

**MID-WEST 2 MURRAY RIVER CROSSING AT
ECHUCA–MOAMA**

**DETAILED FLORA, FAUNA, NATIVE
VEGETATION AND NET GAIN ASSESSMENT**

VicRoads



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GLOSSARY OF TERMS & ABBREVIATIONS

ANSWW	Atlas of New South Wales Wildlife (NSW)
AVW	Atlas of Victorian Wildlife (Vic)
BL&A	Brett Lane and Associates Pty Ltd
DBH	Diameter at Breast Height
DPI	Department of Primary Industries (NSW)
DSE	Department of Sustainability and Environment (Vic)
EEC	Endangered Ecological Community (NSW)
EES	Environmental Effects Statement (Vic)
EPA Act	<i>Environmental Planning and Assessment Act 1979</i> (NSW)
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i> (Federal)
EVC	Ecological Vegetation Class (Vic)
FFG Act	<i>Flora and Fauna Guarantee Act 1988</i> (Vic)
FIS	Flora Information System (Vic)
FM Act	<i>Fisheries Management Act 1994</i> (NSW)
Framework/NVMF	Native Vegetation Management Framework (Vic)
GPS	Global Positioning System
NPW Act	<i>National Parks and Wildlife Act 1974</i> (NSW)
NSW	New South Wales
NV Act	<i>Native Vegetation Act 2003</i> (NSW)
OEH	Office of Environment and Heritage (NSW)
PVPs	Property Vegetation Plans (NSW)
REF	Review of Environmental Factors (NSW)
SIS	Species Impact Statement (NSW)
TEC	Threatened Ecological Community
TPFSRV	Threatened and Protected Fish Species Record Viewer (NSW)
TSC Act	<i>Threatened Species Conservation Act 1995</i> (NSW)

1. EXECUTIVE SUMMARY

VicRoads engaged Brett Lane and Associates Pty Ltd (BL&A) to conduct a Flora, Fauna and Net Gain Assessment for the proposed Murray River Crossing at Echuca-Moama along the Mid-West 2 Corridor. The Mid-West 2 Corridor forms the study area for this investigation and it lies between the intersection of the Murray Valley Highway and Warren Street in Echuca, and the Cobb Highway and Perricoota Road intersection in Moama. The corridor passes to the north of Echuca Cemetery and crosses the Murray River to the north of Echuca Caravan Park. This investigation was commissioned to provide detailed information of the ecological values within the Mid-West 2 Corridor and on the potential impacts on these values across various alignment options. This report outlines any relevant implications under relevant national, state (Victorian and New South Wales) and local legislation and policy.

Extensive survey effort has been undertaken for the project within the Mid-West 2 Corridor. This has included:

- Initial Flora, Fauna and Native Vegetation (Habitat Hectare) Assessment in September 2011;
- Targeted Flora Surveys in November 2011;
- Targeted Fauna Surveys in November 2011 and October 2012;
- Two bat surveys, the first in November 2011 and the second across February and March 2012;
- Further Native Vegetation surveying in added parts of the study area in July 2012; and
- Hollow-bearing tree mapping in NSW in October 2012.

Native Vegetation

Native vegetation within the study area has been determined based on the relevant state level definitions for Victoria and New South Wales (NSW).

A total of 40.67 habitat hectares (71.98 hectares) of native vegetation was recorded across four Ecological Vegetation Classes (EVCs) within the Victorian section of the study area. The following native vegetation was recorded in the Victorian section of the study area:

- 1.67 habitat hectares (2.78 hectares) of very high conservation significance Semi-arid Woodland (EVC 97);
- 1.18 habitat hectares (2.53 hectares) of high conservation significance Riverine Chenopod Woodland (EVC 103);
- 24.70 habitat hectares (40.17 hectares) of very high conservation significance Riverine Chenopod Woodland (EVC 103);
- 0.37 habitat hectares (1.00 hectares) of high conservation significance Grassy Riverine Forest (EVC 106);
- 6.59 habitat hectares (13.94 hectares) of very high conservation significance Grassy Riverine Forest (EVC 106);

- 6.06 habitat hectares (11.28 hectares) of very high conservation significance Riverine Grassy Woodland (EVC 295);
- 0.10 habitat hectares (0.27 hectares) of high conservation significance Riverine Grassy Woodland (EVC 295);
- 1408 large/very large trees within Habitat Zones; and
- Six very large, one large and four small scattered trees.

A total of 14.47 hectares of native vegetation was recorded across two Vegetation Types in New South Wales. The following native vegetation was recorded in the New South Wales section of the study area:

- 8.16 hectares of River Red Gum - Black Box woodland of the semi-arid (warm) climatic zone;
- 6.31 hectares of River Red Gum - herbaceous tall open forest of the Riverina and Murray Darling Depression Bioregions;
- A total of 35 hollow-bearing trees; and
- Eleven scattered trees.

Flora

Three rare or threatened flora species were detected during the investigation, all of which were recorded in Victoria. These included:

- Weeping Myall (threatened under the FFG Act, endangered in Victoria on DSE Advisory List);
- Blue Burr-daisy (rare in Victoria on DSE Advisory List); and
- Pale Flax-lily (vulnerable in Victoria on DSE Advisory List).

These species are likely to be impacted on by the project.

No rare or threatened flora species were recorded in New South Wales.

Based on an assessment of likelihood of occurrence it was considered that suitable habitat occurs within the study area for an additional five listed flora species, Hairy Tails, Slender Darling-pea, Small Scurf-pea, River Swamp Wallaby-grass and Western Water Starwort. Suitable habitat for these species is considered to be limited to areas of higher quality Black Box dominated woodland in Victoria and Forested Wetland in New South Wales.

Targeted flora surveys were undertaken in November 2011 for these additional threatened flora species. No additional threatened flora species were recorded during these surveys. Therefore it is considered unlikely that any additional threatened flora species occurs in the investigation corridor and would be impacted by the proposal.

Fauna

Thirty-four (34) listed fauna species were recorded or had suitable habitat in the study area. These included:

- Azure Kingfisher (near threatened in Victoria on the DSE Advisory List);

- Barking Owl (threatened under the Victorian FFG Act, endangered in Victoria under the DSE Advisory List and listed as vulnerable in NSW under the TSC Act);
- Black-chinned Honey-eater (near threatened in Victoria on the DSE Advisory List and vulnerable in NSW under the TSC Act);
- Brown Quail (near threatened in Victoria on the DSE Advisory List);
- Brown Treecreeper (near threatened in Victoria on the DSE Advisory List and vulnerable in NSW under the TSC Act);
- Bush Stone-curlew (threatened under the Victorian FFG Act, endangered in Victoria under the DSE Advisory List and listed as endangered in NSW under the TSC Act);
- Diamond Firetail (threatened under the Victorian FFG Act, vulnerable in Victoria under the DSE Advisory List and listed as vulnerable in NSW under the TSC Act);
- Eastern Great Egret (migratory on the federal EPBC Act, threatened under the Victorian FFG Act and vulnerable in Victoria on the DSE Advisory List);
- Grey-crowned Babbler (threatened under the Victorian FFG Act, endangered in Victoria under the DSE Advisory List and listed as vulnerable in NSW under the TSC Act);
- Hooded Robin (threatened under the Victorian FFG Act, near threatened in Victoria on the DSE Advisory List and vulnerable in NSW under the TSC Act);
- Intermediate Egret (threatened under the Victorian FFG Act and critically endangered in Victoria on the DSE Advisory List);
- Masked Owl (threatened under the Victorian FFG Act, endangered in Victoria under the DSE Advisory List and listed as vulnerable in NSW under the TSC Act);
- Nankeen Night-heron (near threatened in Victoria on the DSE Advisory List);
- Rainbow Bee-eater (migratory on the federal EPBC Act);
- Royal Spoonbill (vulnerable in Victoria on the DSE Advisory List);
- Speckled Warbler (threatened under the Victorian FFG Act, vulnerable in Victoria under the DSE Advisory List and listed as vulnerable in NSW under the TSC Act);
- Superb Parrot (vulnerable on the federal EPBC Act, threatened under the Victorian FFG Act, endangered in Victoria on the DSE Advisory List and vulnerable in NSW under the TSC Act);
- Swift Parrot (endangered on the federal EPBC Act, threatened under the Victorian FFG Act, endangered in Victoria on the DSE Advisory List and endangered in NSW under the TSC Act);
- Turquoise Parrot (threatened under the Victorian FFG Act, near threatened in Victoria under the DSE Advisory List and listed as vulnerable in NSW under the TSC Act);
- Varied Sittella (vulnerable on the NSW TSC Act);

- White-bellied Sea-Eagle (migratory on the federal EPBC Act, threatened under the Victorian FFG Act and vulnerable in Victoria on the DSE Advisory List);
- Corben’s Long-eared Bat (vulnerable on the federal EPBC Act, threatened under the Victorian FFG Act, vulnerable in Victoria on the DSE Advisory List and vulnerable in NSW under the TSC Act);
- Koala (vulnerable in NSW on the federal EPBC Act, and vulnerable in NSW under the TSC Act);
- Large-footed Myotis (vulnerable in NSW under the TSC Act);
- Squirrel Glider (threatened under the Victorian FFG Act, endangered in Victoria on the DSE Advisory List and vulnerable in NSW under the TSC Act);
- Yellow-bellied Sheathtail Bat (listed as threatened in Victoria under the FFG Act, and vulnerable in NSW under the TSC Act);
- Murray River Tortoise (threatened under the Victorian FFG Act and data deficient in Victoria on the DSE Advisory List);
- Growling Gras Frog (vulnerable on the federal EPBC Act, threatened under the Victorian FFG Act, endangered in Victoria on the DSE Advisory List and endangered in NSW under the TSC Act);
- Golden Perch (vulnerable in Victoria on the DSE Advisory List);
- Maquarie Perch (endangered on the federal EPBC Act, threatened under the Victorian FFG Act, endangered in Victoria on the DSE Advisory List and endangered in NSW under the FM Act);
- Murray Cod (vulnerable on the federal EPBC Act, threatened under the Victorian FFG Act and endangered in Victoria on the DSE Advisory List);
- Murray Hardyhead (vulnerable on the federal EPBC Act, threatened under the Victorian FFG Act, critically endangered in Victoria on the DSE Advisory List and critically endangered in NSW under the FM Act);
- Silver Perch (threatened under the Victorian FFG Act and critically endangered in Victoria on the DSE Advisory List); and
- Trout Cod (endangered in NSW under the FM Act).

Of these species, seven were recorded in Victoria (Brown Treecreeper, Azure Kingfisher, Brown Quail, Nankeen Night-heron, Black-chinned Honeyeater, Corben’s Long-eared bat and Yellow-bellied Sheathtail Bat) and eight were recorded in NSW (Brown Treecreeper, Azure Kingfisher, Nankeen Night-heron, Masked Owl, Varied Sittella, Squirrel Glider, Corben’s Long-eared bat and Yellow-bellied Sheathtail Bat).

These species are likely to be impacted on by the proposal through the loss of and fragmentation of habitat. As similar habitat occurs adjacent and the listed bird and bat species are highly mobile, impacts are not considered to be significant. Mitigation measures including the establishment of glider crossings are recommended to mitigate impacts on the Squirrel Glider.

The Rainbow Bee-eater listed as migratory under the EPBC Act, the Rainbow Bee-eater was recorded during this investigation in both Victoria and NSW.

Targeted fauna surveys were also undertaken during 2011 and 2012 for additional listed fauna species with potential habitat to occur, namely Barking Owl, Bush Stone Curlew and Growling Grass Frog. These fauna species were not recorded during targeted surveys. It is therefore considered unlikely that these species do not permanently reside in the investigation corridor and that they would not be impacted by the proposal.

Design Response and Recommendations

BL&A originally undertook flora and fauna investigations on a previous corridor (the Mid-West corridor) between 2008 and 2011 (BL&A Report 8194 [2.6]). Following the assessment of various alignment options, it was considered that a new corridor (the Mid-West 2 corridor) was to be assessed for flora and fauna. This corridor comprises the study area for the current investigation.

Field assessments within the Mid-west 2 corridor were undertaken during 2011 and 2012. Initially, four alignment route options were considered (2A, 2B, 2C and 2D), for which impacts upon native vegetation and fauna habitat was compared. These impacts were presented in detail in a previous version of this report (BL&A Report 8194 [3.7]). Since then, several alterations in the design have been undertaken to result in the two alignment options that are currently being considered for the road development (2A and 2B).

Recent design changes, namely the narrowing of the ultimate development footprint, have resulted in a large reduction in the impact to ecological values in the study area as detailed below (when compared with impacts presented in BL&A Report 8194 [3.7]).

- Reduction in removal of remnant patch native vegetation in Victoria by between 9.18 and 9.78 hectares (between 5.23 and 5.76 habitat hectares).
- Reduction in removal of Large Old Tree's (LOTs) in Victoria by between 130 and 187 trees.
- Reduction in removal of remnant patch native vegetation in NSW by 1.13 hectares.
- Reduction in removal of hollow bearing trees in NSW by three trees.
- Reduction in removal of scattered trees across Victoria and NSW by 13 trees.

As such, the project has shown application of the three step approach detailed in Victoria's Native Vegetation Management Framework. As impacts to native vegetation cannot be **avoided** for the project, several design changes have been made to **minimise** these impacts. Impacts of the two alignment options currently being considered for the ultimate road development (2A and 2B) are presented in this report, along with the **offsets** required to achieve a net gain.

Option 2B is recommended as the preferred option as it has the least impact to native vegetation and fauna habitat in Victoria. This alignment option takes the route of least disturbance to native vegetation by utilising existing disturbed areas including the tennis courts and sports oval in Echuca.

Implications

The following implications would pertain to the current development proposal:

Commonwealth

- One **EPBC Act** listed species; the Corben's Long-eared Bat was recorded in the study area at a low abundance. Despite the occurrence of the species in the area, the removal of a small amount of habitat is not considered to have a significant impact on the species. Based on the amount of native vegetation proposed to be removed under either two options it is considered prudent that a referral under the EPBC Act be prepared for the project. Based on the details presented in this report, it is recommended that the project be referred as 'Not a Controlled Action'.

Victoria

- A permit will be required under Clause 52.17 of the Campaspe Shire Planning Scheme for the removal of native vegetation in Victoria.
- The current proposal will trigger a referral to the Victorian DSE due to the amount of native vegetation proposed for removal in Victoria.
- Approval will be required by the Victorian Minister for Environment for the removal of very high conservation significance vegetation within the study area.
- The removal of native vegetation within the study area will require offsetting in accordance with Victoria's Native Vegetation Management Framework. Offset targets are detailed as followed for each alignment option:
 - Alignment Option 2A: This option will result in the removal of 16.19 hectares (9.18 habitat hectares) of native vegetation in Victoria as well as the loss of 298 large old trees within patches. This will result in an offset target of 18 habitat hectares as well as the protection of 2,328 large old trees and recruitment of 11,640 new plants.
 - Alignment Option 2B: This option will result in the removal of 15.53 hectares (8.86 habitat hectares) of native vegetation in Victoria as well as the loss of 284 large old trees within patches. This will result in an offset target of 17.33 habitat hectares as well as the protection of 2,200 large old trees and recruitment of 11,000 new plants.
 - Additional offsets, namely the protection of four trees (very large) and recruitment of 50 new plants OR the recruitment of 180 new plants are required for the removal of these four scattered trees in Victoria. The offsets required to compensate for the removal of these four scattered trees in Victoria are common to both alignment options.
- Based on the proposed level of removal of very high conservation significance vegetation in Victoria, the first criterion is met for either of the two alignment options. A Referral to the Victorian Minister for Planning who will determine if an **EES** is required is therefore considered to be necessary for the project.
- One flora species (Weeping Myall) and four fauna species (Masked Owl, Squirrel Glider, Yellow-bellied Sheath-tail Bat and Corben's Long-eared Bat)

listed as threatened on the **FFG Act** were recorded in the study area. The responsible authority will consider impacts on these species when assessing the planning application.

- Three flora species (Weeping Myall, Blue-burr Daisy and Pale Flax-lily) and eight fauna species (Azure Kingfisher, Black chinned Honeyeater, Brown Quail, Brown Treecreeper, Masked Owl, Nankeen Night-heron, Corben's Long-eared Bat and Squirrel Glider) listed under the **DSE Advisory Lists** were recorded in the study area. The responsible authority will consider impacts on these values when assessing the planning application.

New South Wales

- The alignment in the New South Wales section of the study area is fixed and will result in the removal of 5.19 hectares of native vegetation, including nine hollow-bearing trees. An additional two scattered trees will also require removal in NSW.
- As the proposal is for the construction of new road infrastructure and is to be carried out by the Roads and Maritime Services (RMS) Transport Department, it is assessed under Part 5 of the EPA Act and formal offsetting or BioBanking is not required (pers comms. Steve Hall, Senior Vegetation Officer, Murray CMA, September 2012). Rather offsets could be achieved through the protection of like-for-like native vegetation within the Murray CMA. This would be subject to agreement with VicRoads, RMS and Murray CMA.
- A total of 21 fauna species listed under the NSW TSC Act and FM Act were recorded or considered likely to occur in the study area due to the availability of suitable habitat. In the addition to these threatened fauna species one EEC was also identified as occurring within the study area.
- While some threatened species and EEC habitat will be impacted to facilitate the proposed development, impacts are not considered to result in the extinction of any local populations or reduce the long-term existence of any of these species. A Species Impact Statement is therefore not considered to be required for the project. A Review of Environmental Factors (REF) will be required to be prepared at a later date when more information is available to assess all potential impacts to the environment.

2. INTRODUCTION

VicRoads engaged Brett Lane and Associates Pty Ltd (BL&A) to conduct a Flora, Fauna and Net Gain Assessment for the proposed Murray River Crossing at Echuca-Moama along the Mid-West 2 Corridor. This study area lies between the intersection of the Murray Valley Highway and Warren Street in Echuca, and the Cobb Highway and Perricoota Road intersection in Moama. It runs to the north of Echuca Cemetery and crosses the Murray River to the north of Echuca Caravan Park. The Mid-West 2 Corridor forms the study area for this investigation, and is shown in Figure 1.

This investigation was commissioned to provide information on the ecological values within the Mid-West 2 Corridor and on the potential impacts on these values across various alignment options. This report outlines any relevant implications under relevant national, state (Victorian and New South Wales) and local legislation and policy.

The scope of the investigation included:

- A detailed literature and database review of the study area for both Victoria and New South Wales (NSW);
- An initial field survey within the Victorian and NSW sections of the corridor involving:
 - Classification and mapping of all remnant patches of native vegetation within the corridor;
 - Mapping and assessment of fauna habitat within the study area;
 - Habitat hectare and scattered tree assessment in Victoria, as well as mapping of all large old trees within patches;
 - Assessment of the likelihood of occurrence of threatened flora and fauna; and
 - Compilation of detailed flora and fauna species lists for the site.
- Targeted flora survey within the Victorian and NSW sections of the corridor involving visual searching along 5 metre transects for Hairy Tails Slender Darling-pea; Small Scurf-pea River Swamp Wallaby-grass; and Western Water Starwort;
- Targeted fauna surveys within the Victorian and NSW sections of the corridor for Barking Owl, Bush-Stone Curlew, Squirrel Glider and Growling Grass Frog. Details of the various survey methods undertaken are provided in Section 3 of this report.
- A general Bat Survey to determine which bat species, including any threatened bat species, utilise the area.
- A second Bat Survey to further determine the abundance of threatened bat species within the study area.
- Additional field survey including mapping of all hollow-bearing trees in NSW and assessment of aquatic habitat.

- Assessment to compare the impacts to native vegetation and fauna habitat in Victoria (net gain analysis) and NSW across various route options.

This report is divided into the following sections:

Section 3 describes the sources of existing information used for the investigation.

Section 4 presents the field methods for all various types of surveys undertaken as part of the investigation.

Section 5 provides a detailed description of the study area.

Section 6 presents the investigation results, describing the native vegetation, flora and fauna of the study area.

Section 7 discusses the implications of the findings relevant to Commonwealth legislation.

Section 8 discusses the implications of the findings relevant to Victorian legislation and policy.


Section 9 discusses the implications of the findings relevant to New South Wales legislation.

Section 10 provides recommendations to inform the design process and assist the development of a minimum impact proposal.

This investigation was undertaken by a team from BL&A, comprising Khalid Al-Dabbagh (Zoologist), Curtis Doughty (Zoologist), Brett MacDonald (Senior Ecologist), Bill Wallach (Botanist), Justin Sullivan (Senior Ecologist & Project Manager) and Brett Lane (Principal Consultant).



Legend

 Study Area

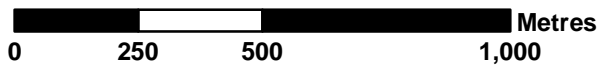






Figure 1: Mid-West 2 Corridor Study Area		
Project: Murray River Crossing Echuca		
Client: VicRoads		
Project No.: 8194	Date: 24/11/2011	Created By: J. Sullivan / M. Ghasemi
 Brett Lane & Associates Pty. Ltd. Ecological Research & Management		
<ul style="list-style-type: none">  Experience  Knowledge  Solutions 	25 Burwood Rd, Hawthorn PO Box 74, Richmond VIC 3121 Australia	ph (03) 9815 2111 fax (03) 9815 2685 blane@ecologicalresearch.com.au www.ecologicalresearch.com.au

3. EXISTING INFORMATION

Existing information used for this investigation is described below. Note that 'study area' refers to the Mid-West 2 Corridor situated between the intersection of the Murray Valley Highway and Warren Street in Echuca, and the Cobb Highway and Perricoota Road intersection in Moama. The study area is shown in Figure 1.

Existing information has been obtained from a wider area, termed the 'search region' defined for this assessment as an area with radius ten kilometres from the approximate centre point of the study area of coordinates: latitude 36° 06' 47" S and longitude 144° 44' 36" E. This provided an indication of threatened species and communities that have the potential to occur in the study area.

The previous Flora and Fauna report on the Echuca Bridge Mid-West Corridor was also reviewed for the purpose of this investigation (BL&A 2011).

3.1. National level

The likelihood of suitable habitat in the study area for nationally threatened ecological communities, flora and fauna species was ascertained on the 12 November 2012 through a search of the online *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Protected Matters Search Tool (DSEWPC 2012) using the search region defined above (see Appendix 10).

3.2. State level

3.2.1. Victorian portion of the study area

Native Vegetation

Pre-1750 (pre-European settlement) vegetation mapping was reviewed to determine the type of native vegetation likely to occur in the study area. Information on Ecological Vegetation Classes was obtained from published EVC benchmarks. These sources included:

- Relevant EVC benchmarks for the Victorian Riverina and Murray Fans bioregions¹ (DSE 2011a) viewed on the 22nd September 2011 and
- Biodiversity Interactive Maps (DSE 2011b) viewed on the 22nd September 2011.

Flora

A list of the flora species recorded in the Victorian section of the search region was obtained from the Viridans Flora Information System (FIS) on the 6th October 2011, a database administered by the Department of Sustainability and Environment (DSE) (Viridans Biological Databases 2011a). This database search listed all plant species, including rare and threatened plants found in the Victorian

¹ A bioregion is defined as "a geographic region that captures the patterns of ecological characteristics in the landscape, providing a natural framework for recognising and responding to biodiversity values". In general bioregions reflect underlying environmental features of the landscape (DNRE 1997).

search region (Appendix 11). The Victorian Biodiversity Atlas Flora records were also reviewed on the same date.

Plant taxonomy used throughout this report follows the FIS standards.

Fauna

A list of the fauna species recorded in the Victorian portion of the search region was obtained from the following sources:

- Atlas of Victorian Wildlife (AVW) on the 5th October 2011, a database administered by DSE (Viridans Biological Databases 2011b; Appendix 13);
- The Victorian Biodiversity Fauna Atlas on the 5th October 2011; and
- The New Atlas of Australian Birds viewed on the 22nd September 2011, administered by Birds Australia (Appendix 15).

Fauna taxonomy used throughout this report follows the AVW nomenclature.

3.2.2. *NSW portion of the study area*

Native Vegetation

Existing information regarding native vegetation types which occur in NSW within the Murray CMA was sourced from various databases incorporated in BioMetric 2.0, a tool that facilitates preparation of Property Vegetation Plans (PVPs) under the NSW *Native Vegetation Act 2003* (NV Act). This tool works alongside separate tools for assessing threatened species, soils, water quality, salinity and invasive native scrub.

