosting habitat critical to the survival of Grey-headed Flying-foxes
- Significantly reduce levels of deliberate Grey-headed Flying-fox destruction associated with commercial horticulture
- Provide information and advice to managers, community groups and members of the public that are involved with controversial flying-fox camps
- Produce and circulate educational resources to improve public attitudes toward Grey-headed Flying-foxes, promote the recovery program to the wider community and encourage participation in recovery actions
- Monitor population trends for the Grey-headed Flying-fox
- Assess the impacts on Grey-headed Flying-foxes of electrocution on powerlines and entanglement in netting and barbed wire, and implement strategies to reduce these impacts
- Oversee a program of research to improve knowledge of the demographics and population structure of the Grey-headed Flying-fox
- Maintain a National Recovery Team to oversee the implementation of the Grey-headed Flying-fox National Recovery Plan.

The recovery actions listed above are largely not applicable to the development. The development is not expected to interfere substantially with the recovery of the species.

Conclusion

The Grey-headed Flying-fox would suffer a negligible reduction in extent of suitable foraging habitat from the development. No breeding camps or other important habitat would be impacted. This impact is unlikely to reduce the population size of the Grey-headed Flying-fox or decrease the reproductive success of this species. The development would not interfere with the recovery of the Grey-headed Flying-fox.

After consideration of the factors above, an overall conclusion has been made that the development is unlikely to result in a significant impact to the Grey-headed Flying-fox and a referral for biodiversity matters is not necessary.

D.1.2 Swift Parrot and Regent Honeyeater

The Swift Parrot (*Lathamus discolor*) and Regent Honeyeater (*Anthochaera phrygia*) are considered moderately likely to occur based on the presence of suitable foraging habitat, particularly winter flowering species *Eucalyptus tereticornis*. These species are known to sporadically occur within and move through the Sydney region, particularly the Swift Parrot while on mainland Australia during winter. Both species are considered likely to only occur intermittently and the likelihood of birds using the trees within the development footprint as a continual source of habitat is low.

The Swift Parrot occurs as a single, migratory population. It is thought that the Regent Honeyeater also comprises a single Australian population.

An action is likely to have a significant impact on a Critically Endangered or Endangered species if there is a real chance or possibility that it will:

1) lead to a long-term decrease in the size of a population

The area impacted by the development contains a minor amount of potential foraging habitat for the Swift Parrot and Regent Honeyeater (approximately 0.02 ha of PCTs and 0.009 hectares of planted native vegetation). While the habitat in the area impacted by the development is not optimal, the loss of potential feed trees would directly affect the opportunity for these species to feed in the area. However, the area impacted by the development is not considered a critical area for the Swift Parrot or Regent Honeyeater and has not been mapped as an area of important habitat for the Regent Honeyeater.

These species may utilise trees in the area impacted by the development for foraging intermittently when suitable inland (i.e. box ironbark woodlands) resources are scarce or opportunistically while moving through the Murray River region. The development would remove a small amount of potential foraging habitat for these species, but the impact will be negligible considering that no high-quality natural foraging habitat will be impacted and the extent of resources in the adjacent environment that will remain.

The Swift Parrot does not breed in mainland Australia. There are only four known key breeding regions remaining for the Regent Honeyeater: north-east Victoria (Chiltern-Albury), and in NSW at Capertee Valley, Hunter Valley and the Bundarra-Barraba region. The small, isolated extent of habitat within the study area would unlikely be included in the Chiltern-Albury extent of this range. The extent of habitat remaining in the area after the proposed development would provide sufficient foraging resources to sustain future visitation, such that the development is unlikely to lead to a long-term decrease in the size of the Swift Parrot or the Regent Honeyeater populations.

2) reduce the area of occupancy of the species

As specialist nectarivores dependent on flowering eucalypts, these species are vulnerable to the loss of quantity and quality of key forage tree species. As a large-scale migrant, the Swift Parrot has the ability to cover vast areas

of its winter range, seeking suitable flowering eucalypt habitat. Similarly, the Regent Honeyeater is known to travel large distances around south-eastern Australia in search of large flowering events. These species may utilise trees in the area impacted by the development for foraging intermittently when suitable resources are scarce.

The development would contribute to the loss of a small amount of marginal potential foraging habitat which would result in a negligible reduction in foraging habitat available. However, it would not reduce the area of occupancy of the Swift Parrot which is estimated at 4,000 square kilometres or the Regent Honeyeater, which is estimated at 300 square kilometres.

3) fragment an existing population into two or more populations

Importantly, the development would not result in fragmentation of habitat for the Swift Parrot and Regent Honeyeater. These species are highly mobile and as a regular behaviour fly long distances over open areas to move between suitable foraging habitats. The development would not affect the movement of the Swift Parrot or Regent Honeyeater between habitat patches or fragment the populations.

4) adversely affect habitat critical to the survival of a species

Habitat critical to the survival of the Swift Parrot includes; those areas of priority habitat for which the Swift Parrot has a level of site fidelity or possess phenological characteristics likely to be of importance to the Swift Parrot. Key habitats for the Swift Parrot on the Western Slopes of New South Wales include large stands of Yellow Box (*Eucalyptus melliodora*), White Box (*Eucalyptus albens*), Ironbark (*Eucalyptus sideroxylon*) and Grey Box (*Eucalyptus microcarpa*) forests.

Habitat critical to the survival of the Regent Honeyeater includes:

- Any breeding or foraging habitat in areas where the species is likely to occur (as defined by the distribution map provided in Figure 2 of the National Recovery Plan – this includes the Sydney Region); and
- Any newly discovered breeding or foraging locations.

The area impacted by the development is mostly cleared and only contains 0.03 hectares of potential foraging habitat for these species (consisting of 0.02 ha of PCTs and 0.009 hectares of planted native vegetation). The development site is within an area where the Regent Honeyeater is could potentially occur, therefore the foraging habitat that will be impacted is considered to be critical to survival. The habitat within the area impacted by the development is not a primary habitat and unlikely to be of critical importance to the survival of these species.

The habitats are likely to only be visited on rare occasion by birds passing through on route to larger higher quality habitats on the coast and inland. The proposal is unlikely to adversely affect habitat critical to the survival of the Swift Parrot and Regent Honeyeater.

5) disrupt the breeding cycle of a population

The Swift Parrot is endemic to south-eastern Australia and breeds only in Tasmania. This species migrates to mainland Australia in autumn. As such, the development would not impact on breeding habitat for this species. Important winter foraging grounds will not be impacted so there would be negligible impact on the life cycle of the Swift Parrot.

There are only four known key breeding regions remaining for the Regent Honeyeater: north-east Victoria (Chiltern-Albury), and in NSW at Capertee Valley, Hunter Valley and the Bundarra-Barraba region. It is likely that this species also breeds in other locations, breeding mostly corresponds with the flowering of key eucalypt and mistletoe species. Nests are usually placed in the canopy of mature trees with rough bark, e.g. ironbarks, sheoaks (*Casuarina*) and rough-barked Apple (*Angophora*). Given the study area is mostly cleared and remaining trees are isolated from any significant woodland patches, it is unlikely that the development site would constitute

breeding habitat for this species. As such, the development would not impact on breeding habitat for the Regent Honeyeater.

6) modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

As a large-scale migrant (Swift Parrot) and a 'rich-patch nomad' (Regent Honeyeater), these species can cover vast areas of their winter range, seeking suitable flowering eucalypt habitat. These species are an occasional visitor to the region and may utilise trees in the area impacted by the development for foraging intermittently when no other suitable resources are available. The impact to foraging habitat from the development would be negligible and the development is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

7) result in invasive species that are harmful to a Critically Endangered or Endangered species becoming established in the Endangered or Critically Endangered species' habitat

The main invasive species harmful to the habitat for the Swift Parrot and Regent Honeyeater in NSW is weeds. The development may result in weed invasion and the removal of habitat may increase competition for food resources, but this impact is considered to be negligible given the context of the habitat in the immediate vicinity of the development (i.e. Murray River riparian corridor) and the locality. Consequently, it is unlikely to result in any further invasive species becoming established in the habitat.

8) introduce disease that may cause the species to decline, or

Infection of native plants by *Phytophthora cinnamomi* has been identified as being spread by construction machinery. This water-borne mould infects the roots of plants and has the potential to cause dieback. It is the intention to use current best practice hygiene protocols as part of a construction environmental management plant to prevent the introduction or spread of pathogens. Mitigation and environmental management procedures for the development would include guidance for preventing the introduction and/or spread of disease-causing agents such as bacteria and fungi.

9) interfere with the recovery of the species.

The *National Recovery Plan for the Swift Parrot* (Commonwealth of Australia 2011) identifies the following actions for recovery of this species:

- Identify the extent and quality of habitat
- Manage and protect Swift Parrot habitat at the landscape scale
- Monitor and manage the impact of collisions, competition and disease
- Monitor population and habitat.