Flora

A list of flora species recorded in the NSW section of the search region was obtained from the Atlas of New South Wales Wildlife (ANSWW) viewed on the 22nd November 2011, a database administered by the Office of Environment and Heritage (OEH). This database search listed all plant species, including rare and threatened plants found in the NSW search region (Appendix 12).

A search of the NSW DPI Noxious Weeds database was also undertaken for this assessment (Appendix 17).

Fauna

A list of the fauna species recorded in the NSW portion of the search region was obtained from the following sources:

- ANSWW viewed on the 3rd November 2011, administered by the OEH (Appendix 14);
- The New Atlas of Australian Birds viewed on the 22nd September 2011, administered by Birds Australia (Appendix 15); and
- Threatened and Protected Fish Species Records Viewer (TPFSRV) viewed on the 8th January 2013, a database administered by the NSW Department of Primary Industries (DPI).

4. FIELD METHODOLOGY

4.1. General methods

The following field methods satisfied the various National, Victorian and NSW survey guidelines.

4.1.1. *Initial Flora and Fauna Field Survey*

An initial flora and fauna field assessment was conducted over five days from 26th to 30th September, 2011. During this assessment, the entire study area was inspected in detail on foot. Sites in the study area found to support native vegetation and/or habitat for rare or threatened flora and/or fauna were mapped. Mapping was undertaken through a combination of aerial photograph interpretation and ground-truthing using a hand held GPS (accurate to approximately five metres).

Flora

Incidental records of flora species within vegetation types and landforms were made whilst conducting field work. Specimens requiring identification using laboratory techniques were collected by botanists of BL&A.

Native vegetation assessment

Native vegetation assessment was undertaken in accordance with the relevant state assessment guidelines. This is defined as follows:

Native vegetation assessment in Victoria

Native vegetation in Victoria has been defined as belonging to three categories (DNRE 2002):

- Remnant patch
- Scattered trees
- Degraded treeless vegetation

A description of these is provided below with the prescribed DSE methods to assess them.

Remnant patch

Remnant patches of native vegetation comprise indigenous plant species considered part of a clearly definable EVC and are defined by the DSE as:

- An area of native vegetation, with or without trees, where at least 25% of the understorey cover is indigenous (excluding bare ground), and/or
- “A group (i.e. three or more) of trees where the tree canopy cover is at least 20%” (DSE 2007a).

Remnant patch vegetation is assessed using the habitat scoring or habitat hectare method (Parkes *et al.* 2003; DSE 2004) whereby components of native vegetation (e.g. tree canopy, understorey and ground cover) are assessed against a DSE-issued EVC benchmark (see appendices) that described the notional pre-

European condition of that EVC. The score effectively measures the percentage resemblance of the vegetation to its original condition.

The habitat hectare score assists in defining the value of remnant native vegetation for assessing its conservation significance and for calculating offsets if removal of native vegetation is approved.

Scattered trees

DSE (2007a) defines scattered trees as indigenous canopy trees with a diameter at breast height (1.3 metres) (DBH) greater than ten centimetres “within an area where at least 75% of the total understorey plant cover is introduced vegetation and the overall canopy cover for a group (i.e. three or more) of trees is less than 20%”.

Scattered trees are counted and their DBH measured. The size class of scattered trees is based on the large tree DBH in the relevant benchmark for the EVC to which it once belonged.

Degraded treeless vegetation

Degraded treeless vegetation comprises all other vegetation (DSE 2007a), either:

- “Minor treeless vegetation” which is vegetation that does not have more than 25% understorey cover that is native or does not contain any canopy trees, or
- “Modified treeless vegetation” which is vegetation that has more than 25% understorey cover that is native, but is now dominated by species that are unlikely to have originally dominated the site. This may include such situations as former grasslands that have had a history of cropping, and now have an extremely modified cover consisting of a few opportunistic, primary colonising native grass species generally amongst exotic species, with little other indigenous diversity.

Minor treeless vegetation requires no further assessment or offsets.

The determination of a patch supporting modified treeless vegetation must be confirmed by DSE. In the case where modified treeless vegetation supports habitat for a rare or threatened species, this will be treated as a remnant patch. A habitat hectare assessment will be required and the conservation significance will be based on the determination of best 50% or remaining 50% habitat. Offsets will be required for the removal of this type of vegetation.

Modified treeless vegetation which does not support habitat for a rare or threatened species requires no further assessment or offsets.

Native vegetation assessment in New South Wales

Native vegetation in New South Wales is classified using three hierarchical levels:

- Formations – Broad classification of vegetation (e.g. Rainforest, Grassland, Grassy Woodland).
- Classes – Detailed classification of vegetation based on geographical range and indicative species (e.g. Northern Warm Temperate Rainforest, Western Slopes Grassland, New England Grassy Woodlands).

- Types – Further classification of vegetation classes based on the dominant canopy species, characteristic mid- and understorey species and landscape position (e.g. Norton's Box - Red Box - White Box grassy open forest of the southern section of the NSW South Western Slopes Bioregion).

Vegetation formations and classes are outlined in Keith (2006). Information on vegetation types was sourced from the BioMetric Vegetation Type tool.

During the site inspection, existing vegetation was classified to type and mapped (using aerial photograph interpretation and ground-truthing) within the study area as per the criteria outlined in the Environmental Outcomes Assessment Methodology (DNR 2005).

According to the NV Act, native vegetation in New South Wales is classified as follows:

- *Remnant vegetation* is any vegetation that is not regrowth.
- *Regrowth* is all native vegetation that has regrown since January 1st 1990. However, regrowth does not include native vegetation that has grown following:
 - Unlawful clearing of remnant native vegetation; or
 - Clearing of remnant native vegetation caused by natural events such as bushfires, floods and droughts (NSW Government 2005).

Tree surveying

The locations of all Large Old Trees (LOTs) within remnant patches in the Victorian section of the study area were mapped using a handheld GPS. The locations of all scattered trees in both Victoria and New South Wales were also mapped using a handheld GPS.

OEH guidelines require hollow-bearing tree surveying and mapping for any development proposal in NSW, as the loss of hollow-bearing trees is a key threatening process under the *Threatened Species Conservation Act 1995* (TSC Act). A systematic search was conducted on the 17th October 2012 for hollow-bearing trees in the NSW portion of the study area, along transects spaced approximately 15 metres apart. All identified hollow-bearing trees were mapped using a hand-held GPS unit (accuracy approximately +/- 5 metres), and the number, nature and size of the hollows was recorded.

Threatened ecological communities

The presence of threatened ecological communities in the study area was assessed against the relevant National and State selection criterion. A search was undertaken for NSW threatened vegetation communities in the search region with the aid of the ANSWW.

Fauna

The following techniques were used to detect fauna species inhabiting the study area:

Direct search and observations during initial assessment

This included traversing the study area during the day searching for and recording fauna species; this effort included the following:

- Bird observation during the day;
- The diurnal bird surveys concentrated on detecting or finding threatened species with emphasis on birds such as the Brown Treecreeper and the Bush Stone-Curlew;
- Incidental searches for mammal scats, tracks and signs (e.g. diggings, signs of feeding and nests/burrows);
- Turning over logs and other ground debris for reptiles, frogs and mammals;
- General searches for reptiles and frogs; including identification of frog calls in seasonally wet areas;
- General searches for bat habitat including water bodies and potential roosting sites such as dead trees with hollows and underneath bark of trees;
- Inspection of hollows and canopies of River Red-gums using binoculars for signs of active nesting or occupation by arboreal mammals.

Spotlighting

Spotlighting was undertaken on the evening of the 26th and the 27th September 2011 and as follows;

- Within the River Red-gum forest, close to the Murray River in the NSW section of the study area corridor. A total of four person hours was spent spotlighting;
- Within the Black Box forest between Warren Street and the Campaspe River in Victoria. A total of four person hours was spent spotlighting.

Spotlighting was mainly targeted at finding nocturnal arboreal mammals likely to be present in the study area with particular emphasis on Squirrel Gliders.

Call playback

Call playback for the Bush Stone-Curlew was undertaken in the two patches of woodland where spotlighting took place (described above). The call of the curlew was played several times, interspersed with listening periods.

Call playback for the Growling Grass Frog was also undertaken at three sites. The first site was at a billabong in River Red-gum woodland on the NSW side of the study area. The second site was at a small well vegetated wetland (large dam) located south of the Warren Street - Murray Valley Highway intersection within the Victorian side of the investigation corridor. The third site was at a billabong along the Campaspe River within the investigation corridor in Victoria.

Call playback was not undertaken for the threatened owls, as the time of the initial investigation was not appropriate for owls and might cause disruption of their breeding activities. This was delayed until November, after the most sensitive period of the breeding season has passed.

Trapping

Two types of mammal traps were employed from the 26th to 30th September 2011 as part of the initial survey work; Elliot traps and Hair Tube traps. Trapping was carried out mainly within the NSW section and as follows:

- A line of ten hair tubes placed at ten metre intervals within the River Red-gum woodland in NSW, mostly placed on the main tree trunks.
- A line of ten small Elliot traps placed at ten metre intervals within a small regrowth section of River red-gum in NSW close to the above hair tubes site;
- A line of ten large Elliot traps placed at ten metre intervals at another section of the River Red-gum woodland in NSW;
- Another line of five hair tubes placed on tree trunks close to the large Elliot traps in NSW;
- And finally a line of ten hair tubes placed on both tree trunks and ground within a mixed River Red-gum and Black Box woodland at a private property within the Victorian section of the investigation corridor.

Habitat assessment

Fauna habitat types were characterised in the study area and are described in Section 6.2.1. The quality of fauna habitat was assessed based on the criteria detailed below. These are based on habitat components which include old-growth trees, fallen timber, leaf litter, surface rocks. Three quality categories were used, as described below:

High: The majority of fauna habitat components are present and habitat linkages to other remnant ecosystems in the landscape are intact.

Moderate: The majority of fauna habitat components are present but habitat linkages to other remnant ecosystems in the landscape are absent; or

The majority of habitat components are absent but habitat linkages to other remnant ecosystems in the landscape are intact.

Low: The majority of fauna habitat components are absent and habitat linkages to other remnant ecosystems in the landscape are absent.

Aquatic habitat assessment in the NSW component of the study area

The RMS Environmental Assessment Practice Note (2011a) required a detailed description of aquatic habitat in the study area, which documented the following attributes of such habitat:

- Dimensions of waterway;
- Depth of water;
- Flow characteristics of water;
- Bed substrate;
- Habitat features;
- Existing infrastructure and barriers to fish movement;

- Width and species composition of riparian vegetation, with particular attention paid to mangroves; and
- Flora and fauna species present.

The results of this assessment have been provided in Section 5.

In addition to the aquatic habitat assessment a search for Threatened Ecological Communities (TEC), related to aquatic fauna communities, listed under the *Fisheries Management Act 1994* (FM Act) was undertaken.

4.1.2. Targeted Flora and Fauna Surveys

Flora survey

Targeted flora surveying was undertaken over three days from 21st to 23rd November 2011. During the targeted flora assessment, areas of suitable habitat identified in the initial survey were walked by two botanists along transects spaced 5 metres apart throughout the entire study area. This methodology was applied in both the Victorian and NSW portions of the study area.

Targeted flora species were undertaken on the species that were initially considered likely to occur due to presence of suitable habitat and included the following:

- Hairy tails;
- Slender Darling-pea;
- Small Scurf-pea;
- River Swamp Wallaby-grass; and
- Western Water Starwort.

Fauna surveys

A large amount of additional targeted fauna surveying work was undertaken between 2011 and 2012. Threatened species that could potentially be impacted by the proposed development and that were considered likely to occur due to the presence of suitable habitat were targeted to gain more information on whether they utilise the study area or otherwise. Details of each of the targeted survey methods are provided below and locations of surveys are presented in Figure 2. Targeted fauna surveys comprised:

- Hair tube trapping for Squirrel Glider: 08/11/2011 to 22/11/2011 (Victoria and NSW);
- Spotlighting and call playback for Bush Stone-curlew, Squirrel Glider and Barking Owl: 08/11/2011 to 17/11/2011 (Victoria and NSW);
- First bat survey: 08/11/2011 to 22/11/2011 (Victoria and NSW);
- Second bat survey: 24/02/2012 to 14/03/2012 (Victoria and NSW);
- Growling Grass Frog survey: 17/10/2012 to 18/10/2012 (Victoria and NSW);
- Arboreal cage trapping for Squirrel Glider: 15/10/2012 to 18/10/2012 (NSW only); and

- Hollow-bearing tree survey, particularly for potential Squirrel Glider habitat: 17/10/2012 (NSW only).

Note that all targeted survey work was undertaken at the appropriate time of year for the relevant species. Surveying was undertaken under the following permits:

- Victorian Department of Sustainability and Environment: Wildlife Act 1975 and Flora and Fauna Guarantee Act 1988 – Research Permit/Permit to take Protected Flora – Permit No. 10004726, File No. FF383118.
- New South Wales National Park and Wildlife Service: National Parks & Wildlife Act 1974, Section 132c – Scientific Licence – Document No. SL100136.

Hair tube trapping survey

Hair tube trapping was used to investigate, in more detail than previously used in the initial fauna survey (see above), the presence and use of the study area by Squirrel Glider. Hair tube trapping was carried out in November 2011 in both the Victorian and NSW sections of the study area, at a higher survey effort than employed during the initial field survey. For this purpose, hair tubes were used and set up on trees targeting arboreal mammals.

Hair tube traps were set up along six different transects as part of the additional targeted surveying. The central point of each of the 50 metre transects is shown in Figure 2. Transects were set up in the following habitats:

- Transect 1: A line of ten hair tubes within River red-gum forest in the NSW section of the study area (see Figure 7 for habitat type).
- Transect 2: A line of ten hair tubes in similar Red River-gum forest in NSW comprising larger and older trees.
- Transect 3: A line of ten hair tubes in the Black Box woodland in the southern section of the Victorian part of the study area (see Figure 4 for habitat type).
- Transect 4: A line of ten hair tubes in another section of the Black Box woodland in Victoria.
- Transect 5: A line of ten hair tubes in River Red-gum dominated forest in the Victorian section of the study area (see Figure 4: for habitat type).
- Transect 6: A line of 14 hair tubes in mixed River red-gum and Black box woodland in the northern part of the Victorian section of the study area.

Hair tube traps were set up on the trunks of trees spaced at five metre intervals and were at least 1.5 metres above ground.

Hair tube traps were collected and hair harvested during the survey was analysed by an expert for use by arboreal mammals.

Call playback and night spotlighting

Detailed targeted surveys of the Bush Stone–Curlew and Barking Owl were undertaken on five different nights at five selected sites within the study area. The surveys were carried out between the 8th and 17th November, 2011. At each of the five survey nights, the threatened species were surveyed consecutively starting with the Bush Stone–Curlew and followed by Barking Owl. Surveys were undertaken following both DSE and OEH Guidelines, except for the Bush Stone–

Curlew for which such guidelines were not available. Survey methods used for the Plains Wanderer were adopted for this species. Spotlighting was also undertaken for Squirrel Glider.

Surveys were conducted from dusk to midnight during mild to warm weather conditions (DSE 2009). Under these conditions, threatened species were more likely to be active, making detection easier. All animals observed during the survey were identified and recorded. Methods followed in each of the surveys are outlined below.

Bush Stone–Curlew

On first arrival at each site, the call of the Bush Stone–Curlew was played through a megaphone in an effort to elicit the response of this species. Following the ten minute call playback and listening time, each site was systematically searched for the species using transects.

The surveyor walked the length of each transect, situated 40 metres apart with a search area of 10 metres either side of the transect line. Transect length depended on the size of native vegetation patch. Each transect was searched for Bush Stone–Curlew using a hand-held spotlight and binoculars.

Barking Owl

Consistent with both DSE and OEH guidelines, the following steps were followed during the Barking Owl surveys:

- 5 minutes initial passive listening,
- 20 seconds call playback,
- 30 seconds silent listening for elicited response,
- 1 minute call-playback in different direction,
- 30 seconds listening for elicited response,
- 1 minute call-playback in different direction,
- 12 minutes silent listening.
- After call playback, a 30-minute spotlighting session was conducted within 200 metres to check trees for any owls while listening for a distant response.
- Spotlighting concentrated on large hollow-bearing trees that may also support tree-dwelling mammals, such as possums and gliders.
- A hand-held spotlight with powerful beam was used.

In addition to above, active diurnal searches were also made to locate evidence of whitewash or regurgitated pellets to determine owl presence in the study area and evaluation of the presence and abundance of suitable hollows that might provide suitable nesting habitat for the owls.

Squirrel Glider

Representative transects were searched for Squirrel Glider after dusk using spotlights. Transects were spaced at 50 metres apart through likely habitat, conducted for 30 minutes.

Bat surveys

Bats were surveyed using electronic detectors to record the ultrasonic echolocation calls of bats. Detectors offer several major advantages over trapping or other means of detection; they are non-invasive, can add significantly to the number of species detected at a particular site, allow detection of species not readily captured, and in many cases, do not need to be attended constantly. In Australia, the Anabat system (Titley Electronics) is the most widely used system. Anabat detectors are especially well suited for unattended detector surveys, with several options available for storing recorded calls.

Automated Anabat Systems

Automated Anabat® (Titley Electronics, Ballina, NSW) bat detectors that record the species-specific echolocation calls of free-flying bats are used at a series of sampling points that are representative of the habitats in the proposed study area. The detectors are programmed to commence operation approximately 30 minutes before dusk, and to cease approximately 30 minutes after dawn.

Calls from the units are downloaded and sent to Dr Greg Richards (Greg Richards and Associates Pty Ltd, Canberra), for identification.

Call identification is based on a key developed by comparing the characteristics of bat search calls within reference calls from known species recorded across Victoria. Identification is largely based on changes to frequency patterns over time, especially as the characteristic frequency changes. Only those recordings that contained at least two definite and discrete calls were classified as bat calls. For most species, a call sequence of several seconds in duration is required before identification can be made confidently.

The identification of echolocation calls from microbats in south-eastern Australia is facilitated by the fact that many calls are species-specific. However, not all species can be consistently or reliably identified. There is a large overlap in the call characteristics of some Victorian species and many calls are attributable only to species “complexes” and not to single species.

A significant limitation in the use of this technique is that it is not possible to census bats accurately. That is, the Anabat unit may record 10 calls of a particular species but it is not known if this represents 10 individuals or one individual flying past 10 times. Therefore, it is not possible to determine utilisation rates as it is for birds.

Sites and times of recording

Two bat surveys were undertaken within the study area, the first during November 2011 and the second survey across February and March 2012. Eight sites were selected for bat recordings and the same sites were used for both surveys. Sites were selected to reflect the various habitats existing in the study area.

First Bat Survey

During the first bat survey, Anabat recording was left for seven nights in the field for each of the sites. The first four sites were recorded between the 8th and 15th; and the second four sites between the 15th and the 22nd November, 2011.

The locations of the recording sites are shown Figure 2. Anabat recorders were located in the following habitats:

- Site 1: The Anabat recorder was set up in Black Box Woodland in the southern part of the Victorian section of the study area.
- Site 2: Set up in a patch of old and mature River Red-gum adjacent to a small billabong, in the central part of the Victorian section.
- Site 3: Set up on the banks of the Campaspe River among tall River Red-gum, in Victoria.
- Site 4: Set up on a small sand hill among indigenous Murray Pines, in Victoria.
- Site 5: Set up among mixed Black box and River Red-gum in the northern part of the Victorian section.
- Site 6: Set up among River Red-gum forest in the NSW section.
- Site 7: Set up on the banks of the Murray River among large and tall River Red-gum trees, on the NSW side.
- Site 8: Set up among River Red-gum forest in another section of the NSW part of the study area.

Second Bat Survey

Following the results of the initial bat survey, it was decided a second bat survey would be undertaken to provide further information of the abundance of particular species. During the second bat survey; the same eight sites were used to record bats as were used in the first survey (described above). Recording during the second survey was carried out between 24th February and 4th March, 2012 for the first four sites, and between 5th and 14th March, 2012 for the second four sites. Unlike the first survey, the Anabat recorders were left for ten nights in the field at each of the recording sites.

This extended survey period was recommended by Dr Greg Richards (Greg Richards and Associates Pty Ltd, Canberra) as to provide additional information on the presence and abundance of threatened bat species.

Growling Grass Frog targeted survey

Growling Grass Frog (GGF) surveying was carried out in accordance with the Federal guidelines (DEWHA 2010), which are also consistent with DSE and OEH guidelines.

The survey was undertaken on two consecutive nights: 17th and 18th October 2012. Prior to commencing surveying, wetlands with potential to support GGF were examined to identify suitable survey locations. Two sites were selected in the NSW portion of the study area, as the only potential habitat in the Victorian portion was dry, and therefore not suitable for GGF detection. The sites were selected based on their likelihood for supporting GGF.

The surveys were conducted at night during warm weather conditions where temperatures were not lower than 14°C with moderate to no wind. Under these conditions, frogs are more likely to be calling and active, making detection easier. For each survey, weather conditions were recorded throughout the survey, including ambient temperature, wind strength and cloud cover / presence absence of precipitation.

Two survey methods were employed: call playback and active searches.

On first arrival at a site, 15 minutes was spent listening for frog calls and all frog species heard calling were noted. After the first five minutes, the call of the Growling Grass Frog was played through a megaphone in an effort to elicit the response of this species.

Following the 15 minute frog call playback and listening time, each site was systematically searched for frogs with a spotlight for 30 minutes. This involved visual inspection of the water body, call recognition and limited active searching (including turning surface debris). All frog species seen or heard during the search time were recorded.

Additional data was collected when GGF was detected at a survey site. This data included age class and microhabitat.

In addition to Federal guidelines, the OEH guidelines require Growling Grass Frog tadpole surveying be carried out in conjunction with call playback and visual searches.

Tadpole surveying was carried out in suitable aquatic habitat in accordance with OEH's survey and assessment guidelines for threatened amphibians (DECC 2009). The specific method applied was dip-netting adjacent to the vegetated margins of suitable wetlands at various depths in the water column. Dip-netting was carried out both night and day on two consecutive days; the 7th and 8th October 2012.