The *National Recovery Plan for the Regent Honeyeater (Anthochaera phrygia)* (Commonwealth of Australia 2011) identifies four strategies for recovery of this species:

- Improve the extent and quality of regent honeyeater habitat.
- Bolster the wild population with captive-bred birds until the wild population becomes self-sustaining.
- Increase understanding of the size, structure, trajectory and viability of the wild population.
- Maintain and increase community awareness, understanding and involvement in the recovery program.

The recovery actions listed above to help recover the Swift Parrot and Regent Honeyeater are largely not applicable to the development. The removal of suitable foraging habitat conflicts with the first strategy of the Regent Honeyeater Recovery Plan, though this impact is not considered likely to interfere with the recovery of this species. The development would not interfere with the recovery of the Swift Parrot.

Conclusion

There would be a minor reduction in extent of potential foraging habitat for the Swift Parrot and Regent Honeyeater from the development. The development would not break apart large blocks or habitat or restrict movement patterns of these species. There would be no impact to breeding habitat for either of these species. It is unlikely to reduce the size of the Swift Parrot population or the Regent Honeyeater population or decrease the reproductive success of these species. The development is unlikely to interfere with the recovery of the Swift Parrot or Regent Honeyeater. After consideration of the factors above, an overall conclusion has been made that the development is unlikely to result in a significant impact to the Swift Parrot or Regent Honeyeater and a referral is not required.

D.1.3 Superb Parrot

Native trees in the study area may provide foraging resources during flowering times for nectarivorous species such as the Superb Parrot (*Polytelis swainsonii*). The Superb Parrot was not observed within the study area during surveys.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

1) lead to a long-term decrease in the size of an important population

The Superb Parrot is endemic to inland south-eastern Australia, where it occurs as a single population. The key breeding populations occur in the Riverina and South-west Slope Regions of NSW, and spill over from there into northern Victoria; most breeding records emanate from these areas. Breeding has not been recorded in the ACT since the 1960s. Any Superb Parrots that may occur in the study area are therefore considered to be part of an important population.

The proposal is unlikely to impact the Superb Parrots long-term population on the site, as the total direct impacted would be 0.03 hectares of potential foraging habitat (consisting of 0.02 ha of PCTs and 0.009 hectares of planted native vegetation). Large areas of similar quality planted native trees will remain in the area following the completion of the proposal

2) reduce the area of occupancy of an important population

The area of occupancy of the Superb Parrot is estimated at 1000 km^2. However, this estimate is considered to be of low reliability. The Superb Parrot is unlikely to be a permanent resident within the study area, however they may be present within the region during their breeding season (September to January), with most sightings located in the northern districts of Belconnen and Gungahlin, and increasingly in Tuggeranong over autumn and winter.

The proposal will result in the removal of a small area (0.03 hectares) of suitable foraging habitat. No breeding habitat is likely to be impacted by the proposal. The area of occupancy of the Superb Parrot is likely to remain the same following the completion of the proposal

3) fragment an existing important population into two or more populations

As a specialist nectarivore dependent on flowering eucalypts, Superb Parrots are vulnerable to the loss of quantity and quality of key forage tree species. As a large-scale migrant, it can cover vast areas of its winter range, seeking suitable flowering eucalypt habitat. The development would not affect the movement of the Superb Parrots between habitat patches or fragment the populations.

4) adversely affect habitat critical to the survival of a species

The habitat critical to the survival of the Superb Parrot can be divided into breeding and foraging habitat. Across its range, the Superb Parrot uses two distinct habitat types for breeding: riverine forests in the Riverina, and box-gum woodlands in the tablelands and slopes. The majority of Superb Parrot nests are in large, living trees with

many hollow branches. After breeding, Superb Parrots generally move away from their breeding habitat in mid-January into River Red Gum, box-pine, box, pine and Boree woodland.

Only one hollow-bearing tree was identified near the development site and it would not be impacted. The small loss of foraging habitat would not adversely affect habitat critical to the survival of the Superb Parrot.

5) disrupt the breeding cycle of an important population

The vegetation in the development does not contain any large hollow-bearing trees and is unlikely to represent suitable breeding habitat. The one hollow-bearing tree identified would be retained. The proposal is unlikely to disrupt the Superb Parrot breeding cycle.

6) modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The site may be used as potential foraging habitat for this species with movements being attributed to changes in food supply between the breeding and non-breeding seasons. In central New South Wales, movements are said to occur when eucalypts flower, and when food becomes scarce due to drought and birds seek alternative sources of food. When making local foraging movements, these birds usually move along wooded corridors, rarely crossing large areas of open ground. The proposal will remove a small area of potential foraging habitat (0.03 hectares). The action is unlikely to modify, destroy, remove or decrease the availability or quality of habitat to the extent that the species is likely to decline.

7) result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

The main invasive species harmful to the habitat for the Superb Parrot in NSW is weeds. The development may result in weed invasion and the removal of habitat may increase competition for food resources, but this impact is considered to be negligible given the context of the habitat in the immediate vicinity of the development (i.e. Murray River riparian corridor) and the locality. Consequently, it is unlikely to result in any further invasive species becoming established in the habitat.

8) introduce disease that may cause the species to decline, or

Infection of native plants by *Phytophthora cinnamomi* has been identified as being spread by construction machinery. This water-borne mould infects the roots of plants and has the potential to cause dieback. It is the intention to use current best practice hygiene protocols as part of a construction environmental management plant to prevent the introduction or spread of pathogens. Mitigation and environmental management procedures for the development would include guidance for preventing the introduction and/or spread of disease-causing agents such as bacteria and fungi.

9) interfere with the recovery of the species.

The National Recovery Plan for the Superb Parrot Polytelis swainsonii identifies the following actions for recovery of this species:

- Determine population trends in the Superb Parrot.
- Increase the level of knowledge of the Superb Parrot's ecological requirements.
- Develop and implement threat abatement strategies.
- Increase community involvement in and awareness of the Superb Parrot recovery program.

The recovery actions listed above to help recover the Superb Parrot are largely not applicable to the action. The action will not interfere with the recovery of the Superb Parrot.

Conclusion

There would be a minor reduction in extent of potential foraging habitat for the Superb Parrot from the development. The development would not break apart large blocks or habitat or restrict movement patterns of this species. There would be no impact to breeding habitat for this species. It is unlikely to reduce the size of the Superb Parrot population or decrease the reproductive success of this species. The development is unlikely to interfere with the recovery of the Superb Parrot. After consideration of the factors above, an overall conclusion has been made that the development is unlikely to result in a significant impact to the Superb Parrot and a referral is not required.

Appendix E. Biodiversity credit report

BAM Credit Summary Report

Proposal Details

Assessment Id
00020694/BAAS19068/20/00020695

Proposal Name
Hume BESS

BAM data last updated *
18/06/2020

Assessor Name
Brenton Hays

Report Created
22/07/2020

BAM Data version *
29

Assessor Number
BAAS19068

BAM Case Status
Open

Date Finalised
To be finalised

Assessment Revision
0

Assessment Type
Part 4 Developments (General)

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone name	Vegetation integrity loss / gain	Area (ha)	Constant	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Potential SAII	Ecosystem credits
River Red Gum herbaceous-grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the eastern Riverina Bioregion.								
3	5_Carex_wetland	21.9	0.0	0.25	High Sensitivity to Potential Gain	1.50		1
							Subtotal	**1**

White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion								
1	266_Poor	31.6	0.0	0.25	High Sensitivity to Potential Gain	2.00	TRUE	1
2	266_Derived_grassland	3.2	0.4	0.25	High Sensitivity to Potential Gain	2.00	TRUE	0
							Subtotal	**1**
							Total	**2**

Species credits for threatened species

Vegetation zone name	Habitat condition (HC)	Area (ha) / individual (HL)	Constant	Biodiversity risk weighting	Potential SAII	Species credits
Petaurus norfolcensis / Squirrel Glider (Fauna)						
266_Poor	31.6	0.02	0.25	2	False	0
					Subtotal	**0**