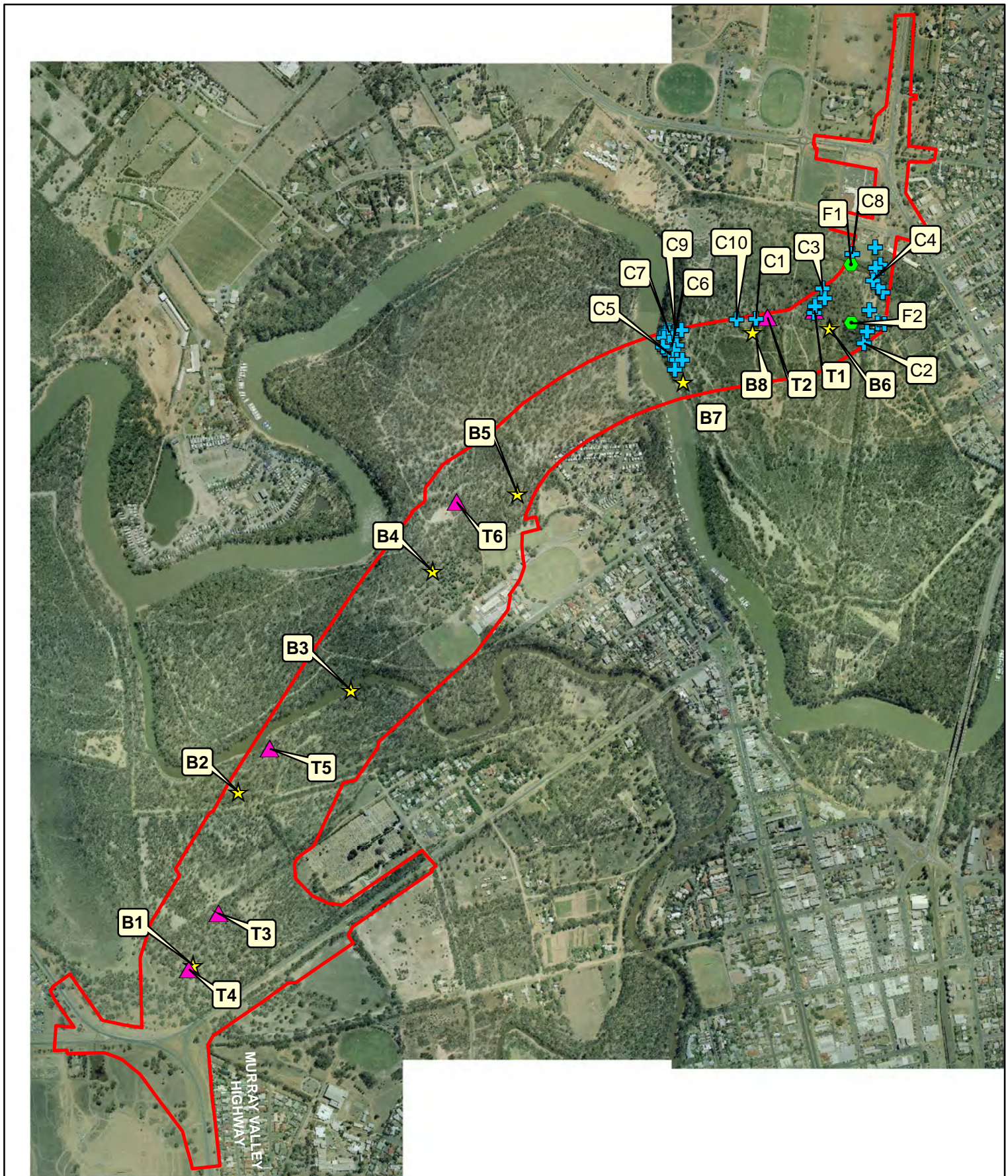
Arboreal cage trapping for Squirrel Glider

Arboreal cage trapping for Squirrel Glider was recommended by Envirokey (2012) as a more suitable method of trapping the species than the large 'Elliot' traps and hair tube traps previously employed (see above). OEH guidelines for survey effort using cage traps requires a minimum of 24 trap-nights over three to four consecutive nights per 50 hectares of suitable habitat (DEC 2004).

Arboreal cage trapping was conducted on four consecutive nights between the 15th and 18th October 2012, using ten standard cage traps in the NSW section of the study area. This equated to a survey effort of 40 trap-nights. Each cage trap was affixed to a suitable Squirrel Glider habitat tree at a height of between two to three metres from the ground, with the trap entrances easily accessible from either the tree trunk or a branch.

The suitability of trees chosen for the traps was based on the following criteria:

- Preference for trees with suitable hollows and evidence of sap feeding sites; and
- Preference for habitat supporting *Acacia* species in the understorey.



Legend

- Study area
- ★ Anabat locations (Bat Survey Sites)
- ▲ Mammal trapping locations (Hair Tubes)
- + Mammal trapping locations (Aerial Cage Traps)
- ◆ Growling Grass Frog Survey Sites

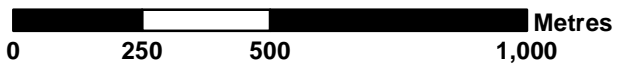


Figure 2: Targeted Fauna Survey Locations		
Project: Murray River Crossing Echuca		
Client: VicRoads		
Project No.: 8194	Date: 14/01/2013	Created By: J. Sullivan / M. Ghasemi
BL&A	Brett Lane & Associates Pty. Ltd. Ecological Research & Management	
● Experience	25 Burwood Rd, Hawthorn	ph (03) 9815 2111 fax (03) 9815 2685
● Knowledge	PO Box 74, Richmond	blane@ecologicalresearch.com.au
● Solutions	VIC 3121 Australia	www.ecologicalresearch.com.au

4.2. Limitations of field assessments

Where feasible, all efforts are made to schedule flora and fauna field surveys in optimal weather conditions and times of year. Nevertheless, field surveys usually fail to record all species present for various reasons, including the seasonal absence of some species and short survey duration. Rare or cryptic species are often missed in short surveys.

Initial flora surveying was carried out in early spring, when many later spring-emergent plant species may have been absent or in the senescent stage of their life-cycle and lacking essential identification characteristics. The timing of the initial survey and condition of vegetation was otherwise considered suitable to ascertain the extent and quality of native vegetation. Targeted flora surveys were then undertaken in late spring within the known flowering time for these species. The timing of the targeted flora survey was therefore considered suitable to ascertain the presence or otherwise of the targeted flora species.

The initial fauna assessment was undertaken during mild to warm weather conditions. These conditions were considered suitable for detecting all groups of fauna likely to occur in the study area; however, many of the fauna species are highly cryptic and are difficult to detect. Targeted fauna surveying was undertaken in mid-late spring when the targeted species are known to be detectable. The timing and survey effort of the targeted fauna surveys was therefore considered suitable to ascertain the presence or otherwise of the targeted fauna species.

The outer limit of works governed by the detailed design was provided from VicRoads in June 2012. On review of this data, some small areas within the alignments fell just beyond the surveyed corridor. These small areas have since been included in the current assessment based on a combination of additional survey effort in July 2012, earlier field assessments and aerial photo interpretation.

As the primary purpose of the investigation was to assess the extent and quality of native vegetation and fauna habitats in the study area and any potential impacts, the review of existing information, combined with the field surveys was sufficient to complete this aspect of the assessment.

Wherever appropriate, a precautionary approach has been adopted in the discussion of implications. That is, where insufficient evidence is available on the occurrence or likelihood of occurrence of a species, it is assumed that it could be in an area of suitable habitat. The implications under legislation and policy are considered accordingly.

5. SITE DESCRIPTION

5.1. Study Area

The study area for this investigation (Figure 1) encompasses the Mid-West 2 Corridor of the second Murray River Crossing at Echuca-Moama. This investigation corridor occurs between the intersection of the Murray Valley Highway and Warren Street in Echuca, and the Cobb Highway and Perricoota Road intersection in Moama via a corridor to the north of Echuca Cemetery and crossing the Murray River to the north of Echuca Caravan Park. Almost the entire study area supports native vegetation including large contiguous areas of Black Box and River Red-gum dominated woodland. Remaining parts of the study area include open roadside areas at either end of the corridor, disturbed open land in the area of the recently removed Echuca Secondary College and existing recreation areas in Echuca (tennis courts, sports oval).

The study area for the investigation encompasses approximately 116 hectares of land, with the corridor extending approximately 4.5 kilometres in length and 400 metres in width at its widest point. Land within the study area is predominantly public land. This includes the larger accessible areas of bushland either side of the Campaspe and Murray Rivers. The areas of public land mostly serve the purpose of recreation and/or conservation. The study area encompasses small areas of land in private ownership. The areas of private land provide various uses including horse grazing. The study area was found to be composed of fertile to heavy clay soils on a mostly flat landscape.

The Victorian section of the study area falls within the North Central CMA and occurs across the boundary of the Victorian Riverina and Murray Fans bioregions. Based on interpretation of DSEs online biodiversity mapping, the Campaspe River has been used as the boundary between the two bioregions, with the Victorian Riverina occurring to the south and the Murray Fans occurring to the north of the Campaspe River (Figure 15).

The New South Wales section of the study area falls within the Murray CMA and the Murray Fans CMA sub-region in the Riverina bioregion (Figure 15). The NSW section of the study area occurs across two Mitchell Landscapes; the Murray Scalded Plains and the Murray Channels and Floodplains. The Local Government Area in the NSW section of the study area is the Murray Shire Council.

5.2. Wildlife Connectivity

The most prominent wildlife corridors in the study area are the two Murray and Campaspe Rivers. This corridor provides movement opportunities for aquatic fauna and waterbirds.

The woodland habitats at the study area are connected to other woodland habitats in the region. On the NSW section of the study area woodland habitat extends in all directions from the proposed alignment. Similarly, the Victorian section of the study area is surrounded by woodland habitats. Species utilising these habitats are free to wander throughout these habitats.

5.3. Description of vegetation in Victoria

Observed vegetation in the Victorian part of the study area consisted of River Red-gum and Black Box dominated woodland with a vast number of large old trees (Figure 3). Areas of native vegetation varied in quality throughout the Victorian section of the study area. Large contiguous areas of Black Box dominated woodland existed north of Warren Street. This area supported some of the highest quality vegetation in the Victorian section of the corridor, supporting a sparse, but mostly native understorey.



Figure 3: Black Box Woodland north of Warren Street, Victoria

The areas to the north of the cemetery as well as either side of the Campaspe River were dominated by River Red-gum (Figure 4). These areas, while supporting several large trees and a contiguous canopy, had a highly disturbed ground layer, distinguished by a dense cover of introduced grasses such as Rye Grass and Great Brome. Indigenous plants including Pale-fruit Ballart, Tangled Lignum and various other herbs and shrubs occurred in these areas at low cover.

An area of semi-arid woodland vegetation distinguished by the presence of the Murray Pine as the main canopy species occurred to the west of the existing Tennis Courts (Figure 5). This area of vegetation occurs on a raised area of sandy soil (referred to herein as ‘the Sandhill’) and while supporting an indigenous canopy of Murray Pines (*Callitris gracilis subs. murrayensis*), is distinguished by the dense carpet of Bridal Creeper, a highly invasive weed species that has taken over the ground layer.



Figure 4: River Red-gum dominated woodland north of the Echuca cemetery, Victoria



Figure 5: Semi-arid Woodland on the 'Sandhill' area in Victoria

Further Black Box dominated woodland occurs to the north and south of the Sandhill. The remaining areas of the Victorian side of the study area support River Red-gum Forest, distinguishable by the high occurrence of large old River Red-gums. River Red-gum Forest was recorded to the west of the Sandhill as well as a narrow band abutting the Murray River at the northern limit of the Victorian section of the study area.

Few indigenous scattered trees were recorded along roadsides either side of the Murray Valley Highway and Warren Street intersection.

5.4. Description of vegetation in New South Wales

Observed vegetation on the New South Wales side of the study area consisted of several various age cohorts of River Red-gums (Figure 6) with the oldest occurring adjacent to the Murray River. Distinct patches of River Red-gum regrowth occurred within this area and are likely to be due to previous disturbance events.

A large area of forested wetland occurred within the north eastern section of the corridor (Figure 7). This area supported a sparse canopy of large River Red-gums with an understorey component dominated by indigenous wetland species including Common Spike-sedge, Poong'ort and various rushes, grasses and herbs. Small billabongs existed within River Red-gum vegetation in the north-eastern part of the study area.

Few indigenous scattered trees were recorded along roadsides either side of the Cobb Highway and Perricoota Road intersection.



Figure 6: River Red-gum recruiting vegetation in New South Wales



Figure 7: River Red-gum Forested Wetland in New South Wales

5.5. Description of aquatic habitat

This section provides a detailed description of the aquatic habitat present within the study area in both Victoria and NSW. Further details including the results of a water quality assessment and fish survey for the study area are provided in a separate report prepared by GHD (2012).

5.5.1. *Victorian component of the study area*

Aquatic habitat in this component of the study area comprised a section of the Campaspe River channel and an adjacent billabong. The Murray River channel falls under the jurisdiction of NSW, and is described below in Section 5.5.2.

The Campaspe River channel was characterised by an excessively turbid water column, high sedimentation, a scarcity of in-stream snags (fallen timber) and a conspicuous lack of aquatic and semi-aquatic flora cover (Figure 8).

The billabong adjacent the Campaspe River (Figure 9) was approximately three hectares in extent and, when full would be approximately two metres deep. When observed in 2011 it was near-full, then virtually empty in 2012. Aquatic and semi-aquatic vegetation was observed to be sparse in both instances. The more dominant species recorded were indigenous and included Common Blown-grass, Ferny Small-flower Buttercup, Common Sneezeweed and knotweed.



Figure 8: Campaspe river channel

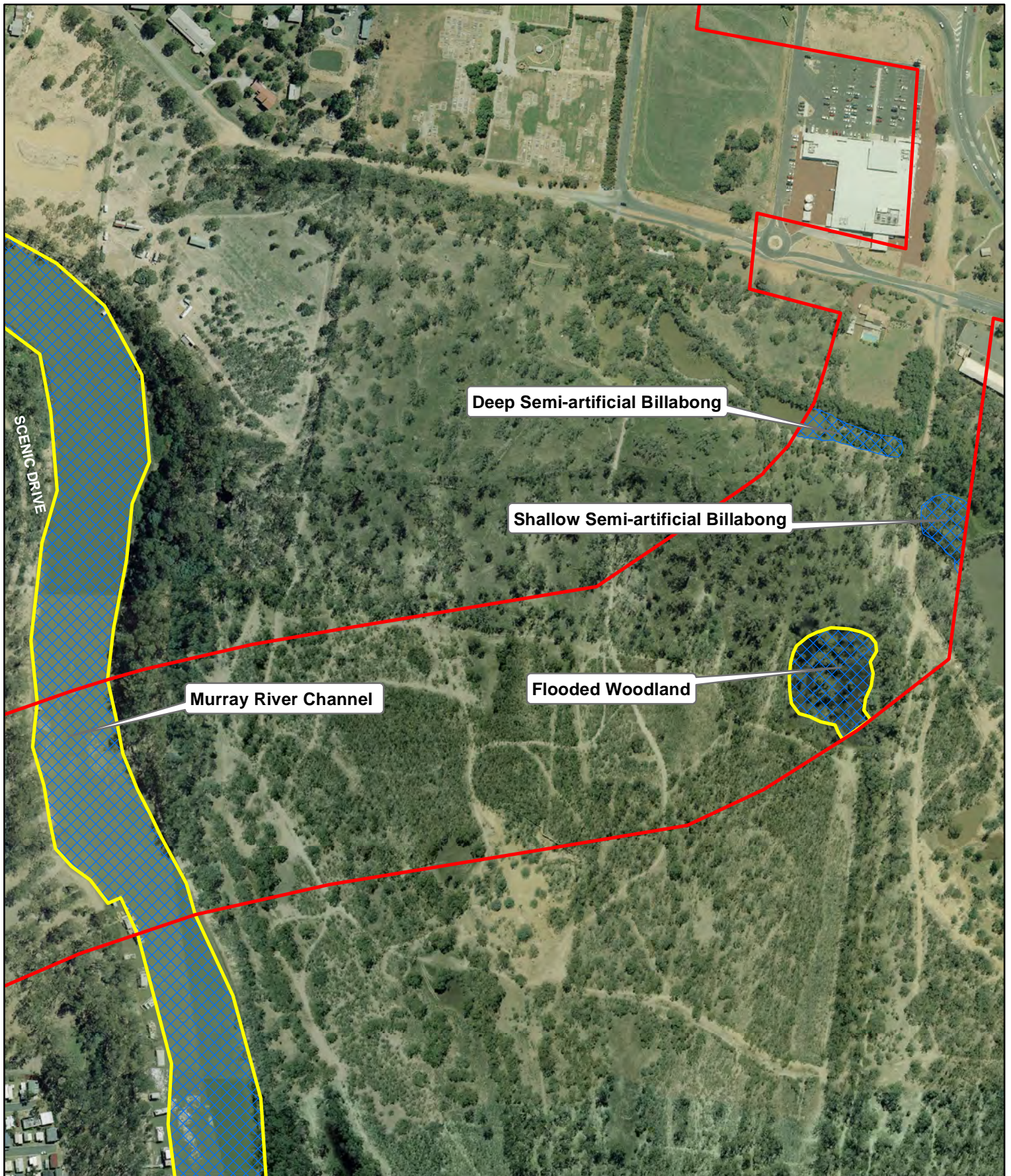


Figure 9: Large near-empty billabong adjacent the Campaspe River

5.5.2. *NSW component of the study area*

The NSW Roads and Maritime Services (RMS) Environmental Assessment Practice Note (2011a) requires a more detailed description of aquatic habitat in the NSW component of the study area than that provided for the Victorian component. The NSW Fisheries Office of Conservation has produced policy and guidelines of aquatic habitat management and fish conservation (NSWFOC 1999). This document describes and classifies waterways in NSW and provides guidelines to manage these aquatic habitats.

Aquatic habitat in this component of the study area comprised a section of the Murray River channel, deep and shallow semi-artificial billabongs and flooded red gum woodland. All of the aquatic habitats in the study area in NSW are considered to include the EEC - Lower Murray River aquatic ecology community which is listed as endangered under the FM Act. Detailed descriptions of these habitats, in accordance with RMS guidelines and FOC policy and guidelines, are provided below. The locations of these habitats are presented below in Figure 10.



Legend

- Study area
- Aquatic Habitat
- Aquatic Ecological Community in the Natural Drainage System of the Lower Murray River Catchment

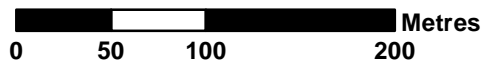


Figure 10: Aquatic Habitat

Project: Murray River Crossing Echuca

Client: VicRoads

Project No.: 8194	Date: 09/01/2013	Created By: K. Al-Dabbagh / M. Ghasemi
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Murray River channel

This habitat is classified as a freshwater habitat and contains riparian vegetation, stream channels and stream substrates (NSWFOC 1999). This aquatic habitat contains the EEC lower Murray River aquatic ecological community (DPI 2007). It is widely acknowledged that the flow characteristics, and subsequent channel structure, of the Murray River have been greatly modified since European settlement. Alienation of much of the river's floodplain and the construction of large on-stream storages and numerous flow regulators along the river has greatly altered its flow regime. In general, flows are weaker, channel sedimentation is higher and flooding is less frequent and of a lower magnitude than would have been in the past.

Within the study area, the Murray River channel was characterised by an excessively turbid water column, high sedimentation, a conspicuous lack of aquatic and semi-aquatic flora cover and in-stream snags (fallen timber). The river channel has undergone extensive bank erosion due to watercraft wave action, rendering much of the banks near-vertical and leading to the premature loss of many large River Red-gum trees through bank collapse (Figure 11). As such, the banks were virtually devoid of stabilising vegetation. The section of the river channel within the study area is approximately 80 metres wide and the water column approximately three to five metres deep.

Further details on the aquatic habitat within the Murray River channel are provided in a separate investigation undertaken by GHD (2012).



Figure 11: Typical bank erosion along the Murray River channel

Deep semi-artificial billabong aquatic habitat

This habitat is classified as a combination of freshwater and artificial habitats as it is a floodplain that has been dammed (NSEFCO 1999). This water body (Figure 12) was presumably one of a chain of a shallow billabongs, situated some 600 metres north-east of the Murray River channel. However, there was ample evidence that it had been dammed and excavated, thereby increasing its size and depth. The billabong was approximately 300 metres long, 20 metres wide and 1.5 metres deep, however the majority lay outside the study area.

Prior to its modification, the billabong would have been periodically inundated by flooding of the Murray River, However, storm water drainage from the adjacent commercial precinct and hotel complex appear to be its current main source of inundation. The bed was composed of dispersive clay substrate and several large snags were observed in the water column.

The banks were steep and moderately vegetated with young indigenous River Red-gum and Black Box trees, indigenous shrubs; bottlebrush and Pale-fruit Ballart and planted willows (introduced). The ground layer was very sparse, comprising introduced grass and forb species. Aquatic and semi-aquatic flora was sparse, comprising a range of indigenous flora including Slender Knot-weed, Cumbungi, Slender Dock and Swamp Wallaby-grass. Introduced Water Couch and Water Buttons were also recorded here.

The water column was observed to be highly turbid and near-eutrophic in this habitat due to high nutrient inputs.

In-stream fauna was only partially assessed, incidentally, and during tadpole sample netting. Species recorded were the native Nankeen Night Heron, White-faced Heron, Australian Wood Duck, Pacific Black Duck, Great Cormorant, Australasian Smelt, Eastern Snake-neck Turtle, several frog species (see results of Growling Grass Frog survey), atylid shrimp and various other macro-invertebrates. The introduced Eurasian Carp and Eastern Gambusia were also recorded.



Figure 12: Deep semi-artificial billabong aquatic habitat

Shallow semi-artificial billabong aquatic habitat

This habitat is considered to be a freshwater floodplain (NSWFCO 1999). This aquatic habitat (Figure 13) was also part of the chain billabongs situated some 600 metres north-east of the Murray River channel. However, it was presumably more representative of the original state of the billabong chain. There was no evidence of any damming or excavation, the billabong being shallow and well vegetated. It was round in shape, approximately 40 metres wide and up to 20 centimetres deep.

Prior to its modification, the billabong would have been periodically inundated by flooding of the Murray River, However, storm water drainage from the adjacent commercial precinct and hotel complex appear to be its current main source of inundation. The bed was composed of dispersive clay substrate and several large snags were observed in the water column.

The entire water column was well vegetated with indigenous flora including Common Spike-sedge, Poong-ort, Cumbungi, Water Plantains, Slender Dock, Common Blown-grass, willow herb and rushes. Introduced Water Couch and Kikuyu were also present. Young indigenous River Red-gum and Black Box trees were scattered throughout.

Native fauna species recorded incidentally were Plains Froglet, Eastern Banjo Frog, Spotted Marsh Frog, Common Froglet, Peron's Tree Frog, Nankeen Night Heron, White-faced Heron, and various terrestrial invertebrates.



Figure 13: Shallow semi-artificial billabong aquatic habitat

Flooded red gum woodland aquatic habitat

This habitat is considered to be freshwater floodplain (NSWFCO 1999). This aquatic habitat contains the EEC lower Murray River aquatic ecological community (DPI 2007). This aquatic habitat (Figure 14) occurred on ephemeral flooded red gum woodland, some 500 metres east of the Murray River channel. It was round in shape, some 50 metres by 60 metres, and up to 15 centimetres deep. The substrate was dispersive clay.

It is presumed that periodic inundation would be effected by both flooding of the Murray River and heavy rainfall.

The entire water column was well vegetated with a sparse canopy of large and sapling River Red-gums, virtually no shrub stratum and a ground stratum dominated by indigenous wetland species such as Common Spike-sedge, Poong'ort, various rushes, Swamp Wallaby-grass, Austral Sweet-grass, Common Blown-grass, willow herb, Water Milfoil, Ferny Small-flower Buttercup, Common Sneezeweed and Slender Dock.

Water quality and in-stream fauna was not assessed as part of this investigation. Native fauna species recorded incidentally, and during the frog survey, were Plains Froglet, Eastern Banjo Frog, Spotted Marsh Frog, Common Froglet, Peron's Tree Frog, White-faced Heron, Pacific Black Duck and various terrestrial invertebrates.



Figure 14: Flooded red gum woodland aquatic habitat

6. ASSESSMENT RESULTS

6.1. Flora and Vegetation assessment

6.1.1. Native Vegetation

Native vegetation within the study area has been determined based on the relevant state level definitions for Victoria and New South Wales. The results of the native vegetation assessment have been provided separately for Victoria and New South Wales in the sub-sections below. For the purpose of this assessment, a unique Vegetation Site identification number has been given to each patch of vegetation across the entire study area.

The native vegetation recorded within the study area is presented in Figure 15 and in more detail in Figures 16 to 19.

6.1.1.1. Native Vegetation in Victoria

Remnant Patches

Pre-European EVC mapping in Victoria (DSE 2011b) indicates that the study area and surrounds would have supported various Ecological Vegetation Classes (EVCs) prior to European settlement based on modelling of factors including rainfall, aspect, soils and remaining vegetation.

Evidence on site, including floristic composition and soil characteristics, suggested that the following EVCs were present within the study area:

- Semi-arid Woodland (EVC 97);
- Riverine Chenopod Woodland (EVC 103);
- Grassy Riverine Forest (EVC 106); and
- Riverine Grassy Woodland (EVC 295).

Details of the above recorded EVCs are provided below.

Semi-arid Woodland (EVC 97) has a vulnerable conservation status in the Murray Fans bioregion. The benchmark for this EVC describes it as “Non-eucalypt woodland or open forest to 12 m tall, of low rainfall areas. [It] occurs in a range of somewhat elevated positions not subject to flooding or inundation. The surface soils are typically light textured loamy sands or sandy loams” (Appendix 5). This EVC was distinguished in the study area by the presence of Murray Pines as the dominant canopy species.

Riverine Chenopod Woodland (EVC 103) has a vulnerable conservation status in the Victorian Riverina bioregion and an endangered conservation status in the Murray Fans bioregion. The benchmark for this EVC describes it as “Eucalypt woodland to 15 m tall with a diverse shrubby and grassy understorey occurring on most elevated riverine terraces. [It is] confined to heavy clay soils on higher level terraces within or on the margins of riverine floodplains (or former floodplains), naturally subject to only extremely infrequent incidental shallow flooding from major events if at all flooded (Appendix 5). This EVC was distinguished in the study area by the presence of Black Box as the dominant canopy species.

Grassy Riverine Forest (EVC 106) has a depleted conservation status in both the Victorian Riverina and Murray Fans bioregions. The benchmark for this EVC describes it as “Occur[ing] on the floodplain of major rivers, in a slightly elevated position where floods are infrequent, on deposited silts and sands, forming fertile alluvial soils. [It is] River Red Gum forest to 25 m tall with a ground layer dominated by graminoids. Occasional tall shrubs [are] present.” (Appendix 5). This EVC was distinguished in the study area by the presence of tall dense River Red-gum as the dominant canopy species.

Riverine Grassy Woodland (EVC 295) has a vulnerable conservation status in both the Victorian Riverina and Murray Fans bioregions. The benchmark for this EVC describes it as “Occur[ing] on the floodplain of major rivers, in a slightly elevated position where floods are infrequent, on deposited silts and sands, forming fertile alluvial soils. [It is] River Red Gum woodland to 20 m tall with a ground layer dominated by graminoids and sometimes shrubby or with chenopod shrubs.” (Appendix 5). This EVC was distinguished in the study area by the presence of sparse River Red-gum as the dominant canopy species.

Twenty-six (26) remnant patches (referred to herein as Habitat Zones 1 to 23, and HZ 2A, 6A and 15A) comprising the abovementioned EVCs were identified in Victoria (Table 1). Refer to Figure 15 to 18 for Habitat Zone locations.

Table 1: Description of Habitat Zones in Victoria

Habitat Zone	EVC	Bioregional Conservation Status	Description
1, 2, 2A	103	Vulnerable	Small patch of Black Box woodland that generally lacks the canopy layer. Understorey consists mostly of immature Black Box as well as a light cover of native wallaby grass and few indigenous herbs.
3	103	Vulnerable	Roadside remnant of Black Box dominated woodland. Understorey consists of native shrubs and grasses. High cover of introduced grasses.
4	103	Vulnerable	Roadside remnant of Black Box dominated woodland. Understorey consists of native shrubs including Pale fruit Ballart and grasses. Consists of moderate cover of introduced grasses and Fog Fruit (creeping weed). One specimen of Weeping Myall (endangered) recorded in this habitat zone.
5	103	Vulnerable	Roadside remnant of Black Box dominated woodland. Understorey consists of native shrubs including Pale fruit Ballart and grasses. Consists of moderate cover of introduced grasses and Fog Fruit (creeping weed).

Habitat Zone	EVC	Bioregional Conservation Status	Description
6, 19	103	Vulnerable	Large patch of high quality Black Box dominated woodland with high proportion of Large Old Trees (LOT's) present. Sparse yet diverse understorey of indigenous herbs, shrubs and grasses. High leaf litter and low weed cover. River Red-gums becoming co-dominant west of HZ 21.
6A	103	Vulnerable	Roadside patch of Woodland consisting of a mixed canopy of Black Box and River Red-gum. Native shrub layer consisting of Pale-fruit Ballart and chenopods. High weed cover, mainly Perennial Veldt-grass.
7, 10	103	Vulnerable	Contiguous woodland patch consisting mostly of immature Black Box. Low canopy cover. Sparse understorey of indigenous herbs, shrubs and grasses. Very high leaf litter and low weed cover.
8	295	Vulnerable	Large open patch of River Red-gum dominated woodland, consisting predominantly of a young canopy. Understorey heavily disturbed and consists mostly of introduced grasses, namely Rye Grass and Great Brome.
9	295	Vulnerable	Linear patch of River Red-gum dominated woodland, distinguished by the presence of several Large Old Trees, most of which are dead and support hollows. Understorey disturbed and consists mostly of introduced grasses, namely Panic Veldt grass, Rye Grass and Great Brome.
11	295	Vulnerable	Open patch of River Red-gum dominated woodland, consisting predominantly of a young canopy and high cover of immature trees. Understorey grazed by horses and hence supports a low diversity of native species.
12	103	Vulnerable	Linear patch of Black Box dominated woodland occurring along either side of an existing dirt track. Understorey supports a sparse yet diverse cover of indigenous species. Weed cover very high and dominated by Rye Grass and Onion Grass.
13	106	Depleted	Large patch of River Red-gum dominated Forest situated south of the Campaspe River. Canopy dense and supports several Large Old Trees. Understorey sparse yet diverse cover of indigenous herbs and shrubs. Weed cover extremely high, consisting predominantly of a sea of Panic Veldt Grass, Rye Grass and Great Brome.

Habitat Zone	EVC	Bioregional Conservation Status	Description
14	295	Vulnerable	Linear patch of River Red-gum dominated woodland occurring as a band along the northern side of the Campaspe River. Understorey sparse yet diverse cover of indigenous herbs and shrubs. Weed cover extremely high, consisting predominantly of a sea of Rye Grass and Great Brome.
15	295	Vulnerable	Small patch in the north west corner of the old Echuca Secondary College grounds consisting of few River Red-gum trees and three Murray Pines. Understorey disturbed and consists predominantly of introduced species.
15A	295	Vulnerable	Small remnant patch with contiguous River Red-gum canopy in front of old Echuca Secondary College grounds.
16, 20	103	Endangered	Patch of Black Box dominated woodland consisting of a sparse yet diverse cover of indigenous shrubs and herbs. Weed cover very high consisting predominantly of Bridal Creeper, Panic Veldt-grass and Annual Veldt-grass.
17	97	Vulnerable	Outlying occurrence of Semi-arid woodland distinguished by the occurrence of Murray Pines (<i>Callitris gracilis subs. murrayensis</i>) as the dominant canopy species. Patch occurs on the Sandhill area northwest of the old Echuca Secondary College. Understorey sparse yet diverse cover of indigenous shrubs and herbs, including several specimens of Weeping Myall (endangered). Weed cover very high consisting predominantly of Bridal Creeper, forming a mat over the ground layer.
18	106	Depleted	Large patch of River Red-gum dominated Forest situated southeast of the Murray River. Canopy dense and supports several Large Old Trees. Understorey sparse cover of indigenous shrubs including Silver Wattle and Pale fruit Ballart. Weed cover very high, consisting predominantly of Bridal Creeper and Annual Veldt Grass.
21	295	Vulnerable	Patch of recruiting River Red-gum woodland, distinguished by the dense occurrence of immature River Red-gums and few Large Old Trees. Sparse understorey consisting of indigenous sedges and a very low weed cover.

Habitat Zone	EVC	Bioregional Conservation Status	Description
22	103	Endangered	Large patch of Black Box dominated woodland with high proportion of Large Old Trees (LOT's) present. Patch occurs in a disturbed area supporting a matrix of dirt tracks which provide vehicular access to the boat ramp on the Murray River to the north. Sparse yet diverse understorey of indigenous herbs, shrubs and grasses, including the presence of Blue-burr Daisy (rare). High leaf litter and high weed cover.
23	106	Depleted	Linear patch of River Red-gum dominated Forest consisting of several Large Old Trees. Understorey heavily disturbed as occurs in an area of recreation adjacent to the Murray River, therefore predominately consisting of introduced grasses.

The habitat hectare assessment results for these habitat zones are provided in Table 2, including the number of large old trees in each. More detailed habitat scoring results are presented in Appendix 3.

The conservation significance of habitat zones presented in Table 2 is based on the bioregional conservation status of the EVCs, habitat score of the vegetation, any significant site attributes and the results of the best / remaining 50% habitat assessment, presented in Appendix 6.

The assessment for best / remaining 50% of habitat has been undertaken for each Victorian listed flora and fauna species that has been recorded or is likely to occur in each habitat zone (DSE 2007a).

Table 2: Summary of habitat hectare assessment results for native vegetation in Victoria

Habitat Zone	EVC	Area (ha)	Habitat Score (out of 100)	Habitat Hectare (Hha)	Conservation Significance	No. of large trees in habitat zone
1	103	0.02	33	0.01	High	0
2	103	0.02	33	0.01	High	0
2A	103	0.27	47	0.13	High	0
3	103	1.88	47	0.89	High	10
4	103	0.33	45	0.15	High	4
5	103	1.63	57	0.93	Very High	27
6	103	9.65	71	6.85	Very High	187
6A	103	1.36	51	0.69	Very High	22
7	103	1.23	69	0.85	Very High	5
8	295	5.29	51	2.70	Very High	8
9	295	1.44	56	0.81	Very High	26
10	103	4.20	50	2.10	Very High	7
11	295	2.08	57	1.19	Very High	5
12	103	1.24	58	0.72	Very High	16
13	106	9.31	49	4.56	Very High	66
14	295	1.83	52	0.95	Very High	29
15	295	0.16	34	0.06	High	4
15A	295	0.11	38	0.04	High	3
16	103	5.39	55	2.96	Very High	124
17	97	2.78	60	1.67	Very High	137
18	106	4.63	44	2.04	Very High	47
19	103	10.43	67	6.99	Very High	404
20	103	1.88	56	1.06	Very High	104
21	295	0.63	66	0.42	Very High	4
22	103	3.17	49	1.55	Very High	155
23	106	1.00	37	0.37	High	14
Totals		71.98		40.67		1408

* NOTE: Due to the vast number of Large Old Trees (LOTs) within habitat zones recorded in the study area, no distinction was made between large and very large trees in the field. Rather, all trees over the benchmark large tree diameter have been recorded simply as large trees.

Scattered trees

Scattered trees recorded at the intersection of the Murray Valley Highway and Warren Street in Victoria would have once comprised the canopy component of Riverine Chenopod Woodland (EVC 103). A total of eleven scattered trees occurred in the Victorian side of the study area of which six were very large, one was large and four were small compared to the benchmark large tree diameter at breast height (DBH) for Riverine Chenopod Woodland (EVC 103) in the Victorian

Riverina bioregion of 50 centimetres (Appendix 5). Scattered trees recorded in Victoria are summarised in Table 3. All scattered trees recorded within the study area are detailed in Appendix 4 of this report and locations can be viewed on Figures 16 - 19.

Table 3: Summary of Scattered Trees in Victoria

Size Class	Representative EVC	DBH range (cm)	Conservation Significance	Number of trees
Very Large	Riverine Chenopod Woodland (EVC 103)	75 or greater	Medium	6
Large		50 to 74	Medium	1
Medium		38 to 49	Medium	0
Small		12 to 37	Low	4
Total				11

Very large, large and medium scattered trees in the Victorian section of the study area are assigned a medium conservation significance based on the bioregional conservation status of the EVC to which they once belonged. Small scattered trees in Victoria are defined as having low conservation significance according to the Framework.

6.1.1.2. Native Vegetation in New South Wales

Remnant Patches

Current native vegetation mapping, as indicated in Keith (2006), suggested the following vegetation formations may occur within the study area:

- Grassy Woodlands;
- Semi-arid Woodlands; and
- Forested Wetlands.

Information provided from the BioMetric database of vegetation types in the Murray CMA, combined with evidence on site, including floristic composition and soil characteristics, suggested that all native vegetation in the New South Wales section of the study area was of the **Forested Wetlands** formation, and furthermore classified as **Inland Riverine Forest**. Two different vegetation types were recorded within the Inland Riverine Forest class:

- River Red Gum - Black Box woodland of the semi-arid (warm) climatic zone (45% cleared in Murray CMA); and
- River Red Gum - herbaceous tall open forest of the Riverina and Murray Darling Depression Bioregions (10% cleared in the Murray CMA)

Seven patches (referred to herein as Habitat Zones 24 to 31) comprising the abovementioned vegetation types were identified in the New South Wales section of the study area. Habitat Zones 24 to 31 are described and areas presented below in Table 4. A total of 14.47 hectares of native vegetation was recorded in New South Wales. Locations of Habitat Zones in NSW are shown in Figure 15 and in more detail in Figure 19.

Table 4: Description of Habitat Zones in New South Wales

Habitat Zone	Vegetation Type	% cleared in Murray CMA	Area (ha)	Description
24	River Red Gum - Black Box woodland of the semi-arid (warm) climatic zone	45%	1.16	River Red-gum dominated patch of woodland abutting the Murray River, with some Black Box in the canopy. Indigenous shrubs including Pale-fruit Ballart, Silver Wattle and Tangled Lignum present. Ground layer supports a high cover of introduced grasses, namely Annual Veldt-grass. Banks of the Murray River highly impacted by erosion.
25	River Red Gum - Black Box woodland of the semi-arid (warm) climatic zone	45%	2.21	Sparse River Red-gum dominated patch of woodland with some Black Box present. Canopy sparse with moderate cover of eucalypt regrowth. Understorey disturbed to form series of tracks. Ground layer very sparse, mostly bare ground.
26	River Red Gum - Black Box woodland of the semi-arid (warm) climatic zone	45%	3.77	River Red-gum dominated patch of woodland with some Black Box present. Canopy mostly absent, rather patch distinguished by high cover of regrowth of various age cohorts. Indigenous shrubs including Pale-fruit Ballart and Silver Wattle present. Ground layer very sparse, supporting mostly leaf litter and bare ground.
27	River Red Gum - herbaceous tall open forest of the Riverina and Murray Darling Depression Bioregions	10%	0.16	River Red-gum dominated shallow forested wetland. Old growth River Red-gums scattered throughout. Predominately indigenous understorey dominated by Common Spike-sedge with scattered rushes.
29	River Red Gum - Black Box woodland of the semi-arid (warm) climatic zone	45%	1.02	Patch of River Red-gum woodland consisting entirely of young dense regrowth. Canopy absent due to previous disturbance. Ground layer very sparse, supporting mostly leaf litter and bare ground.

Habitat Zone	Vegetation Type	% cleared in Murray CMA	Area (ha)	Description
30	River Red Gum - herbaceous tall open forest of the Riverina and Murray Darling Depression Bioregions	10%	4.21	River Red-gum dominated shallow forested wetland. Old growth River Red-gums scattered throughout. Indigenous understorey dominated by Common Spike-sedge and rushes, with various indigenous wetland species present including Nardoo, Water Ribbons, Water Milfoil and <i>Amphibromus sp.</i> . Low weed cover and moderate eucalypt recruitment.
31	River Red Gum - herbaceous tall open forest of the Riverina and Murray Darling Depression Bioregions	10%	1.94	Disturbed River Red-gum dominated woodland occurring adjacent to existing billabong. Vegetation occurs either side of an existing bush track and has therefore been susceptible to weed invasion by species such as Desert Ash and Patterson's Curse. Billabong full of sitting water at time of survey.
Total area (ha)			14.47	

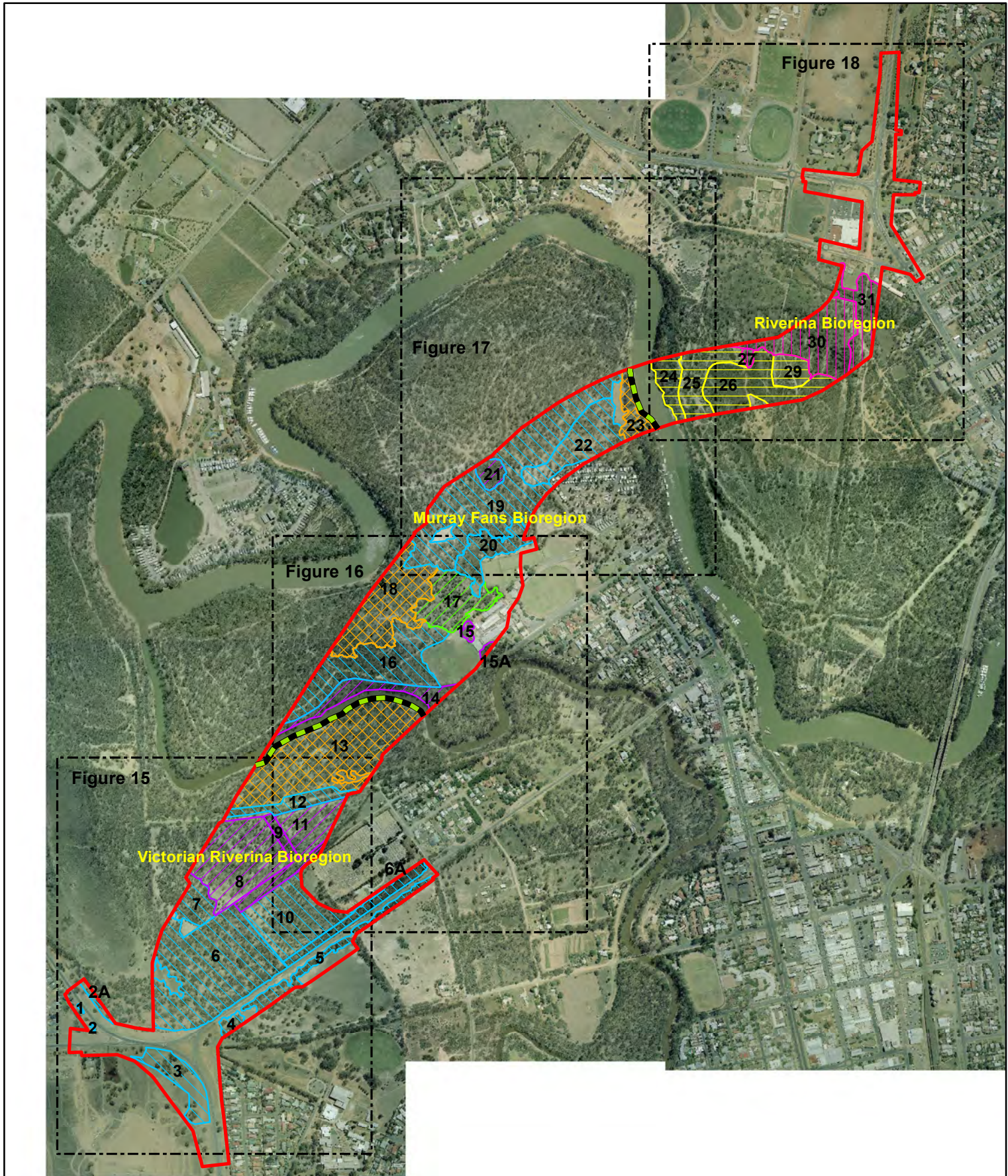
*Note that Habitat Zone 28 has been removed based on the current assessment

All remnant patches of native vegetation in the NSW section of the study area occur within the Murray Channels and Floodplains Mitchell Landscape, which is 56% cleared.

Scattered Trees

Scattered trees recorded around the intersection of the Cobb Highway and Perricoota Road in New South Wales would have once comprised the canopy component of 'River Red Gum - Black Box woodland of the semi-arid (warm) climatic zone'. Eleven scattered trees occurring outside areas mapped as patches of native vegetation were recorded in the New South Wales side of the study area (See Figure 19). All scattered trees recorded within the study area are detailed in Appendix 4 of this report and locations are shown in Figures 16 – 19.

Scattered Trees in the NSW Section of the study area occur across two Mitchell Landscapes; the Murray Channels and Floodplains (56% cleared) and the Murray Scalded Plains (92% cleared).



Legend

Native Vegetation

- Victoria**
- Grassy Riverine Forest (EVC 106)
 - Riverine Chenopod Woodland (EVC 103)
 - Riverine Grassy Woodland (EVC 295)
 - Semi-arid Woodland (EVC 97)

New South Wales

- River Red Gum - herbaceous tall open forest
- River Red Gum - Black Box woodland

- Study Area
- Habitat Zones
- Bioregion Boundaries

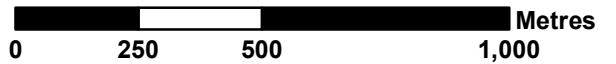


Figure 15: Study Area and Native Vegetation - Overview

Project: Murray River Crossing Echuca

Client: VicRoads

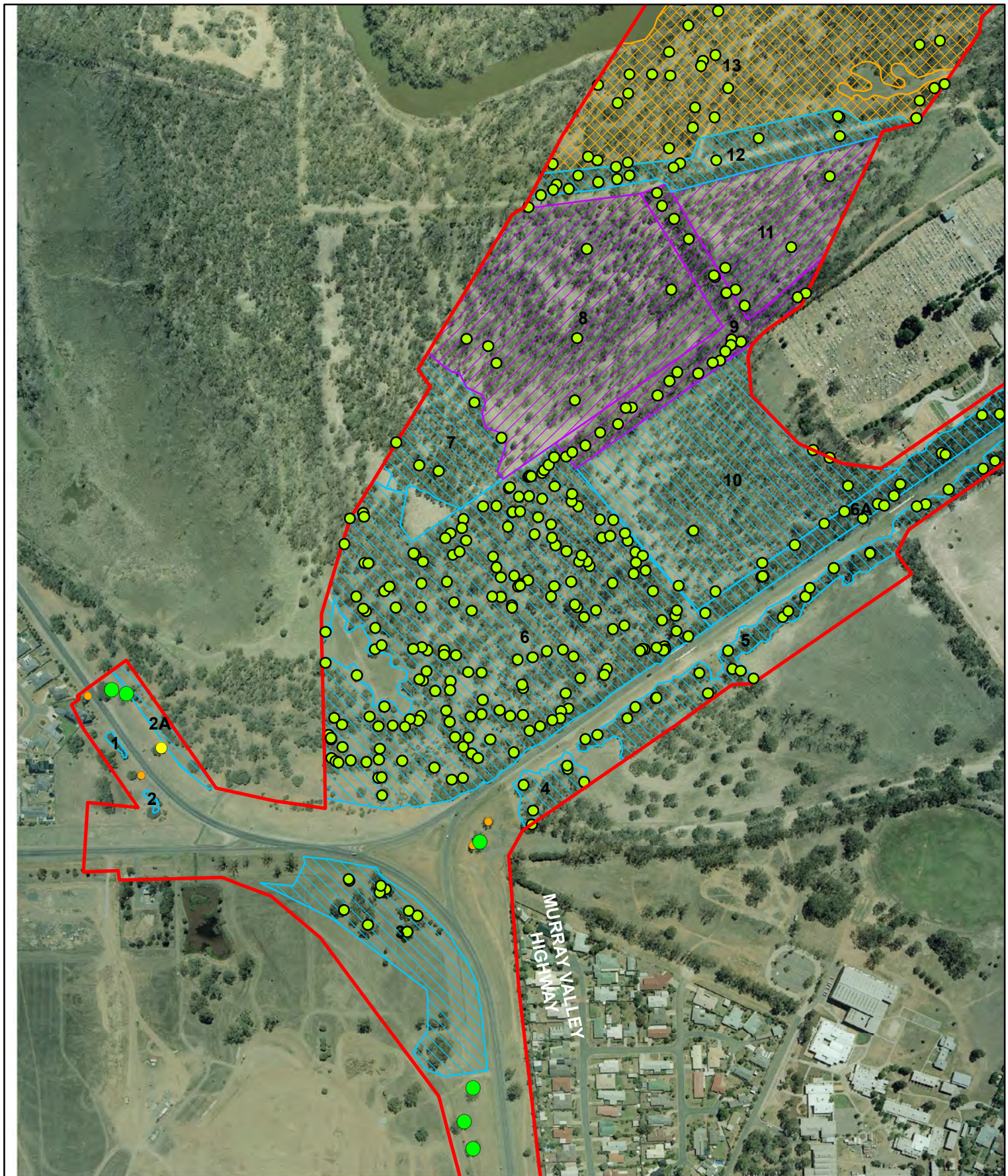
Project No.: 8194 Date: 16/11/2012 Created By: J. Sullivan / M. Ghasemi



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Legend


Native Vegetation



Victoria

-  Grassy Riverine Forest (EVC 106)
-  Riverine Chenopod Woodland (EVC 103)
-  Riverine Grassy Woodland (EVC 295)
-  Semi-arid Woodland (EVC 97)

New South Wales

-  River Red Gum - herbaceous tall open forest
-  River Red Gum - Black Box woodland