Appendix F. Protected Matters Search Tool Report

Australian Government
Department of the Environment and Energy

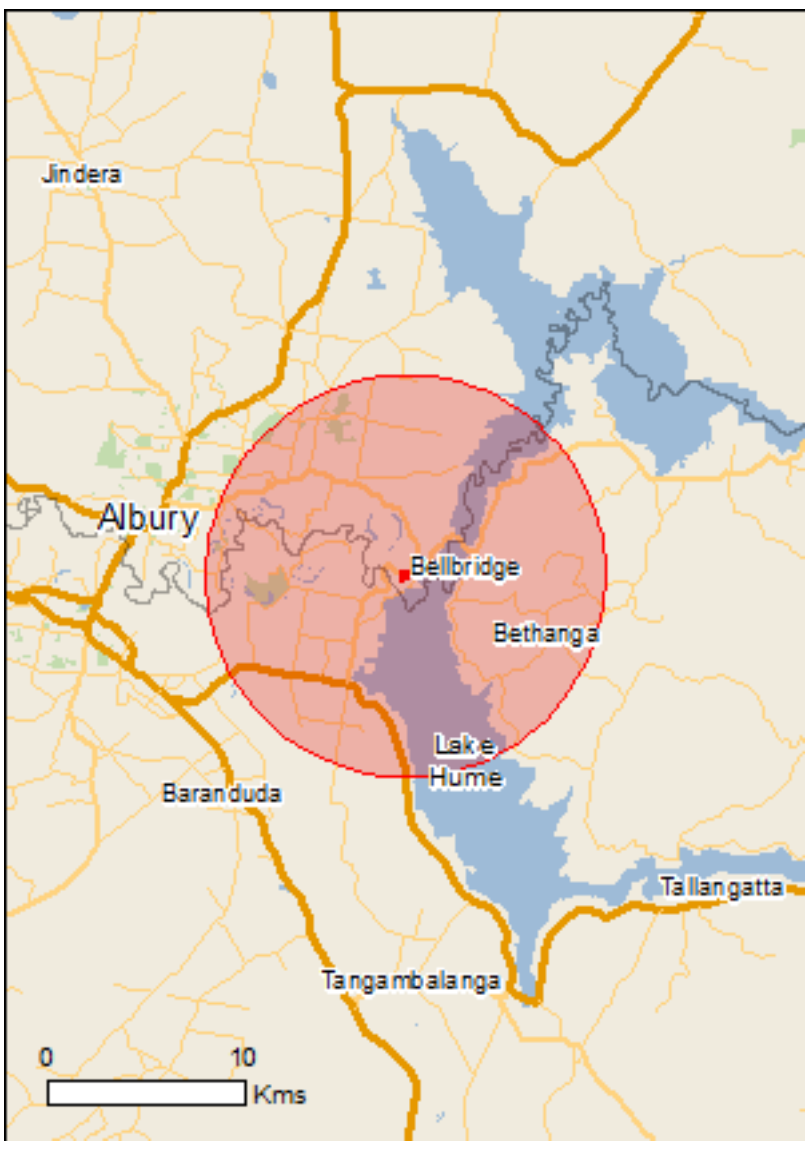
EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 12/06/20 15:23:25



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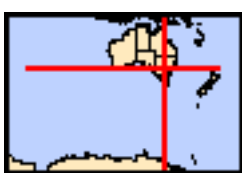

Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	1
Wetlands of International Importance:	7
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	3
Listed Threatened Species:	27
Listed Migratory Species:	13

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	6
Commonwealth Heritage Places:	None
Listed Marine Species:	20
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	5
Regional Forest Agreements:	1
Invasive Species:	34
Nationally Important Wetlands:	2
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

National Heritage Properties		[Resource Information]
Name	State	Status
Historic		
Bonegilla Migrant Camp - Block 19	VIC	Listed place

Wetlands of International Importance (Ramsar)	[Resource Information]
Name	Proximity
Banrock station wetland complex	600 - 700km upstream
Barmah forest	100 - 150km upstream
Gunbower forest	200 - 300km upstream
Hattah-kulkyne lakes	400 - 500km upstream
Nsw central murray state forests	100 - 150km upstream
Riverland	500 - 600km upstream
The coorong, and lakes alexandrina and albert wetland	600 - 700km upstream

Listed Threatened Ecological Communities		[Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia	Endangered	Community likely to occur within area
Weeping Myall Woodlands	Endangered	Community may occur within area
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Critically Endangered	Community likely to occur within area

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Breeding known to occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat known to occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat likely to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within