 Study Area

-  Habitat Zones
-  Large Old Trees

Scattered Trees

Victoria





-  Very Large
-  Large
-  Small
-  New South Wales



Figure 16: Study Area and Native Vegetation - Detailed

Project: Murray River Crossing Echuca

Client: VicRoads

Project No.: 8194

Date: 24/11/2011

Created By: J. Sullivan / M. Ghasemi

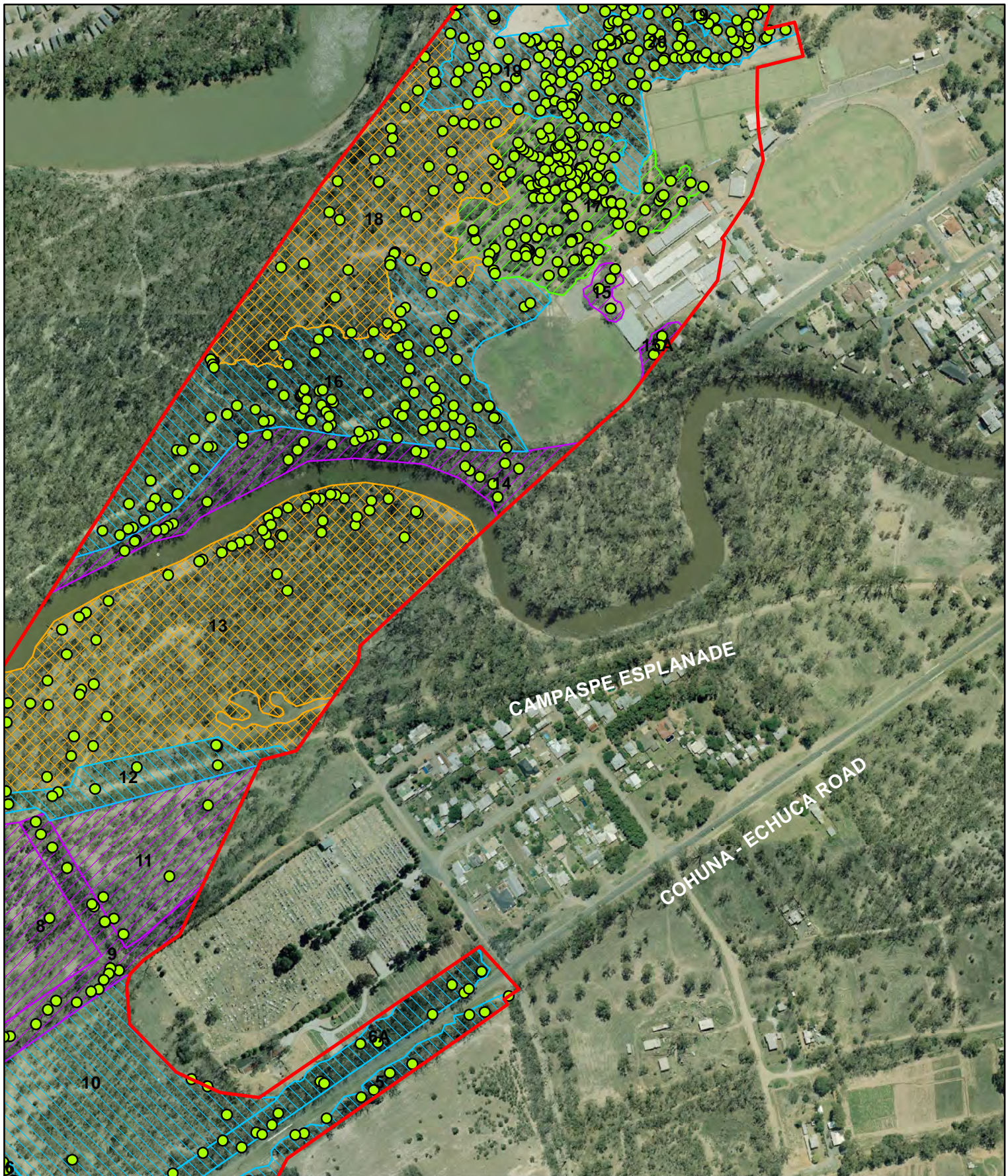


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Legend


Native Vegetation



Victoria

-  Grassy Riverine Forest (EVC 106)
-  Riverine Chenopod Woodland (EVC 103)
-  Riverine Grassy Woodland (EVC 295)
-  Semi-arid Woodland (EVC 97)

New South Wales





-  River Red Gum - herbaceous tall open forest
-  River Red Gum - Black Box woodland

 Study Area

-  Habitat Zones
-  Large Old Trees

Scattered Trees

Victoria

-  Very Large
-  Large
-  Small
-  New South Wales

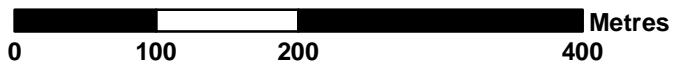


Figure 17: Study Area and Native Vegetation - Detailed

Project: Murray River Crossing Echuca

Client: VicRoads

Project No.: 8194




Date: 24/11/2011

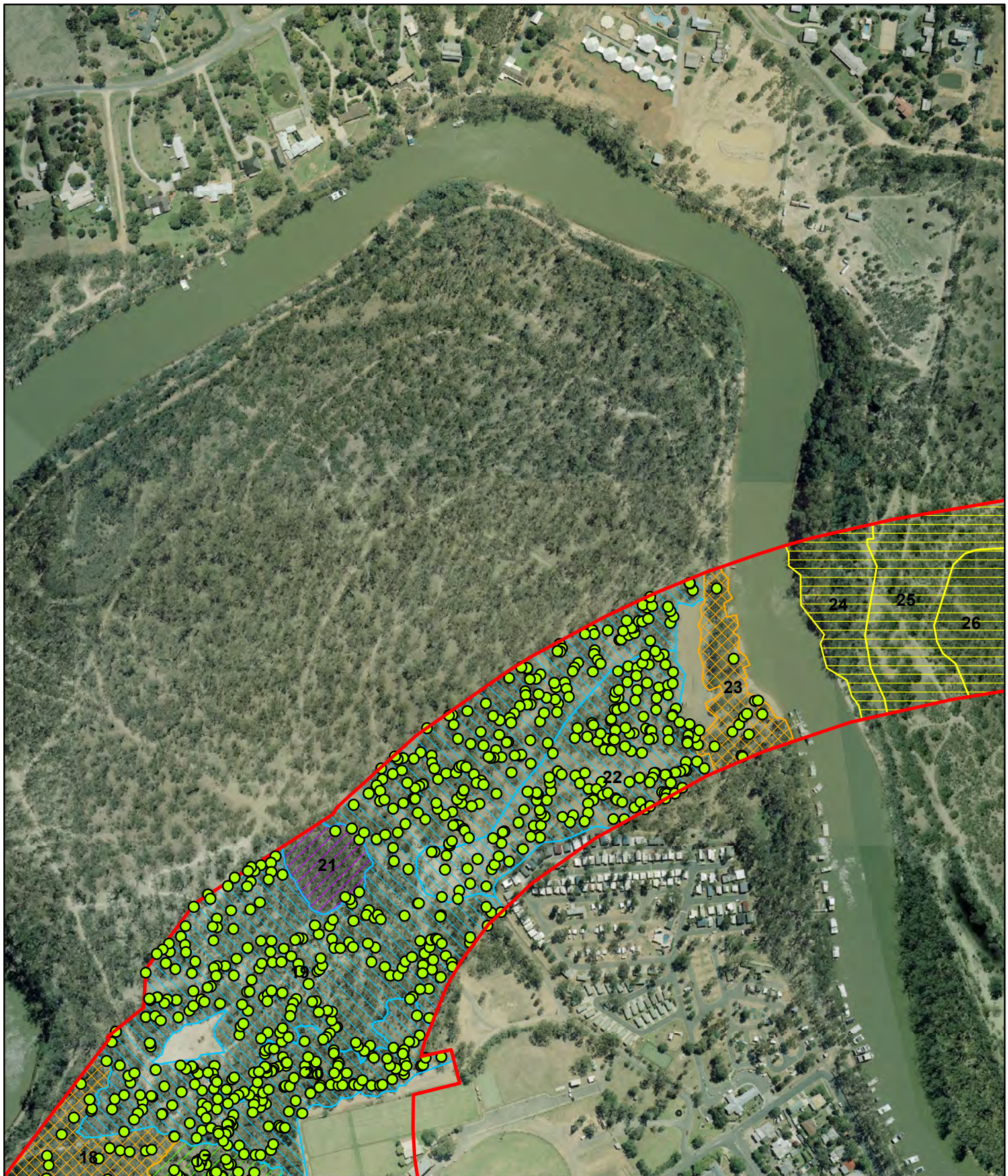
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Legend


Native Vegetation


Victoria

-  Grassy Riverine Forest (EVC 106)
-  Riverine Chenopod Woodland (EVC 103)
-  Riverine Grassy Woodland (EVC 295)
-  Semi-arid Woodland (EVC 97)

New South Wales

-  River Red Gum - herbaceous tall open forest
-  River Red Gum - Black Box woodland

 Study Area

- 3** Habitat Zones
-  Large Old Trees

Scattered Trees

Victoria





-  Very Large
-  Large
-  Small
-  New South Wales



Figure 18: Study Area and Native Vegetation - Detailed

Project: Murray River Crossing Echuca

Client: VicRoads

Project No.: 8194	Date: 24/11/2011	Created By: J. Sullivan / M. Ghasemi
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Legend

Native Vegetation

Victoria

- Grassy Riverine Forest (EVC 106)
- Riverine Chenopod Woodland (EVC 103)
- Riverine Grassy Woodland (EVC 295)
- Semi-arid Woodland (EVC 97)

New South Wales

- River Red Gum - herbaceous tall open forest
- River Red Gum - Black Box woodland

Study Area

- 3 Habitat Zones
- Large Old Trees

Scattered Trees

Victoria

- Very Large
- Large
- Small

New South Wales

Metres
0 100 200 400

Figure 19: Study Area and Native Vegetation - Detailed

Project: Murray River Crossing Echuca

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6.1.2. Flora

During the field assessment 113 plant species were recorded. Of these, 66 (58%) were indigenous and 47 (42%) were introduced or non-indigenous native in origin. All flora species recorded during the current field assessment are listed in Appendix 1.

6.1.2.1. Threatened flora species

Database searches from the Flora Information System (FIS) of Victoria (Viridans Biological Databases 2011a), the Wildlife Atlas of New South Wales (OEH 2011) and the EPBC Protected Matters Search Tool (DSEWPC 2011) indicate that within the search region there are records of, or there occurs potential suitable habitat for, 38 rare or threatened flora species. Of these, eight species were listed under the federal EPBC Act, seven on the New South Wales *Threatened Species Conservation Act 1995* (TSC Act), 13 on the Victorian *Flora and Fauna Guarantee Act 1988* (FFG Act) and 35 on the Victorian DSE's Advisory List for Rare and Threatened Flora (DSE 2007b). These species are listed in Appendix 1.

Three rare or threatened flora species were detected during the current investigation;

- Blue Burr-daisy;
- Pale Flax-Lily; and
- Weeping Myall.

The status of these species and their occurrence in the study area is discussed below. These three species are likely to be impacted by the project.

Blue Burr-daisy (*Calotis cuneifolia*)

Blue Burr-daisy is listed as rare in Victoria on the DSE Advisory list. This species was recorded in one area in Black Box Woodland in Victoria (HZ 19).

Pale Flax-Lily (*Dianella sp. aff. longifolia* (Riverina))

Pale Flax-lily is listed as vulnerable in Victoria on the DSE Advisory list. This species is not well described in Victoria, though is restricted to the Riverina area and is deemed to have affinities with *Dianella longifolia*. This species was recorded throughout the Victorian section of the study area as sparsely scattered individuals in several locations and therefore is not shown in Figure 20.


Weeping Myall (*Acacia pendula*)

Weeping Myall is listed as threatened under the Victorian FFG Act and endangered in Victoria on the DSE Advisory list. This species was recorded at two sites within the Victorian section of the study area. This included one plant within a patch of Black Box woodland along the southern side of Warren Street (HZ 4), and several individuals within the Callitris dominated woodland on the Sandhill (HZ 17), west of the Echuca Tennis Club.

The locations of Blue Burr-daisy and Weeping Myall recorded within the study area are shown in Figure 20. Pale Flax-Lily was recorded throughout the Victorian section of the study area and therefore is not shown in Figure 20.



Legend

 Study Area

Threatened Flora

 Blue Burr-daisy

 Weeping Myall

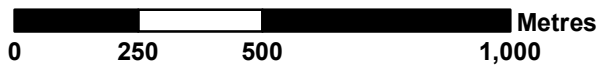


Figure 20: Threatened Flora Species Recorded

Project: Murray River Crossing Echuca

Client: VicRoads

Project No.: 8194

Date: 24/11/2011

Created By: J. Sullivan / M. Ghasemi



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The likelihood of occurrence in the study area of threatened species listed under the EPBC Act, TSC Act and/or FFG Act is addressed in Table 5. Suitable habitat is considered to exist for five species of threatened flora within areas of high quality Black Box dominated woodland in Victoria and Forested Wetland in New South Wales based on this assessment:

- Hairy Tails (FFG Act);
- Slender Darling-pea (EPBC Act, FFG Act and TSC Act);
- Small Scurf-pea (FFG Act and TSC Act);
- River Swamp Wallaby-grass (EPBC Act and TSC Act); and
- Western Water Starwort (EPBC Act, FFG Act and TSC Act).

Threatened Flora targeted survey

Targeted flora surveying was undertaken in areas of suitable habitat in November 2011 during the peak flowering times for these above listed species. None of the above listed threatened flora species were recorded during this survey and therefore are now considered unlikely to occur. The results of the targeted flora survey are reflected in Table 5.

6.1.3. *Threatened ecological communities*

Victorian portion of the study area

No threatened ecological communities were recorded in the Victorian portion of the study area.

NSW portion of the study area

One listed endangered ecological community (EEC) was recorded in the NSW section of the study area, namely, the *Aquatic Ecological Community in the Natural Drainage System of the Lower Murray River Catchment* (commonly known as the Murray River EEC), listed as endangered by the NSW Department of Primary Industries (DPI 2007). This EEC is made up of an assemblage of native fauna and is addressed in Section 6.3.4 of this report.

Table 5: EPBC Act, TSC Act and FFG Act listed flora species and likelihood of occurrence

Common Name	Scientific Name	Conservation Status			Habitat	Likelihood of occurrence in study area
		EPBC	FFG	TSC		
Buloke	<i>Allocasuarina luehmannii</i>		L		Woodlands on non-calcareous soils. This tree species commonly grows with Grey Box (Entwisle 1996a).	No suitable habitat and no Buloke recorded in study area – does not occur.
Hairy Tails	<i>Ptilotus erubescens</i>		L		Fertile soils with grassland and woodland communities in northern and western Victoria (Walsh 1996).	Suitable habitat originally considered in Black Box Woodland in Victoria. Not recorded during targeted survey in known flowering period – unlikely to occur.
Ridged Spider-orchid (Greencomb Spider-orchid)	<i>Caladenia tensa</i>	E			Eucalyptus and Callitris woodland in well drained sandy loams. Grows among shrubs (Jones 2006).	Area of sandy soil within the study area is limited to ‘the Sandhill’ behind the old Echuca Secondary College in Victoria. While this area supports a Callitris dominated canopy, the understorey is highly disturbed and covered by a thick layer of bridal creeper throughout. No suitable habitat – Unlikely to occur.
Red Swainson-pea	<i>Swainsona plagiotropis</i>	V	L	V	Grows on flat grassland and in heavy red soil. Occurs in the upper Murray River valley in the south-western plains of NSW and into Victoria (DEC 2005).	No grassland habitat recorded within the study area – unlikely to occur.
Ridged Water-milfoil	<i>Myriophyllum porcatum</i>	V	L		Rare and restricted to northern and north western Victoria where it has been recorded growing in temporary waterholes, lagoons, farm dams, and rock holes and on clay pans (Jeanes 1996a).	Endemic to Victoria. Ground layer of River Red-gum dominated woodland on the Victorian side of the study area is highly degraded and disturbed. No suitable habitat in Victoria. Does not occur in NSW – Unlikely to occur.
River Swamp Wallaby-grass	<i>Amphibromus fluitans</i>	V		V	Confined to permanent swamps principally along the Murray River between Wodonga and Echuca, uncommon to rare in the south (Walsh 1994).	Suitable habitat in Forested Wetland habitat in New South Wales. Not recorded during targeted survey. (Common Swamp Wallaby-grass, <i>Amphibromus nervosus</i> recorded commonly in NSW) – unlikely to occur.
Silky Swainson-pea	<i>Swainsona sericea</i>		L	V	Rare in Victoria, of disjunct occurrence in north of state where usually found in grassland and grassy woodland (Jeanes, 1996b).	Some suitable habitat in Black Box Woodland in Victoria. Though not recorded during initial detailed survey undertaken during the known peak flowering time for the species – unlikely to occur.
Slender Darling-pea	<i>Swainsona murrayana</i>	V	L	V	In black box and grassland on level plains, floodplains and depressions (DEC 2005). Seasonally inundated flats and around lakes (Jeanes, 1996b).	Suitable habitat in Black Box Woodland in Victoria and Forested Wetland habitat in New South Wales. Not recorded during targeted survey in known flowering period – unlikely to occur.
Small Scurf-pea	<i>Cullen parvum</i>		L	E	Seasonally wet areas with heavy soils in Grasslands and Grassy (River Red-gum) Woodlands (Jeanes, 1996b).	Suitable habitat in Black Box Woodland in Victoria and Forested Wetland habitat in New South Wales. Not recorded during targeted survey in known flowering period – unlikely to occur.
Spiny Rice-flower	<i>Pimelea spinescens subsp. spinescens</i>	C	L		Grasslands or open shrublands on basalt derived soils (Entwisle 1996b).	No suitable grassland habitat recorded within study area – unlikely to occur.

Common Name	Scientific Name	Conservation Status			Habitat	Likelihood of occurrence in study area
		EPBC	FFG	TSC		
Turnip Copperburr	<i>Sclerolaena napiformis</i>	E	L	E	Grasslands on clay-loam soils (DEC 2005).	No suitable grassland habitat recorded within study area – unlikely to occur.
Weeping Myall	<i>Acacia pendula</i>		L		Rare in Victoria with isolated occurrences near Waracknabeal and Echuca. Mainly on floodplains in fertile alluvial clay and red earth soils (Entwisle <i>et.al</i> 1996).	Recorded in Black Box dominated woodland and Callitris woodland within the Victorian section of the study area – recorded in VIC.
Western Water-starwort	<i>Callitriche cyclocarpa</i>	V	L	V	NSW and Victoria in thick patches in floodwaters (DEC 2005). Mostly aquatic, in damp, swampy places (Jeanes, 1999).	Suitable habitat in Forested Wetland habitat in New South Wales. Not recorded during targeted survey in known flowering period – unlikely to occur.
Yarran Wattle	<i>Acacia omalophylla</i>		L		Widespread in New South Wales but just crossing the Murray River into Victoria where present as mainly remnant populations in paddocks and roadsides (Entwisle, <i>et. al</i> 1996).	Not recorded during initial detailed assessment – unlikely to occur.
Yellow-tongue Daisy	<i>Brachyscome chrysoglossa</i>		L		In Victoria occurring as far west as Jeparit and Horsham, extending eastward to Strathmerton and Ulupna Island. Commonly on clay soils subject to inundation (Short 1999).	No suitable habitat recorded – unlikely to occur.

C = Critically Endangered; E = Endangered; V = Vulnerable; L = Listed as threatened under FFG Act

6.2. Fauna

6.2.1. *Habitat assessment*

Almost the entire study area supports native vegetation including large contiguous areas of Black Box and River Red-gum dominated woodland. All such forested and woodland areas were considered **high** quality habitat for fauna. Wetland habitat recorded in the study area was considered as **moderate** quality for fauna. See Section 4.1.1 for habitat assessment criteria.

All fauna habitats recorded in the study area are described below and shown in Figure 21.

River Red-gum Forests: Consisted of several age cohorts of River Red-gum's with the oldest occurring adjacent to the Murray River.

In the NSW section of the study area, the River Red-gum Forests consist of distinct patches of regrowth within this area, likely due to previous disturbance events. A large area of forested wetland occurs within the north eastern section of the corridor. This area supports a sparse canopy of large River Red-gums with an indigenous understorey component dominated by wetland species including Common Spike-sedge, Poong'ort and various rushes, grasses and herbs.

In the Victorian section of the study area, the areas either side of the Campaspe River and the shores of the Murray River were dominated by River Red-gum. These areas, while supporting several large trees and a contiguous canopy, had a highly disturbed ground layer, distinguished by a dense cover of introduced grasses such as Great Brome. Indigenous plants including Pale-fruit Ballart, Tangled Lignum and various other herbs and shrubs occurred in these areas at low cover.

Black Box Woodlands: The Black Box Woodlands in the Victorian part of the study area consists of numerous large old trees. These areas of Black Box dominated woodland exist north of Warren Street and to the north and south of the Sandhill, between the Murray River and the Murray Pine dominated woodland. The Warren Street area supports some of the highest quality habitat in the Victorian section of the corridor, supporting a sparse, but mostly native understorey. The NSW section of the study area supports scattered Black Box trees.

Mixed Murray Pine–River Red-gum woodland: In the Victorian part of the study area an area of woodland dominated by the Murray Pine occurs to the west of the existing Tennis Courts. This area of vegetation occurs on a raised area of sandy soil and while supporting an indigenous canopy of Murray Pines, is distinguished by the dense carpet of Bridal Creeper, a highly invasive weed species that has taken over the ground layer.

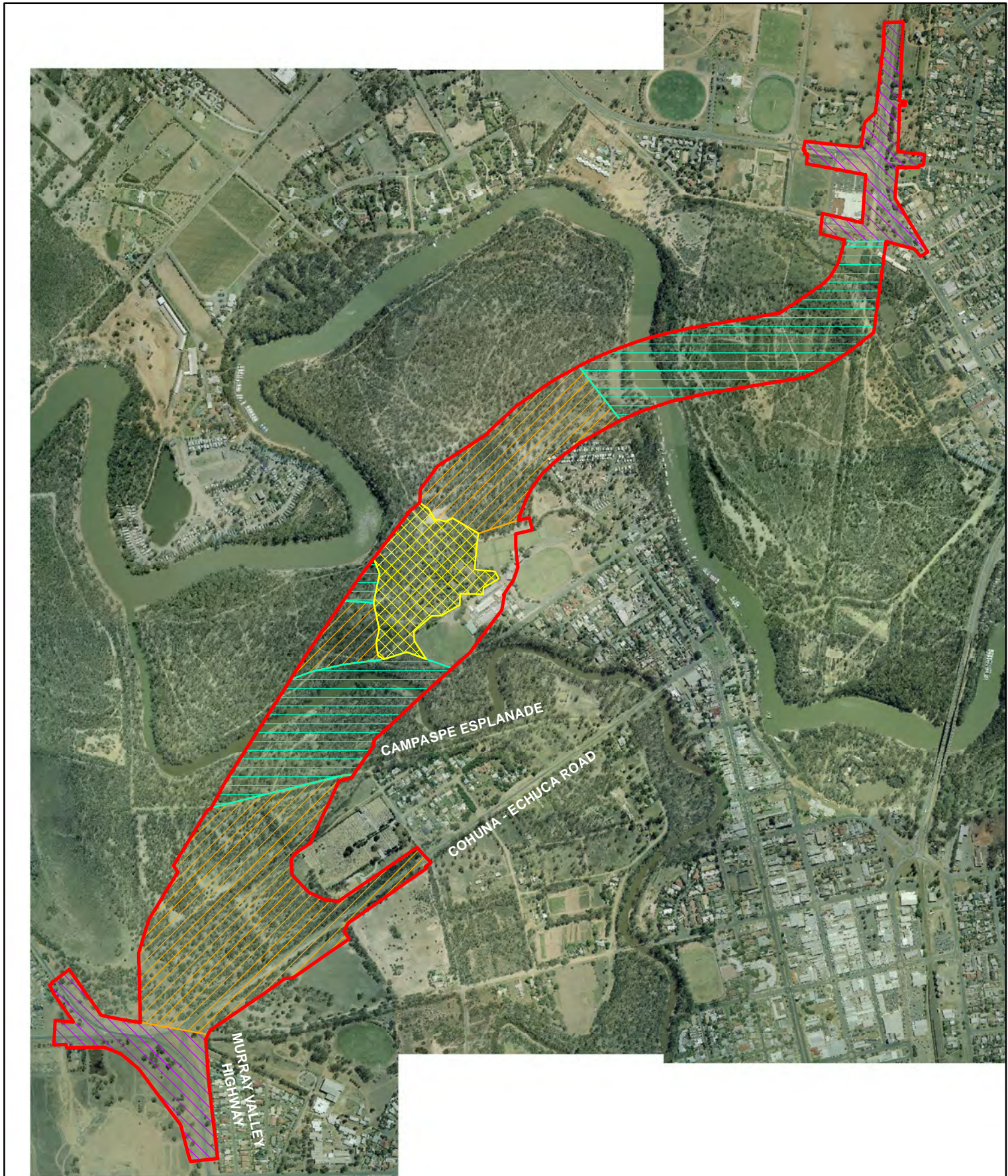
Wetlands: Aquatic habitat in the study area consists of the Campaspe River in Victoria and Murray River and billabongs on the New South Wales section of the study area. There is little bank side aquatic vegetation along either of the rivers within the study area, although sedges and Common Reed were present on small sections of the Murray River. The rivers provide continuity in habitat, and are therefore high value habitat corridors, mostly for fish and other aquatic fauna. Common species of frogs may also utilise the rivers for movement, in particular during the non-breeding season.

Several billabongs were located within the River Red-gum woodland in the New South Wales part of the study area and in similar habitat along the Campaspe River in the Victorian section of the study area.

Some of these have a moderate cover of fringing vegetation, which is likely to provide cover and breeding habitat for a number of common native frog species. The water quality was found to be poor and carp were present in at least one of the billabongs. The habitat quality of the billabongs for fauna is considered as moderate.

In addition, a small wetland (Large dam) is located at the edge of the investigation corridor south near the Warren Street - Murray Valley Highway junction. At the time of the survey, the wetland was well vegetated and was found to provide habitat for five species of local frogs and several aquatic birds.

Disturbed roadside vegetation: This habitat consists of modified and highly disturbed areas. These areas are unlikely to support threatened species, although scattered trees will provide some habitat for locally common native fauna species.



Legend

- Study Area
- Fauna habitat**
- Black Box habitat
- Disturbed roadside habitat
- Murray Pine-River Red-gum habitat
- River Red-gum habitat

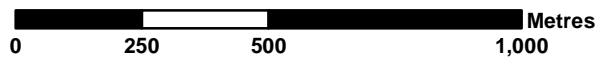


Figure 21: Fauna Habitats of Study Area

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6.2.2. Fauna species

The review of existing information and current field survey indicated that 210 fauna species may occur within the study area (Both of the Victorian and NSW sections), including 161 bird (eight introduced), 23 mammal (four introduced), 10 reptile, six frog, and 11 fish species (Appendix 2).

During the field assessment 138 fauna species were recorded. This included 105 bird (seven introduced), 22 mammal (four introduced), four reptile, six frog and two fish species (Appendix 2).

The study area was found to be rich in fauna as it consisted of high quality forest and woodlands, and moderate quality wetlands. These habitats attracted a large and diverse fauna. Fauna species, particularly birds, were not usually restricted to certain habitats; they were almost equally distributed among the various habitat types, with the exception of the waterbirds, which were generally confined to the river banks and other wetlands. Records for fauna, as stated above, originated from existing databases and those recorded during the field inspection days. The distribution of records is summarised in Table 6 below.

Table 6: Fauna species in the study area from existing databases and observations in the field

Fauna	Number of species from source				Total species
	AVW	BA	ANSWW	Recorded	
Birds	137	141	66	105	161
Mammals	20	-	15	22	23
Reptiles	6	-	3	4	9
Frogs	4	-	1	6	6
Fish	10	-	-	1	10

Sources: AVW, Atlas of Victorian Birds; BA, New Atlas of Australian Birds; ANSWW, Atlas of NSW Wildlife; Recorded during field inspection days.

6.2.3. Listed threatened fauna species

The review of existing information and current field survey indicate that within the search region 52 listed fauna species (37 bird, seven mammal, three reptile, one frog, five fish and one invertebrate) listed on the EPBC Act, FFG Act and/or the DSE advisory list (DSE 2007c) may occur within the Victorian section of the study area.

Similarly, threatened species listed on the TSC Act and FM Act including those listed on the EPBC Act, likely to occur in the NSW section of the study area included 40 species (26 birds, seven mammals, one reptile, one frog, four fish and one invertebrate).

Their likelihood of occurrence within the study area is assessed and presented in Table 12. Species that are likely to occur are highlighted. Table 12 indicates all

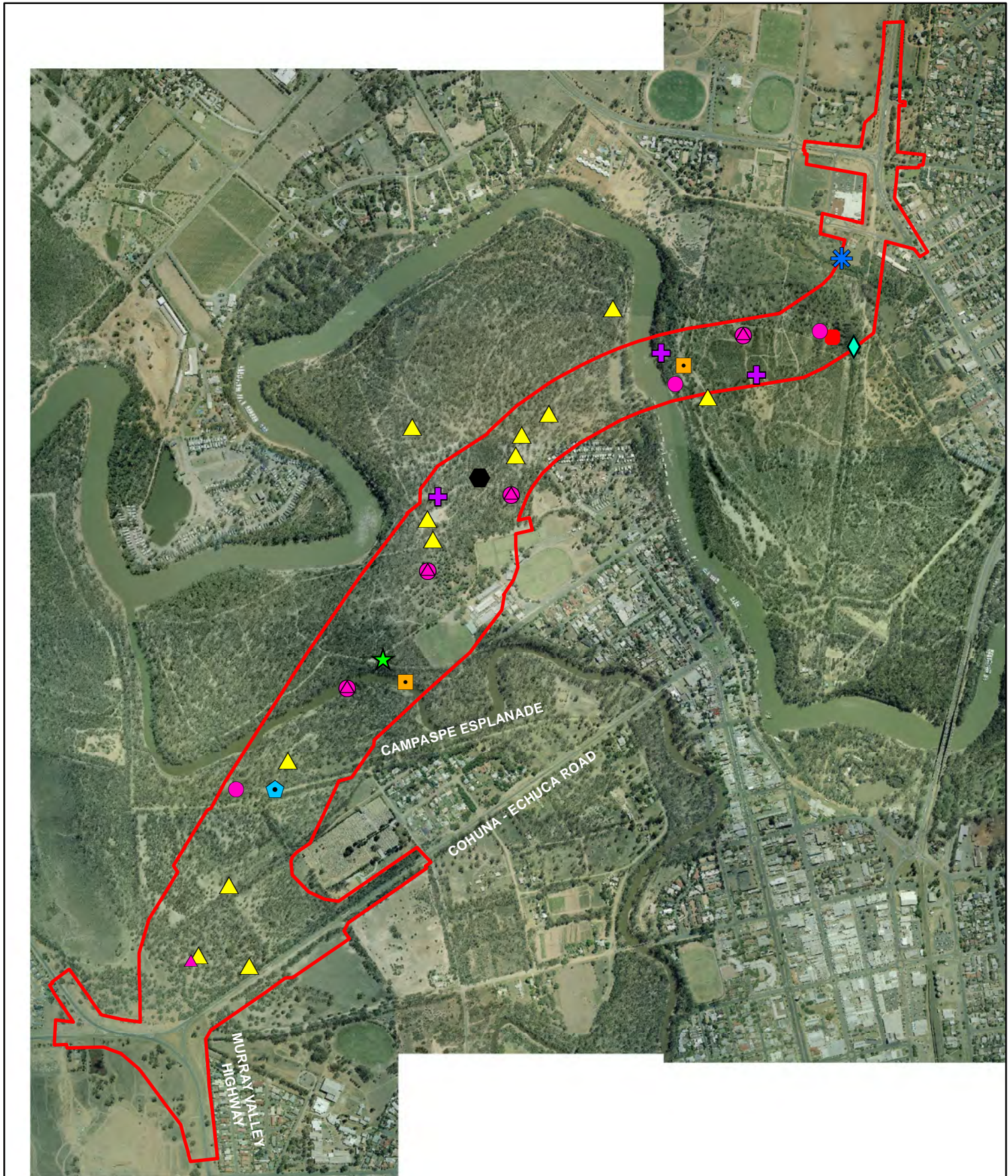
threatened species and also species listed as migratory species under the EPBC Act.

Of the listed fauna species predicted to occur in the study area (Victoria and NSW), 11 threatened fauna species were recorded. These include:

- Brown Treecreeper;
- Masked Owl;
- Azure Kingfisher;
- Brown Quail;
- Varied Sittella;
- Nankeen Night Heron;
- Black-chinned Honeyeater;
- Rainbow Bee-eater;
- Corben's Long-eared Bat;
- Yellow-bellied Sheath-tail Bat; and
- Squirrel Glider.

The location of threatened fauna species recorded during the investigation is presented in Figure 22. Threatened fauna recorded in the study area are discussed in the following sections.

Based on the likelihood of occurrence assessment for threatened fauna, suitable habitat was deemed to occur in the study area for 33 listed fauna species, including the 11 listed species recorded. These 33 species, including those recorded in the study area are shaded in grey in Table 12 and are discussed in more detail below. Species considered unlikely to occur based on lack of suitable habitat or lack of recent and regular records from the search region are not highlighted and not discussed further.



Threatened Fauna

- ★ Azure Kingfisher
- Black-chinned Honeyeater
- ⬢ Brown Quail
- ◇ Masked Owl
- Yellow-bellied Sheattail Bat
- ▲ Corben's Long-eared Bat
- ▲ Brown Treecreeper
- Nankeen Night Heron
- ✚ Rainbow Bee-eater
- ✳ Squirrel Glider
- Varied Sittella

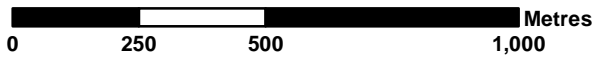


Figure 22: Threatened Fauna Species Recorded		
Project: Murray River Crossing Echuca		
Client: VicRoads		
Project No.: 8194	Date: 12/04/2013	Created By: K. Al-Dabbagh / M. Ghasemi
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Birds

Based on the assessment in Table 12, 20 listed threatened bird species were considered likely to occur in the study area. The vulnerability of these species to potential impacts from the proposed development is discussed below.

Threatened species recorded within the study area

Seven species of threatened birds were recorded during the field inspection days within the study area. These are shown in Figure 22 and discussed below.

- **Brown Treecreeper (DSE - near threatened, TSC - vulnerable):** This species (*Climacteris picumnus victoriae*) is listed as near threatened in Victoria on the DSE Advisory List and vulnerable in NSW under the TSC Act. It occurs mostly in eucalypt dominated woodlands, especially with rough-barked eucalypts and often with open grassy understorey. It has been recorded in River Red-gum and Black Box woodlands and requires hollows for breeding (Higgins *et al.* 2001).

A large and viable population of the Brown Treecreeper was found to inhabit all sections of the study area particularly those areas dominated by Black Box (Figure 22). The species was also found to breed in suitable hollows within the study area. The removal of native vegetation within the study area is likely to have a negative impact on this species, namely through the reduction of suitable breeding habitat.

The taxonomic status of the population at Echuca was questioned by Envirokey (2012), as Echuca lies in a distributional transition zone between the threatened *Victoriae* sub-species and the non-threatened *picumnus* sub-species, according to Shodde and Mason (1999). As such, in the absence of detailed taxonomic studies of the population, and under the precautionary principle, the Echuca population must be considered as the threatened *Victoriae* sub-species. Further analysis could be undertaken (and consultation with the Office of Environment and Heritage (OEH)) to provide more confidence in whether the Brown Treecreeper recorded at the study area is the threatened sub-species.

- **Masked Owl (FFG listed, DSE - endangered, TSC - vulnerable):** This species (*Tyto novaehollandiae* race *novaehollandiae*) is listed as threatened under the Victorian FFG Act, endangered in Victoria under the DSE Advisory List and listed as vulnerable in NSW under the TSC Act. It mostly occurs in open woodlands and forests that provide dense and tall tree cover, and adjoining open habitats such as cleared farmlands (Higgins 1999). According to the NSW recovery plan for the Masked Owl (DEC 2006), records of the species are very scarce in the Echuca/Moama region. Similarly, there are very few records in the Victorian AVW for the region. Therefore it is likely to occur in low numbers in the region.

One individual was recorded in the NSW component of the study area (Figure 22), and the removal of native vegetation within the study area is likely to have a negative impact on this species, namely through the reduction of suitable habitat.

- **Azure kingfisher (DSE - near threatened):** This species is listed as near threatened in Victoria on the DSE Advisory List. It is a wetland associated species, found to inhabit vegetated freshwater wetland margins or along streams and rivers (Higgins 1999). One individual was recorded on the shores of the Campaspe River (Figure 22).

This species is not likely to be directly impacted since it is restricted to the river banks and only a small section of their habitat would be altered during the development. However there is potential for indirect impacts such as sediments or spills entering the waterway making it difficult to fish and shading of the bridge.

- **Brown Quail (DSE - near threatened):** This species is listed as near threatened in Victoria on the DSE Advisory List. It inhabits tall ground vegetation over damp ground, usually in woodlands, grassland, heath, bracken and stands of vegetation fringing wetlands (Marchant & Higgins 1993). A pair was located in tall grass on the margin of a billabong along the Campaspe River (Figure 22).

The removal of native vegetation within the study area is likely to have an impact on this species, namely through the reduction of suitable habitat.

- **Varied Sittella (TSC – vulnerable):** This species is listed as vulnerable on the NSW TSC Act. This species is not listed in Victoria. It inhabits eucalypt open woodlands and forests (Higgins and Peter 2002). One individual was recorded in the NSW component of the study area (Figure 22).

The removal of native vegetation within the study area is likely to have an impact on this species, namely through the reduction of suitable habitat.

- **Nankeen Night Heron (DSE – near threatened):** This species is listed as near threatened in Victoria on the DSE Advisory List. This heron inhabits littoral and estuarine habitats and terrestrial wetlands. Nankeen Night Herons are mainly nocturnal species but roost in tall trees near wetlands during the day (Marchant & Higgins 1990). Several Nankeen Night Heron individuals were located during spotlighting on both the shores of the Murray and the Campaspe Rivers (Figure 22).

This species is not likely to be impacted since it is restricted to the aquatic habitats and only a small section of their habitat would be altered during the development.

- **Black-chinned Honeyeater (DSE – near threatened, TSC – vulnerable):** This species is listed as near threatened in Victoria on the DSE Advisory List and vulnerable in New South Wales under the TSC Act. This honeyeater inhabits open box-ironbark forests and woodlands. Usually found in Red or Mugga Ironbarks, Grey Box, Yellow Gum and Yellow Box. Especially mature tall trees along gullies, low-lying flats and lower slopes. The species is gregarious, usually seen in groups of 3–10 birds (Higgins *et al.* 2001).

The removal of native vegetation within the study area is likely to have an impact on this species, namely through the reduction of suitable habitat.

Species with suitable habitat that were not recorded within the study area

Apart from species recorded in the study area, 13 additional threatened bird species are considered likely to occur within the study area, mostly due to the presence of suitable habitats; these include:

Woodland birds: Ten species of woodland birds were considered likely to occur in the study area. These included three parrots and seven additional bush birds. The likelihood of the presence of these species in the study area is as follows:

- **Swift Parrot (EPBC – endangered, FFG listed, DSE – endangered, TSC – vulnerable):** The Swift Parrot migrates to Victoria from Tasmania in winter to feed on the flowering eucalypts of the inland slopes of the Great Divide. The species is considered as nomadic in Victoria and NSW, with movements being determined by flowering eucalypts (Emison *et al.* 1987; Higgins *et al.* 2001). Although the Swift Parrot may occasionally pass through the study area, it is highly unlikely it would occur regularly or in significant numbers. For this reason this species is unlikely to be significantly impacted by the project. There are no records of the species in AVW but one record in the ANSWW, and although the study area contains potential foraging habitat, the preferred food trees of the species in this region, such as Red Ironbark, Grey Box, Yellow Gum and White Box, are absent.
- **Superb Parrots (EPBC – vulnerable, FFG listed, DSE – endangered, TSC – vulnerable):** This species occurs mainly in mature healthy River Red-gums in forest growing on river flats along with Yellow Box, Black Box and Cypress Pine (Higgins 1999). Forest and woodlands often contain an open mid-storey of wattles and ballart. It nests in the hollows of large trees (dead or alive), mainly in tall, riparian River Red-gum forest or woodland. This species' range includes Barmah-Millewa Forest, within approximately 20km of the study area. It is possible this species may occasionally occur in the study area due to the presence of suitable foraging habitat; however numbers are unlikely to be significant, especially as no records within the search region were found in Victoria or NSW. The centre of the Victorian population occurs in habitats further east along the Murray River, associated with the Barmah – Millewa forests. This species is unlikely to be significantly impacted by the project.
- **Turquoise Parrot (FFG listed, DSE – near threatened, TSC – vulnerable):** This species occurs in eucalypt forests and woodlands with grassy ground cover and sometimes with a shrubby understorey. The species has been recorded mostly from box/ironbark eucalypt associations although it may also occur in riparian woodlands dominated by River Red-gum (Higgins 1999). It feeds on seeds of grasses and shrubs. There are three old records of this species from the AVW (1984–86) and none in the ANSWW. Although this species may occur in the study area as suitable habitat is present, it is unlikely to occur there regularly, as evidenced by the lack of recent atlas records, despite records being submitted regularly to most of these databases. This species is unlikely to be significantly impacted by the project.
- **Bush Stone-curlew (FFG listed, DSE – endangered, TSC – endangered):** It occurs in lightly timbered open forests and woodlands, as well as cleared land with patches of remnant trees, usually with a sparse cover of grasses and often with fallen timber for cover (Marchant and Higgins 1993). There are five

records of this species within close proximity to the study area within Victoria, including one record within one kilometre and another record within two kilometres. One of the records is from 2006 from Echuca Secondary College. In addition, the species was also recorded once in the ANSWW.

This species was considered likely to occur in the Black Box and River Red-gum woodland habitats within the study area but was not detected during the targeted fauna survey work in January 2009 (BL&A 2011). A similar attempt at finding them during 26th–30th, September 2011 surveys was made with extensive diurnal surveys and night spotlighting, but none was located. Personal communications with local land owners indicated that the bird has been known to nest on land within the study area in previous years. Information obtained via the project Community Consultative Group as part of 2008 assessment of the Mid-West Corridor indicated that the Bush-Stone Curlew occurs regularly further north and south of the study area but was unlikely to occur in the vicinity of the proposed alignment (BL&A 2011).

A more detailed targeted survey was undertaken during the period 8th–10th, and 15th–17th, November 2011 to ascertain the status of this species on the study area. This species was not located. Results of the latest survey are described in Section 5.2.1. This species is unlikely to be impacted by the project.

- **Grey-crowned Babbler (FFG listed, DSE – endangered, TSC vulnerable):** It occurs in woodlands of Black Box, Grey Box, Yellow Box and Cypress-pine, and in open forest dominated by River Red-gum, sometimes with a mid-storey of Black Wattle and groundcover with abundant leaf litter and sparse cover of grasses. The Grey-crowned Babbler is a territorial, co-operative breeding species. The species roosts communally at night in nests known as dormitory nests, comprising sticks externally in a domed form and lined with softer materials such as grass, feathers or wool. Dormitory nests usually number several (usually a minimum of four) in a small area and if used, house up to 14 birds. The babbler is an active, gregarious species and members of a group often draw attention to themselves by their noisy chattering calls and other group behaviours such as chasing and mobbing (Higgins and Peter 2002).

Four records of the Grey-crowned Babbler were located within the ANSWW search region from 2004 and 2005. No records of this species exist from the Victorian section of the search region. The highest quality potential habitat is considered to occur in the Black Box woodland. Given that potential habitat exists, this species was considered to have potential to occur in woodland habitat within both sides of the study area. During the field survey, as was the case during the 2009 surveys (BL&A 2011), no evidence was found for the occurrence of this species. No nests were located and no birds were found. Information obtained from the Murray Shire indicated that this species is occasionally observed along the proposed alignment on the New South Wales side of the Murray River (BL&A 2011). Such occurrences appear to be dispersing individuals, in the absence of nests that would suggest a permanent presence in the study area. It is therefore unlikely that a breeding population of Grey-crowned Bblers occurs in the vicinity of the proposed alignment, although they may occur elsewhere along the Murray River nearby. This species is unlikely to be significantly impacted by the project.

- Potentially suitable habitat also occurs for several other woodland species, such as the **Diamond Firetail**, **Speckled Warbler** (FFG listed, DSE – vulnerable, TSC - vulnerable) and **Hooded Robin** (FFG listed, DSE - endangered, TSC - vulnerable). The AVW did not contain record of these species, but the ANSWW contains one record for each within the search region. Therefore, although these species may occasionally utilise the habitats in the study area, they are unlikely to occur regularly or in significant numbers. These species are unlikely to be significantly impacted by the project.
- **Barking Owl** (FFG listed, DSE – endangered, TSC – vulnerable): The Barking Owl occurs in dry forests and woodlands dominated by eucalypts and is known to inhabit riparian vegetation dominated by species such as River Red-gum and Black Box. The species requires large trees for roosting and hollows for nesting. The Barking Owl has not been recorded in the AVW search region, but has been recorded once within the ANSWW search region. The study area contains numerous large and hollow trees, in particular on the Victorian side of the Murray River. Therefore the Barking Owl was considered likely to occur.

The owls were not targeted in the initial survey (26–30/09/11) as the time of year for such studies was not suitable for effective survey. A detailed targeted survey was later undertaken (8–10 and 15–17/11/11) and this species was not recorded. Results of the survey are described in Section 5.2.1. Following the results of the targeted survey, the Barking Owl is now considered unlikely to be a permanent resident within the study area. For this reason it is considered unlikely that the Barking Owl will be significantly impacted by the project.

- **White-bellied Sea-eagle** (EPBC – migratory, FFG listed, DSE – vulnerable): The eagle may occur in and forage along the Murray River. One record of this species occurs in the search region from 1999. It is mostly a coastal species, but is also known to occur along the Murray River (Emison *et al.* 1987). The species is known to build its nests in River Red-gum trees, and as suitable habitat is present, it is likely to occur in the study area. No nests of this species were found during the assessment and it is unlikely to be a resident in the area on regular basis. This species is unlikely to be significantly impacted by the project.

Waterbirds: The AVW lists a number of threatened waterbird species from the search region. These species include: **Eastern Great Egret** (EPBC – migratory, FFG listed, DSE - vulnerable) (8 records between 1984 and 2001), **Intermediate Egret** (FFG listed, DSE – critically endangered)(5 records between 1994 and 2001), and **Royal Spoonbill** (DSE – vulnerable) (3 records between 1989 and 1994), Very limited habitat for waterbirds occurs along the Rivers and the billabongs, and such habitat would be temporally used for foraging but unlikely to support breeding. In addition, there were more records of threatened ducks and terns; none of which was considered likely to occur due to a lack of suitable habitat (see Table 12). These species are unlikely to be significantly impacted by the project.

Migratory Birds

The EPBC Act Protected Matters Search results also identified suitable habitat in the search region for listed migratory bird species protected under this Act.

Most of the migratory species have not been recorded in the search region and habitat for them (wetter forests and gullies) is absent (see Table 12). Therefore it is expected they would not occur regularly in the study area and are unlikely to be significantly impacted by the proposed development.

However, the **Rainbow Bee-eater**, a summer visitor to the region, was recorded within the study area. The bee-eater was not recorded during the initial 2011 survey, probably as it had not yet arrived in the area, but was later recorded during the November 2011 and October 2012 surveys. It has also previously been reported on both sides of the river in the study area (BL&A 2011). The Rainbow Bee-eater is widespread in Australia and while listed under the EPBC Act as a migratory species, it is not threatened.

Mammals

Based on the assessment in Table 12, five listed mammal species were considered likely to occur in the study area, including two arboreal mammals and three bats. The vulnerability of these species to potential impacts from the proposed development is discussed below.