Name	Status	Type of Presence
		area
[Pedionomus torquatus](#) Plains-wanderer [906]	Critically Endangered	Species or species habitat may occur within area
[Rostratula australis](#) Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Fish		
[Galaxias rostratus](#) Flathead Galaxias, Beaked Minnow, Flat-headed Galaxias, Flat-headed Jollytail, Flat-headed Minnow [84745]	Critically Endangered	Species or species habitat known to occur within area
[Maccullochella peelii](#) Murray Cod [66633]	Vulnerable	Species or species habitat known to occur within area
[Macquaria australasica](#) Macquarie Perch [66632]	Endangered	Species or species habitat may occur within area
Frogs		
[Crinia sloanei](#) Sloane's Froglet [59151]	Endangered	Species or species habitat known to occur within area
[Litoria raniformis](#) Growling Grass Frog, Southern Bell Frog, Green and Golden Frog, Warty Swamp Frog, Golden Bell Frog [1828]	Vulnerable	Species or species habitat known to occur within area
Insects		
[Synemon plana](#) Golden Sun Moth [25234]	Critically Endangered	Species or species habitat may occur within area
Mammals		
[Dasyurus maculatus maculatus (SE mainland population)](#) Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat may occur within area
[Nyctophilus corbeni](#) Corben's Long-eared Bat, South-eastern Long-eared Bat [83395]	Vulnerable	Species or species habitat may occur within area
[Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)](#) Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
[Pteropus poliocephalus](#) Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Plants		
[Amphibromus fluitans](#) River Swamp Wallaby-grass, Floating Swamp Wallaby-grass [19215]	Vulnerable	Species or species habitat known to occur within area
[Caladenia concolor](#) Crimson Spider-orchid, Maroon Spider-orchid [5505]	Vulnerable	Species or species habitat likely to occur within area
[Caladenia tensa](#) Greencomb Spider-orchid, Rigid Spider-orchid [24390]	Endangered	Species or species habitat likely to occur within area
[Prasophyllum petilum](#) Tarengo Leek Orchid [55144]	Endangered	Species or species habitat may occur within area
[Prasophyllum validum](#) Sturdy Leek-orchid, Mount Remarkable Leek-	Vulnerable	Species or species

Name	Status	Type of Presence
orchid [10268]		habitat may occur within area
Swainsona recta Small Purple-pea, Mountain Swainson-pea, Small Purple Pea [7580]	Endangered	Species or species habitat likely to occur within area
Reptiles		
Aprasia parapulchella Pink-tailed Worm-lizard, Pink-tailed Legless Lizard [1665]	Vulnerable	Species or species habitat likely to occur within area
Delma impar Striped Legless Lizard, Striped Snake-lizard [1649]	Vulnerable	Species or species habitat likely to occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat likely to occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat likely to occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat likely to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat likely to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species

Name	Threatened	Type of Presence
		habitat may occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land - Airservices Australia
Commonwealth Land - Australian Postal Corporation
Commonwealth Land - Australian Telecommunications Commission
Commonwealth Land - Defence Housing Authority
Defence - BANDIANA MILITARY AREA
Defence - WIRLINGA ORDNANCE DEPOT

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat likely to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Breeding known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat likely to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species

Name	Threatened	Type of Presence
		habitat likely to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat likely to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat likely to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat may occur within area

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Bonegilla N.C.R.	VIC
Bonegilla Wetland B.R.	VIC
River Murray Reserve	VIC
River Murray Reserve (non-PV)	VIC
Ryans Lagoon N.C.R.	VIC

Regional Forest Agreements	[Resource Information]

Note that all areas with completed RFAs have been included.

Name	State
North East Victoria RFA	Victoria

Invasive Species

[Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Alauda arvensis Skylark [656]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Carduelis chloris European Greenfinch [404]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Cytisus scoparius Broom, English Broom, Scotch Broom, Common Broom, Scottish Broom, Spanish Broom [5934]		Species or species habitat likely to occur within area
Eichhornia crassipes Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Nassella neesiana Chilean Needle grass [67699]		Species or species habitat likely to occur within area
Nassella trichotoma Serrated Tussock, Yass River Tussock, Yass Tussock, Nassella Tussock (NZ) [18884]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Solanum elaeagnifolium Silver Nightshade, Silver-leaved Nightshade, White Horse Nettle, Silver-leaf Nightshade, Tomato Weed, White Nightshade, Bull-nettle, Prairie-berry, Satansbos, Silver-leaf Bitter-apple, Silverleaf-nettle, Trompillo [12323]		Species or species habitat likely to occur within area
Ulex europaeus Gorse, Furze [7693]		Species or species

Name	Status	Type of Presence
		habitat likely to occur within area

Nationally Important Wetlands [Resource Information]

Name	State
Lake Hume	VIC
Ryan's Lagoon	VIC

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-36.103458 147.032063,-36.103736 147.033297,-36.10247 147.033715,-36.101386 147.034016,-36.101352 147.033243,-36.101751 147.032031,-36.102279 147.031505,-36.10312 147.031741,-36.103476 147.031923,-36.103458 147.032074

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-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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