- **Squirrel Glider (FFG listed, DSE – endangered, TSC – vulnerable):** It occurs in dry forests and woodland and utilises habitats with mature and mixed-age trees, including those dominated by River Red-gum and with Silver Wattle and Black Wattle in the understorey. The species requires hollows for building dens and a range of hollow types can be utilised (Menkhorst 1995). Squirrel Gliders are known to utilise linear road reserves with suitable habitat and in many rural areas of Victoria depend on such habitat, particularly the large trees (van der Ree 2002, van der Ree and Bennett 2003). There were 28 AVW records of this species within the search region ranging from 1980 to 2000; three of these locations are close to the study area (within one kilometre). While not detected during either of the initial or targeted hair tube trapping surveys undertaken in the study area, one Squirrel Glider was detected incidentally during spotlighting surveys in November 2012. This Squirrel Glider was recorded adjacent aerial cage trap no. 8 (see Section 6.2.4 below).

Results of the status of this species in the study area are described in Section 5.2.1. This species is likely to be impacted by the project, and mitigation measures have been included in Section 11.2.

- **Koala (EPBC – vulnerable in NSW, TSC – vulnerable):** Inhabits sclerophyll forest and woodlands on both sides of the Great Divide (Menkhorst 1995). While the AVW contained no records of the species, the ANSWW contained one record from the search region. It is likely that the species may inhabit the study area, but such presence would be rare since habitats in the study area lack the preferred eucalypt food for the Koala. This species is unlikely to be significantly impacted by the project.
- **Bats:** These include the **Corben's Long-eared Bat (EPBC – vulnerable, FFG listed, DSE – vulnerable, TSC – vulnerable)** (previously known as Greater Long-eared Bat, south eastern form), **Large-footed Myotis (TSC – vulnerable)** and **Yellow-bellied Sheathtail Bat (TSC – vulnerable, FFG listed)**.

The Large-Footed Myotis occurs in habitats where vegetation is associated with streams and waterways (Menkhorst 1995); this species was not recorded

during either of the bat surveys undertaken as part of this investigation and therefore is not discussed further.

The presence of Corben's Long-eared Bat and Yellow-bellied Sheath-tail Bat was confirmed in the study area during the bat surveys and is discussed further below in Section 6.2.6.

Reptiles

Based on the assessment in Table 12, The **Murray River Tortoise (FFG listed, DSE – data deficient)** is the only listed reptile species considered likely to occur in the study area. There were three records of the turtle in the AVW search region, but none from the ANSWW. The species is likely to inhabit the shores of the Murray and Campaspe Rivers and also probably billabongs along these rivers.

Frogs

Based on the assessment in Table 12, one listed frog species was considered to potentially occur in the study area. The **Growling Grass Frog (EPBC – vulnerable, FFG listed, DSE – endangered, TSC – endangered)** (Victorian nomenclature) occurs in permanent, still or slow flowing water with fringing and emergent vegetation in streams, swamps, lagoons and artificial wetlands such as farm dams and abandoned quarries (Clemann and Gillespie 2004). It was considered to potentially occur in suitable water bodies in both the Victorian and NSW components of the study area.

Following the negative results of the October 2012 targeted survey; it was considered that the Growling Grass Frog is unlikely to be a permanent resident in the study area.

Fish

Based on the assessment in Table 12, six listed fish species were considered likely to occur in the study area. These include:

- **Macquarie Perch (EPBC – endangered, FFG listed, DSE – endangered, FM – endangered);**
- **Murray Hardhead (EPBC - vulnerable, FFG listed, DSE – critically endangered, FM – critically endangered);**
- **Murray Cod (EPBC – vulnerable, FFG listed, DSE – endangered, FM – endangered);**
- **Silver Perch (FFG listed, DSE critically endangered);**
- **Golden Perch (DSE – vulnerable) and**
- **Trout Cod (FM endangered).**

Of these the AVW contained records of the Golden and Silver Perch from the search region. The TPFSRV contained records for two of these species the Murray Cod and Trout Cod. While not recorded in the aquatic survey undertaken in the study area (GHD 2012), all the above fish species are considered likely to occur in the rivers passing through the study area. Impacts to fish species should be mitigated by ensuring erosion controls and other mitigation measures are put in place during construction (Section 11.2).

6.2.4. *Endangered Ecological Communities*

The Fisheries Scientific Committee has listed the *Aquatic Ecological Community in the Natural Drainage System of the Lower Murray River Catchment* as an Endangered Ecological Community (EEC) under the NSW FM Act.

The area that this EEC encompasses includes all natural creeks, rivers and associated lagoons, billabongs and lakes of the regulated portions of the Murray River downstream of the Hume Weir. This area includes the Murray River and all natural billabongs and wetlands on the NSW section of the study area (Figure 10).

The Murray River EEC is characterised by a list of assemblages of native fauna species including crustaceans, fish, insects, molluscs and sponges. The community includes 23 native fish species and over 400 recorded native invertebrate species. This list can be viewed in Appendix 16. All indigenous aquatic biota within the bounds of this EEC has legal protection under the NSW FM Act.

6.2.5. *Threatened Species targeted Surveys*

Results of the hair tube trapping

An extensive trapping regime was set up during November 2011 (8–22/11/2011) to investigate possible presence of the threatened Squirrel Glider within the study area. Hair tube traps were used and set up at six different transects (Figure 2) representing the different woodland and forest habitats within the study area (for details of methods; see section 4.1.2).

The analysis of hair trapped by the hair tubes did not reveal the presence of Squirrel Glider at any section of the study area. However, the hair tubes recorded the presence of the Common Brushtail Possum and Sugar Glider; both common arboreal mammals in both Victoria and NSW.

Results of the arboreal cage trapping for Squirrel Glider (NSW only)

Arboreal cage trapping was conducted within suitable habitat in the NSW portion of the study area during October 2012 (16-19/10/2012) to determine the status of the threatened Squirrel Glider in NSW.

The results were negative for Squirrel Glider; the only species trapped was the Common Brushtail Possum. Detailed results are presented in Table 7 and trap locations are presented in Figure 2.

However, during incidental spotlighting during the 2012 Growling Grass Frog targeted survey, a Squirrel Glider was detected adjacent aerial cage trap no. 8 (see Section 6.2.4 below).

Weather conditions during each trap night of the arboreal cage trapping for Squirrel Glider are summarised as follows:

- 15/10/2012 - Cool evening, gentle breeze, 90% cloud cover, moderate precipitation, 1/4 moon.
- 16/10/2012 - Cool evening, gentle breeze, clear sky, no precipitation, 1/4 moon.
- 17/10/2012 - Cool evening, no breeze, clear sky, no precipitation, 1/4 moon.
- 18/10/2012 - Cool evening, no breeze, clear sky, no precipitation, 1/4 moon.

Table 7: Detailed results of the aerial cage trapping for Squirrel Glider

Trap no.	Trap set date	Habitat type	Trap tree details	Species trapped	Trap status
1	15/10/2012	Floodplain woodland, shallow ephemeral inundation, dominated by sparse canopy of young and mature River Red-gum, numerous hollow-bearing trees, shrub layer largely absent, ground layer dominated by indigenous semi-aquatic grasses, sedges and herbs.	Large River Red-gum, several small hollows, sap flows evident	Nil	Closed, baited
	16/10/2012			Nil	Open, baited
	17/10/2012			Nil	Open, baited
	18/10/2012			Nil	Open, baited
2	15/10/2012	Floodplain woodland, shallow ephemeral inundation, dominated by sparse canopy of young and mature River Red-gum, numerous hollow-bearing trees, shrub layer largely absent, ground layer dominated by indigenous semi-aquatic grasses, sedges and herbs.	Very large River Red-gum, numerous large and small hollows, sap flows evident	Nil	Open, baited
	16/10/2012			Common Brushtail Possum	N/A
	17/10/2012			Nil	Open, baited
	18/10/2012			Nil	Closed, baited
3	15/10/2012	Floodplain woodland, shallow ephemeral inundation, dominated by sparse canopy of young and mature River Red-gum, numerous hollow-bearing trees, shrub layer largely absent, ground layer dominated by indigenous semi-aquatic grasses, sedges and herbs.	Very large River Red-gum, numerous large and small hollows, sap flows evident	Nil	Open, baited
	16/10/2012			Nil	Open, baited
	17/10/2012			Nil	Closed, baited
	18/10/2012			Nil	Open, baited
4	15/10/2012	Floodplain woodland, shallow ephemeral inundation, dominated by sparse canopy of young and mature River Red-gum, numerous hollow-bearing trees, shrub layer largely absent, ground layer dominated by indigenous semi-aquatic grasses, sedges and herbs.	Large River Red-gum, several large and small hollows, sap flow evident	Nil	Open, baited
	16/10/2012			Nil	Open, baited
	17/10/2012			Nil	Open, baited
	18/10/2012			Nil	Open, baited
5	15/10/2012	Riparian woodland dominated by full canopy of mature River Red-gum, numerous hollow-bearing trees, tall shrub layer dominated by Silver Wattle, ground layer dominated by exotic grasses.	Large River Red-gum, 1 large hollow, sap flows evident	Nil	Open, baited
	16/10/2012			Nil	Open, baited
	17/10/2012			Nil	Open, baited
	18/10/2012			Nil	Open, baited
6	15/10/2012	Riparian woodland dominated by full canopy of mature River Red-gum, numerous hollow-bearing trees, tall shrub layer dominated by Silver Wattle, ground layer dominated by exotic grasses.	Large River Red-gum, no hollows, sap flows evident	Nil	Closed, baited
	16/10/2012			Nil	Open, baited
	17/10/2012			Nil	Open, baited
	18/10/2012			Nil	Open, baited
7	15/10/2012	Riparian woodland dominated by full canopy of mature River Red-gum, numerous hollow-bearing trees, tall shrub layer dominated by Silver Wattle, ground layer dominated by exotic grasses.	Large River Red-gum, no hollows, sap flows evident	Nil	Open, baited
	16/10/2012			Nil	Open, baited
	17/10/2012			Nil	Open, baited
	18/10/2012			Nil	Open, baited
8	15/10/2012	Grassy woodland dominated by Black Box and River Red-gum regrowth with thin scattering of mature canopy trees, hollow-bearing trees largely absent, shrub layer dominated by Pale-fruit Ballart, <i>Acacia</i> species absent. Ground layer very sparse.	Medium sized River Red-gum, no hollows	Nil	Open, baited
	16/10/2012			Nil	Open, baited
	17/10/2012			Nil	Open, baited
	18/10/2012			Nil	Open, baited
9	15/10/2012	Riparian woodland dominated by full canopy of mature River Red-gum, numerous hollow-bearing trees, tall shrub layer dominated by Silver Wattle, ground layer dominated by exotic grasses.	Large River Red-gum, several large hollows, sap flows evident	Common Brushtail Possum	N/A
	16/10/2012			Nil	Closed, baited
	17/10/2012			Common Brushtail Possum	N/A
	18/10/2012			Nil	Closed, baited
10	15/10/2012	Floodplain woodland, shallow ephemeral inundation, dominated by sparse canopy of young and mature River Red-gum, numerous hollow-bearing trees, shrub layer largely absent, ground layer dominated by indigenous semi-aquatic grasses, sedges and herbs.	Large River Red-gum, no hollows, sap flows evident	Nil	Open, baited
	16/10/2012			Nil	Open, baited
	17/10/2012			Nil	Open, baited
	18/10/2012			Nil	Closed, baited

Results of call playback and spotlighting

2011 surveys

Detailed targeted surveys were undertaken at the study area during November 2011. These were designed to compliment earlier surveys carried out during the initial surveys of September 2011. The methods and timing for these surveys are described above in the methods section (section 4.1.2).

Surveys were aimed at determining the status of the Bush Stone–Curlew and Barking Owl. Results of these surveys are summarised in Table 8 below.

Despite extensive survey effort, none of the two threatened fauna species were detected although suitable habitat is present. Due to this it has been concluded that the Bush Stone-curlew and Barking Owl are not permanent residents in the study area.

2012 survey

Incidental arboreal spotlight surveying was carried out on the evenings of October 17th and 18th 2012 in the NSW portion of the study area, concurrently with the Growling Grass Frog survey (see below).

On the 17th October 2012 an unidentified glider (*Petaurus* spp.) was observed in a tree adjacent cage trap no. 8 (see Figure 22). Numerous photographs were taken of the specimen to aid in identification. Expert advice on the identification of the glider was provided by Rodney Van der ree, based on the photographs. His conclusion was the specimen was ‘almost certainly a Squirrel Glider’ (pers. Com. Rodney Vander ree). As such, the Squirrel Glider is considered resident (at least) in the NSW portion of the study area.

On the 18th, a Masked Owl was identified near cage trap no. 2 (see Figure 22). See Section 6.2.3 above for species details.

Table 8: Summary of results from the targeted fauna surveys undertaken during November 2011. Survey targeted the Barking Owl, Bush Stone-Curlew and Squirrel Glider.

Site	Date	Weather conditions	Habitat type	Findings	
				Threatened spp	Other species
Site No. 1 – southern part of study area; Victorian section	8 / 11 / 2011	Clear night, Calm, warm	Black Box Woodland	No threatened spp detected	6 Common Ringtail Possum 6 Common Brushtail Possum
Site No. 2 – central part of study area; Victorian section	8 / 11 / 2011	Clear night, Calm, warm	River red-gum forest close to large billabong	No threatened spp detected	4 Common Ringtail Possum 6 Common Brushtail Possum 2 Nankeen Night Heron 1 Southern Boobook 1 Tawny Frogmouth Many Barking Marsh Frog Few Peron's Tree Frog Few Plain Froglet
Site No. 3 – – northern part of study area; NSW section	15/ 11 / 2011	Clear night, Calm, warm	River Red-gum Forest – close to Murray river	No threatened spp detected	2 Common Ringtail Possum 3 Common Brushtail Possum 1 Black Rat 1 Southern Boobook Many Barking Marsh Frog
Site No. 4 – – northern part of study area; NSW section	15/ 11 / 2011	Clear night, Calm, warm	River Red-gum Forest – away from Murray river	No threatened spp detected	1 Common Brushtail Possum 1 Black Rat
Site No. 5 – – northern part of study area; Victorian section	16 / 11 / 2011	Clear night, Calm, warm	River Red-gum–Black Box mixed Forest	No threatened spp detected	12 Common Ringtail Possum 11 Common Brushtail Possum 2 Black Rat 1 Tawny Frogmouth 1 Red Fox

Spp = species.

Results of the Growling Grass Frog survey

Suitable habitat for the Growling Grass Frog was identified in the NSW portion of the study area, but not in the Victorian. Two survey sites were selected, and are described as follows:

Site 1: Deep semi-artificial billabong aquatic habitat

This water body was presumably one of a chain of a shallow billabongs, situated some 600 metres north-east of the Murray River channel. However, there was ample evidence that it had been dammed and excavated, thereby increasing its size and depth.

The banks were steep and moderately vegetated with young River Red-gum and Black Box trees, planted willows and bottlebrush and Pale-fruit Ballart shrubs. The ground layer was very sparse, comprising introduced grass and forb species. Aquatic and semi-aquatic flora was sparse, comprising sedges and rushes, Slender Knot-weed, Cumbungi, Water Couch, Water Buttons, Slender Dock and Swamp Wallaby-grass.

A more detailed description of this wetland is provided above in Section 5.4.2.

Site 2: Flooded red gum woodland aquatic habitat

This aquatic habitat occurred on ephemeral flooded red gum woodland, some 500 metres east of the Murray River channel. It is presumed that periodic inundation would be effected by both flooding of the Murray River and heavy rainfall.

The entire water column was well vegetated with a sparse canopy of large and sapling River Red-gums, virtually no shrub stratum and a ground stratum dominated by indigenous wetland species such as Common Spike-sedge, Poong'ort and various rushes, Swamp Wallaby-grass, Austral Sweet-grass, Common Blown-grass, willow herb, Water Milfoil, Ferny Small-flower Buttercup, Common Sneezeweed and Slender Dock.

A more detailed description of this wetland is provided above in Section 5.4.2.

The location of the above survey sites are presented in Figure 2.

Six frog species were aurally detected during the survey, and none was detected visually (Table 9). These were all common frogs and are not threatened species. No Growling Grass Frogs were heard or observed during the current targeted survey. Weather conditions recorded during the survey are presented in Table 10.

Table 9: Frog species detected during the targeted survey

	Survey Date	Species						
		Eastern Banjo Frog	Barking Marsh Frog	Spotted Marsh Frog	Common Froglet	Plains Froglet	Peron's Tree Frog	Growling Grass Frog
Site 1	17/10/2012	2	-	-	-	3	-	-
	18/10/2012	1	1	-	-	2	-	-
Site 2	17/10/2012	2	-	4	1	7	1	-
	18/10/2012	1	-	7	-	9	-	-
Total		6	1	11	1	21	1	0

Table 10: Weather conditions during Growling Grass Frog survey

	Survey Date	Start Time	Temperature °C	Wind	Cloud cover	Precipitation
Site 1	17/10/2012	21:15	15.6	Still	Clear sky	No
	18/10/2012	21:15	16.0	Still	Clear sky	No
Site 2	17/10/2012	20:30	15.9	Still	Clear sky	No
	18/10/2012	20:20	17.2	Still	Clear sky	No

Results of the hollow-bearing tree survey (NSW only)

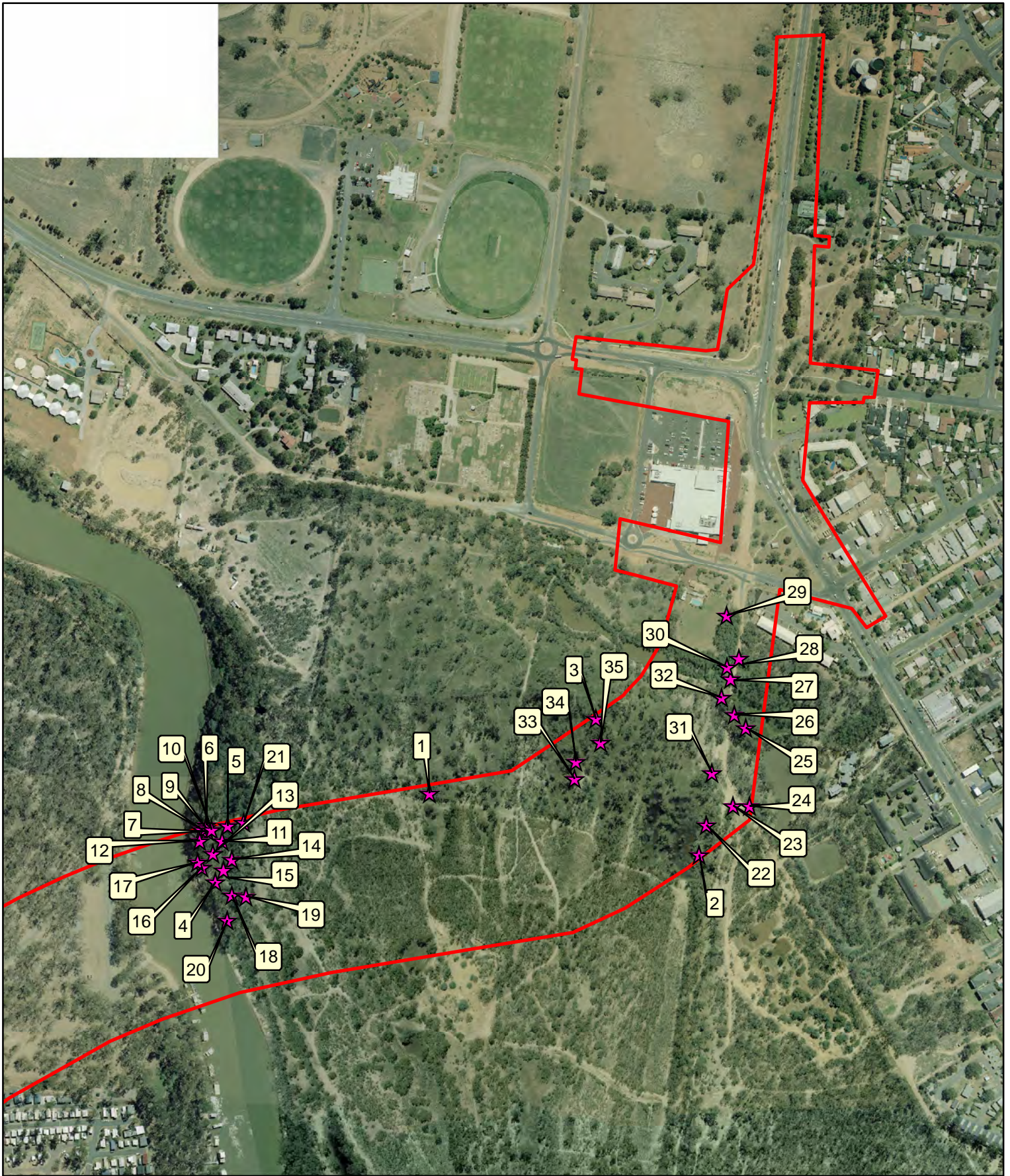
Thirty-five (35) hollow-bearing trees were recorded in the NSW component of the study area, the majority of which were associated with the riparian zone of the Murray River and the gazetted road reserve (Forbes Street) in the north-east of the study area. The number, nature of and approximate size of the hollows is presented in Table 11, and their locations are presented in Figure 23.

Hollow dependant threatened species include:

- Barking Owl;
- Brown Treecreeper;
- Masked Owl;
- Superb Parrot;
- Turquoise Parrot;
- Brush-tailed Phascogale;
- Corben's Long-eared Bat;
- Large-footed Myotis
- Squirrel Glider; and
- Yellow-bellied Sheath-tail Bat.

Table 11: Hollow bearing trees in the NSW portion of the study area

Tree no.	Tree species	Tree hollow details
1	River Red-gum	5 Potential small spouts
2	River Red-gum	4 Trunk hollows (20-50 cm diam'), 8 spouts (10-25 cm diam')
3	River Red-gum	2 Trunk hollows (20 cm diam'), one spout (15 cm diam')
4	River Red-gum	One spout (15 cm diam')
5	River Red-gum	3 Spouts (10-25 cm diam')
6	Dead stag	One trunk hollow (20 cm diam')
7	Dead stag	One trunk hollow (25 cm diam')
8	River Red-gum	Numerous potential trunk fissures
9	River Red-gum	One spout (10 cm diam')
10	River Red-gum	One potential 10 cm diam' spout
11	River Red-gum	Numerous potential spouts
12	River Red-gum	One spout (15 cm diam')
13	River Red-gum	2 Spouts (10 cm diam')
14	River Red-gum	2 Spouts (10 cm diam')
15	River Red-gum	Large trunk basal hollow
16	Dead stag	One trunk hollow (30 cm diam'), 3 spouts (15 cm diam')
17	River Red-gum	One trunk hollow (30 cm diam'), 5 spouts (10 cm diam')
18	River Red-gum	One trunk hollow (20 cm diam')
19	River Red-gum	One trunk hollow (15 cm diam')
20	River Red-gum	One trunk hollow (20 cm diam')
21	River Red-gum	One trunk fissure (10 cm diam')
22	River Red-gum	2 Potential spouts
23	River Red-gum	2 Spouts (10-15 cm diam')
24	River Red-gum	3 Potential spouts (10 cm diam')
25	Dead stag	One trunk fissure (10 cm diam')
26	River Red-gum (near dead)	One large trunk hollow (30 cm diam')
27	River Red-gum	One spout (20 cm diam')
28	River Red-gum	3 Potential spouts (10 cm diam')
29	River Red-gum	2 Spouts (15 cm diam')
30	Dead stag	Potential small spouts
31	River Red-gum	2 Potential spouts (10 cm diam')
32	River Red-gum	One trunk hollow (15 cm diam'), 2 spouts (10 cm diam')
33	River Red-gum	4 Spouts (10 cm diam')
34	River Red-gum	2 Potential spouts (10 cm diam')
35	Dead stag	One trunk hollow (30 cm diam'), one spout (15 cm diam')



Legend

- Study Area
- ★ Hollow bearing trees



Figure 23: Hollow bearing trees		
Project: Murray River Crossing Echuca		
Client: VicRoads		
Project No.: 8194	Date: 24/11/2011	Created By: J. Sullivan / M. Ghasemi
<div style="display: flex; justify-content: space-between; align-items: center;"> <div style="text-align: center;"> <p>BL&A</p> </div> <div style="text-align: center;"> <p>Brett Lane & Associates Pty. Ltd. Ecological Research & Management</p> </div> <div style="text-align: center;"> </div> </div> <div style="display: flex; justify-content: space-between; font-size: 0.8em; margin-top: 5px;"> <div style="width: 30%;"> <p>● Experience</p> <p>● Knowledge</p> <p>● Solutions</p> </div> <div style="width: 40%;"> <p>25 Burwood Rd, Hawthorn PO Box 74, Richmond VIC 3121 Australia</p> </div> <div style="width: 30%;"> <p>ph (03) 9815 2111 fax (03) 9815 2685 blane@ecologicalresearch.com.au www.ecologicalresearch.com.au</p> </div> </div>		

Table 12: Listed fauna identified as occurring or potentially occurring in the study area

Common Name	Scientific Name	Conservation Status				Habitat	Number of Records from the AVW	Number of Records from NSW databases	Likelihood of Occurrence
		EPBC	FFG	DSE	TSC				
Birds									
Australasian Bittern	<i>Botaurus poiciloptilus</i>	EN	L	EN	VU	Usually inhabits permanent freshwater wetlands with tall dense vegetation, particularly those dominated by sedges, rush, reeds or cutting grass (Marchant and Higgins 1990).	0	0	No suitable habitat and lack of recent and regular records, unlikely to occur
Australian Painted Snipe	<i>Rostratula australis</i>	VU, M (CAMBA)	L	CE	EN	Shallow freshwater or brackish swamps, usually inland and often ephemeral, with emergent vegetation such as River Red Gum and Lignum and muddy margins. Uncommon summer visitors to Victoria (Marchant and Higgins 1993; Garnett and Crowley 2000).	0	0	No suitable habitat and lack of recent and regular records, unlikely to occur
Azure Kingfisher	<i>Alcedo azurea</i>			NT		Mostly well vegetated freshwater wetland margins or along tidal rivers and creeks, especially with still or slowly flowing waters (Higgins 1999).	3	0	One bird observed on the Murray River. Recorded in the study area
Barking Owl	<i>Ninox connivens connivens</i>		L	EN	VU	Eucalyptus dominated forests and woodlands, commonly near water-bodies, such as streams and rivers, and requires hollow trees for nesting and trees with dense foliage for roosting. Prefers edge habitats to the interior of forests, with riparian vegetation through farmland supporting the species most regularly. It prefers sites with higher proportion of large trees greater than 60 centimeters in diameter at breast height and containing hollows (Higgins and Davies 1996; Taylor et al. 2002).	0	1	Suitable habitat present and targeted survey was undertaken. The Barking Owl was not recorded during targeted survey, therefore unlikely to be a permanent resident
Black Falcon	<i>Falco subniger</i>			VU	VU	Inhabits woodlands, open country and terrestrial wetlands in arid and semi-arid zones. Mainly occurs over open plains and undulating land with large tracts of low vegetation. It is more commonly found in north western Victoria and is only occasionally found in southern Victoria. It is a highly mobile species, moving in response to food availability and seasonal conditions (Marchant and Higgins 1993).	1	0	No suitable habitat and lack of recent and regular records, unlikely to occur
Black-chinned Honeyeater	<i>Melithreptus gularis gularis</i>			NT	VU	Open box-ironbark forests and woodlands. Usually found in Red or Mugga Ironbarks, Grey Box, Yellow Gum and Yellow Box. Especially mature tall trees along gullies, low-lying flats and lower slopes. Characteristic box-ironbark species, widespread but moderately common. The species is gregarious, usually seen in groups of 3–10 birds (Higgins et al. 2001; Tzaros 2005).	0	1	Few birds observed within the Black Box woodland. Recorded in the study area
Blue-billed Duck	<i>Oxyura australis</i>		L	EN	VU	Terrestrial freshwater and brackish wetlands, preferring deep permanent, well vegetated water bodies. Secretive birds, usually feeding in open water or beside tall dense vegetation (Marchant and Higgins 1990).	2	0	No suitable habitat and lack of recent and regular records, unlikely to occur
Brown Quail	<i>Coturnix ypsilophora australis</i>			NT		Prefers tall ground vegetation, such as grass, ferns and shrubs over damp or swampy ground. Also occurs in grasslands, cereal crops, stubble, leafy crops, heath, bracken and stands of vegetation fringing freshwater wetlands. In Victoria it is widespread and could be locally common in suitable habitats (Marchant and Higgins 1993).	2	0	Two pairs were observed in Black Box forest in Victorian section. Recorded in the study area
Brown Treecreeper	<i>Climacteris picumnus victoriae</i>			NT	VU	Woodlands dominated by eucalyptus, especially Stringybarks or other rough-barked eucalypts usually with open grassy understorey, some dead trees and fallen timber (Higgins et al. 2001).	17	6	A thriving population occurred on both sides of Murray River. Recorded at the study area
Bush Stone-curlew	<i>Burhinus grallarius</i>		L	EN	EN	Plains and riverine grassy woodlands, box-ironbark forests often with dead leaves and fallen dead timber. The species is mainly found in north and west Victoria. This species has declined since European settlement, especially in the south of the state (Marchant and Higgins 1993; Robinson and Johnson 1997; Olsen et al. 2005).	5	1	Suitable habitat present and targeted survey was undertaken. The Bush Stone-curlew was not recorded during targeted survey, therefore is considered unlikely to be a permanent resident
Cattle Egret	<i>Ardea ibis</i>	M (JAMBA, CAMBA)				Terrestrial freshwater wetlands and pasture, in association with cattle (Marchant and Higgins 1990).	1	0	No suitable habitat and lack of recent and regular records, unlikely to occur

Common Name	Scientific Name	Conservation Status				Habitat	Number of Records from the AVW	Number of Records from NSW databases	Likelihood of Occurrence
		EPBC	FFG	DSE	TSC				
Diamond Dove	<i>Geopelia cuneata</i>		L	NT		Mostly arid and semi-arid grassland savannah, often of spinifex and in low open woodlands with grassy understorey; also often in open riparian woodlands (Higgins and Davies 1996).	1	0	No suitable habitat and lack of recent and regular records, unlikely to occur
Diamond Firetail	<i>Stagonopleura guttata</i>		L	VU	VU	Commonly found in open forests and woodlands often with sparse grassy understorey also occur along watercourses and in farmland areas. Widespread but scattered. Populations have declined in Victoria since the 1950's (Higgins et al. 2006).	1	1	Suitable habitat present, likely to occur
Eastern Great Egret	<i>Ardea modesta</i>	M (JAMBA, CAMBA)	L	VU		Variety of wetlands including estuaries and intertidal mudflats; various permanent and ephemeral freshwater, brackish and saline wetlands; shallows of deep permanent lakes (Marchant and Higgins 1990).	8	0	Suitable habitat present in wetland habitats along the Murray River and billabongs, likely to occur
Fork-tailed Swift	<i>Apus pacificus</i>	M (JAMBA, CAMBA, ROKAMBA)				Aerial, over inland plains, sometimes above foothills or in coastal areas, over cliffs and urban areas (Higgins 1999).	0	0	May occasionally fly over the study area, unlikely to occur regularly
Grey Goshawk	<i>Accipiter novaehollandiae novaehollandiae</i>		L	VU		Inhabit rainforests, open forests, swamp forests, woodlands and plantations. Most abundant where forest or woodland provide cover for hunting from perches, some movement to open farmland and urban areas outside breeding season. In Victoria most common in Otway ranges (Marchant and Higgins 1993).	1	0	No suitable habitat and lack of recent and regular records, unlikely to occur
Grey-crowned Babbler	<i>Pomatostomus temporalis temporalis</i>		L	EN	VU	Inhabits dry woodlands and forests with a shrub layer and a groundcover of leaf litter and fallen timber. In Victoria it is found in woodlands and forests with box-ironbark eucalypt associations and River Red Gums, including narrow remnants along roadsides and streams. Formerly widespread over much of Victoria, but populations has declined and range has contracted markedly, mostly from the south and west since the 1970's (Higgins and Peter 2002; Tzaros 2005).	0	4	Suitable habitat present and local residents have reported sightings. Likely to occur
Gull-billed Tern	<i>Gelochelidon nilotica</i>		L	EN		Shallow freshwater and saline wetlands, intertidal mudflats, also in sheltered inshore marine waters where they roost on sandbars and beaches. In Victoria mainly on inland lakes of Western district and Murray Valley and also occur at Corner Inlet (Higgins and Davies 1996).	1	0	No suitable habitat and lack of recent and regular records, unlikely to occur
Hardhead	<i>Aythya australis</i>			VU		Inhabits large, deep waters where vegetation is abundant, particularly deep swamps and lakes, pools and creeks. It also occurs on freshwater meadows, seasonal swamps with abundant aquatic flora, reed swamps, wooded lakes and swamps, rice fields, and sewage ponds (Marchant and Higgins 1990).	5	0	No suitable habitat and lack of recent and regular records, unlikely to occur
Hooded Robin	<i>Melanodryas cucullata cucullata</i>		L	NT	VU	Mostly in lightly timbered woodlands dominated by acacias or eucalypts, often with pockets of saplings or taller shrubs, an open shrubby understorey, sparse grasses and patches of bare ground and leaf-litter with scattered fallen timber. This species typically occurs north of the great divide in shrubland or woodland dominated by acacias (Higgins and Peter 2002; Tzaros 2005).	0	1	Suitable habitat present, likely to occur
Intermediate Egret	<i>Ardea intermedia</i>		L	CE		Mainly in inland freshwater wetlands, occasionally visit coastal wetlands and forages amongst aquatic vegetation in shallow water and requires trees for roosting and nesting. Often occurs in wetlands that contain vegetation, including <i>Typha</i> . They are generally scarce in Victoria only few breeding records from Gunbower Island and Murray River, few pairs nested near Barmah during deep spring floods (Marchant and Higgins 1990).	5	0	Suitable habitat present in wetland habitats along the Murray River and billabongs, likely to occur
Latham's Snipe	<i>Gallinago hardwickii</i>	M (JAMBA, CAMBA, ROKAMBA, Bonn Convention (A2H))		NT		Occurs in wide variety of permanent and ephemeral wetlands; it prefers open freshwater wetlands with dense cover nearby, such as the edges of rivers and creeks, bogs, swamps, waterholes (Naarding 1983; Higgins and Davies 1996).	0	0	Suitable habitat present in wetlands, however due to lack of any records it is considered unlikely to occur

Common Name	Scientific Name	Conservation Status				Habitat	Number of Records from the AVW	Number of Records from NSW databases	Likelihood of Occurrence
		EPBC	FFG	DSE	TSC				
Malleefowl	<i>Leipoa ocellata</i>	M, VU	L	EN		Mainly in semi-arid zones in heath and mallee-heath, rarely arid zones. Associated with mallee, particularly floristically rich tall dense mallee of higher rainfall areas (Marchant and Higgins 1993).	0	0	No suitable habitat, unlikely to occur
Masked Owl	<i>Tyto novaehollandiae</i> race <i>novaehollandiae</i>		L	EN	VU	Mostly occurs in open woodlands and forests that provide dense and tall tree cover, and adjoining open habitats such as cleared farmlands (Higgins 1999).	0	0	Suitable habitat at the study area and was recorded on the NSW section. Recorded in the study area
Musk Duck	<i>Biziura lobata</i>			VU		This species inhabits terrestrial wetlands, estuarine habitats and sheltered inland waters. Almost entirely aquatic, preferring deep water of large swamps, lakes and estuaries, where conditions are stable and aquatic flora abundant (Marchant and Higgins 1990).	7	0	No suitable habitat, unlikely to occur
Nankeen Night Heron	<i>Nycticorax caledonicus hillii</i>			NT		Inhabits littoral and estuarine habitats and terrestrial wetlands. Mainly nocturnal foraging over soft or firm substrates in still or slow-moving shallow water, on exposed shores, banks and flats of wetlands, or swampy vegetation. Often occurs where sheltered by tall emergent or ground vegetation and near trees used for roosting (Marchant and Higgins 1990).	1	0	Suitable habitat present along the rivers and at wetlands in the study area. Recorded in the study area
Plains Wanderer	<i>Pedionomus torquatus</i>	VU	L	CE		This species inhabits native grasslands with sparse cover, preferring grasslands that include Wallaby Grass and Stipa species. In Victoria no recent records in south east, sporadic reports from Keilor–Werribee Plains. Widespread in small areas in the mallee, most common in northern Victoria between Bendigo and Swan Hill (Marchant and Higgins 1993).	0	0	No suitable habitat, unlikely to occur
Rainbow Bee-eater	<i>Merops ornatus</i>	M (JAMBA)				Usually in open or lightly timbered areas, often near water. Occur in partly cleared land such as farmland and in sand-dunes, both coastal and inland (Higgins 1999).	14	1	Birds observed flying over the study area in woodland habitats, Recorded in the study area
Regent Honeyeater	<i>Anthochaera phrygia</i>	EN, M (JAMBA)	L	CE	VU	Mainly occurs in dry sclerophyll forests and box-ironbark woodlands with copious flowering eucalypts and/or mistletoes, usually near rivers and creeks on inland slopes of the Great Dividing Range. It can also occur in small remnant patches or isolated clumps of mature flowering trees in farmland, coastal or urban areas. Occur in northern and central Victorian box-ironbark forests. It is now considered extinct in western Victoria (Higgins <i>et al.</i> 2001).	0	0	No suitable habitat and lack of recent and regular records, unlikely to occur
Royal Spoonbill	<i>Platalea regia</i>			VU		This species occurs in terrestrial wetlands, sheltered marine habitats and wet grasslands. Foraging limited to shallow waters, often among aquatic or emergent vegetation or submerged logs that shelter prey and favour coastal habitats (Marchant and Higgins 1990).	3	0	Suitable habitat present in wetland habitats along the Murray River and billabongs, likely to occur
Rufous Fantail	<i>Rhipidura rufifrons</i>	M (Bonn Convention (A2H))				Primarily found in dense, moist habitats. Less often present in dry sclerophyll forests and woodlands (Higgins <i>et al.</i> 2006).	0	0	No suitable habitat and lack of recent and regular records, unlikely to occur
Satin Flycatcher	<i>Myiagra cyanoleuca</i>	M (Bonn Convention (A2H))				Tall forests and woodlands in wetter habitats but not in rainforest (Higgins <i>et al.</i> 2006).	0	0	No suitable habitat and lack of recent and regular records, unlikely to occur
Speckled Warbler	<i>Chthonicola sagittata</i>		L	VU	VU	Inhabits dry eucalypt forests and woodlands, especially those with box-ironbark eucalypt associations. It is also found in River Red Gum woodlands. The species is uncommon, populations have declined since the 1980s (Higgins and Peter 2002; Tzaros 2005).	0	1	Suitable habitat present, likely to occur
Superb Parrot	<i>Polytelis swainsonii</i>	VU	L	EN	VU	It occurs in riparian River Red Gum forests and adjacent areas of box eucalypt vegetation from the Murrumbidgee and Murray Rivers northwards to the Namoi Valley (Higgins 1999).	0	1	Suitable habitat present, likely to occur

Common Name	Scientific Name	Conservation Status				Habitat	Number of Records from the AVW	Number of Records from NSW databases	Likelihood of Occurrence
		EPBC	FFG	DSE	TSC				
Swift Parrot	<i>Lathamus discolor</i>	EN	L	EN	EN	This species prefers a narrow range of eucalypts in Victoria, including White Box, Red Ironbark and Yellow Gum as well as River Red Gum when this species supports abundant 'lerp'. It breeds in Tasmania and migrates to the mainland of Australia for the autumn, winter and early spring months (Higgins 1999; Kennedy and Tzaros 2005).	0	1	Suitable foraging habitat present when River Red-gum is flowering, likely to occur
Turquoise Parrot	<i>Neophema pulchella</i>		L	NT	VU	Occur in eucalypt woodlands and open forests, with ground cover of grasses and sometimes low understorey of shrubs. It usually occurs in native grassy forests and woodlands composed of mixed assemblages of native pine and variety of eucalypts. It can also occur in savannah woodlands and riparian woodlands. In Victoria is has been recorded in East Gippsland, the north and north east districts (Higgins 1999).	3	0	Suitable habitat present, likely to occur
Varied Sittella	<i>Daphoenositta chrysoptera</i>				VU	Inhabits eucalypt open woodlands and forests (Higgins and Peter 2002)	4	0	Birds observed in the woodland habitat. Recorded in the study area
Whiskered Tern	<i>Chlidonias hybridus javanicus</i>			NT		Inhabit shallow terrestrial freshwater wetlands, either permanent or ephemeral, including lakes, swamps, river pools, reservoirs and sewage farms. In Victoria few records in Gippsland and north east, but widespread elsewhere in west of state (Higgins and Davies 1996).	2	0	No suitable habitat and lack of recent and regular records, unlikely to occur
White-bellied Sea-Eagle	<i>Haliaeetus leucogaster</i>	M (CAMBA)	L	VU		Occurs in maritime habitats, terrestrial large wetlands and coastal lands of tropical and temperate Australia and offshore islands. Its range extends far inland only over large rivers and wetlands (Marchant and Higgins 1993).	1	0	Suitable habitat present along Murray River, may occasionally fly over, likely to occur
White-throated Needletail	<i>Hirundapus caudacutus</i>	M (JAMBA, CAMBA, ROKAMBA)				Aerial, over all habitats, but probably more over wooded areas, including open forest and rainforest. Often over heathland and less often above treeless areas such as grassland and swamps or farmland (Higgins 1999).	1	0	May fly over the study area during summer months, unlikely to occur regularly
Mammals									
Brush-tailed Phascogale	<i>Phascogale tapoatafa tapoatafa</i>		L	VU	VU	Dry forest and woodland in association with box, ironbark and Stringybark eucalypts (Menkhorst 1995).	0	0	No suitable habitat and lack of recent and regular records, unlikely to occur
Brush-tailed Rock Wallaby	<i>Petrogale penicillata</i>	VU	L	CE		Rock faces with large tumbled boulders, ledges and caves (Menkhorst 1995).	0	0	No suitable habitat and lack of recent and regular records, unlikely to occur
Corben's Long-eared Bat (south-eastern form)	<i>Nyctophilus Corbeni</i>	VU	L	VU	VU	Occurs in a range of inland woodland and shrubland communities including box, ironbark and cypress pine woodlands (Menkhorst 1995, DSEWPC 2013).	0	0	Suitable habitat present. Recorded in the study area
Koala	<i>Phascolarctos cinereus</i>	VU in NSW only			VU	Inhabits schlerphyll forests and woodlands on both sides of the GDR. Arboreal, agile climbers and mostly solitary (Menkhorst 1995).	0	1	Suitable habitat present, likely to occur
Large-footed Myotis	<i>Myotis macropus</i>				VU	They inhabit vegetated areas in association with streams and permanent waterways (Churchill 2008).	0	0	Suitable habitat although was not recorded during bat surveys, unlikely to be a permanent resident
Spot-tailed Quoll	<i>Dasyurus maculatus maculatus</i>	EN	L	EN	VU	Rainforest, wet and dry forest, coastal heath and scrub and River Red-gum woodlands along inland rivers (Menkhorst 1995).	0	0	No suitable habitat and lack of recent and regular records, unlikely to occur
Squirrel Glider	<i>Petaurus norfolcensis</i>		L	EN	VU	Dry forest and woodland and nearby riverine corridors (Menkhorst 1995).	28	0	Suitable habitat present. Recorded in the study area

Common Name	Scientific Name	Conservation Status				Habitat	Number of Records from the AVW	Number of Records from NSW databases	Likelihood of Occurrence
		EPBC	FFG	DSE	TSC				
Yellow-bellied Sheath-tail Bat	<i>Saccolaimus flaviventris</i>		L		VU	Wide range of habitats, from wet and dry sclerophyll forests to open woodlands, acacia shrubland and mallee. Migratory species found only between January and April (Churchill 2008).	0	0	Suitable habitat present. Recorded in the study area
Reptiles									
Bandy Bandy	<i>Vermicella annulata</i>		L	NT		Wide range of habitats including wet coastal forest, savannah woodland, mallee, mulga and other acacia scrub to spinifex-covered desert sandhills (Cogger 2000).	2	0	No suitable habitat and lack of recent and regular records, unlikely to occur
Murray River Tortoise	<i>Emydura macquarii</i>		L	DD		Rivers, creeks and lagoons associated with the Murray/Darling drainage system (Wilson and Swan 2003).	2	0	Suitable habitat along the Murray River and wetland habitats, likely to occur
Striped Legless Lizard	<i>Delma impar</i>	VU	L	EN	VU	Tussock grasslands on the volcanic plains often associated with scattered rocks and cracked soils (Cogger 2000).	0	0	No suitable habitat and lack of recent and regular records, unlikely to occur
Frogs									
Growing Grass Frog	<i>Litoria raniformis</i>	VU	L	EN	EN	Permanent, still or slow flowing water with fringing and emergent vegetation in streams, swamps, lagoons and artificial wetlands such as farm dams and abandoned quarries (Clemann and Gillespie 2004).	0	0	Suitable habitat in wetlands in the NSW section of the study area however was not recorded during targeted survey, unlikely to be a permanent resident
Fish									
Golden Perch	<i>Macquaria ambigua</i>			VU		Found in a number of different riverine habitats and within these favours slow-moving and turbid sections (Allen et al. 2002).	6	0	Suitable habitat along the Murray River, likely to occur
Macquarie Perch	<i>Macquaria australasica</i>	EN	L	EN	FM EN	Cool, clear water of rivers and lakes. Favours slower moving water (Allen et al. 2002).	0	0	Suitable habitat along the Murray River, likely to occur
Murray Cod	<i>Maccullochella peelii</i>	VU	L	EN		Slow flowing turbid water of rivers and streams of low elevation; also fast flowing clear upland streams (Allen et al. 2002).	0	1	Suitable habitat along the Murray River, likely to occur
Murray Hardyhead	<i>Craterocephalus fluviatilis</i>	VU	L	CE	FM CE	Lakes and billabongs, mostly around dense vegetation (Allen et al. 2002).	0	0	Suitable habitat along the Murray River, likely to occur
Silver Perch	<i>Bidyanus bidyanus</i>		L	CE		Rivers, lakes and reservoirs, preferring area of rapid flow. Originally in most of the Murray river, but currently numbers have declined (Allen et al. 2002).	4	0	Suitable habitat along the Murray River, likely to occur
Trout Cod	<i>Maccullochella macquariensis</i>				FM EN	Rapidly flowing streams, around the cover of logs and debris, over rocky or gravel bottoms.	0	1	Suitable habitat along the Murray River, likely to occur
Insects									
Golden Sun Moth	<i>Synemon plana</i>	CE	L	CE		Areas that are, or have been native grasslands or grassy woodlands. It is known to inhabit degraded grasslands with introduced grasses being dominant, with a preference for the native wallaby grass being present (DEWHA 2009).	0	0	No suitable habitat and lack of recent and regular records, unlikely to occur

DSE – Status from DSE Advisory List; EPBC – Status under EPBC Act; FFG – Status under FFG Act; TSC – Status from Threatened Species Conservation Act (NSW); AVW – Atlas of Victorian Wildlife; NSW databases – Atlas of NSW wildlife and Threatened and Protected Fish Species Records Viewer; CE – Critic ally endangered; EN – Endangered; VU– Vulnerable; NT – Lower risk near threatened; DD = data deficient; L – Listed on FFG Act; FM – Status under Fisheries Management Act; M = Listed migratory species; (JAMBA) = Japan-Australia Migratory Bird Agreement; (CAMBA) = China-Australia Migratory Bird Agreement; (ROKAMBA) = Republic of Korea- Australia Migratory Bird Agreement; (Bonn Convention (A2H)) = listed under Section of Bonn Convention.

6.2.6. Results of the Bat Survey

Bats were recorded across two separate survey periods, the first during November 2011 and second during February and March 2012. During these surveys, bats were recorded at eight sites representing the various habitats presented in the study area; five of the sites were within the Victorian part of the study area and three sites were in the NSW part of the study area. The location of the bat survey sites is presented in Figure 2. The timing and location of the survey sites are described above in the methods section (section 4.1.2).

The high number of bat calls recorded during both surveys suggests the study area is an important area for bats in general. This is not surprising since the woodlands and forest within which recording was carried out, combined with the presence of the Murray and Campaspe Rivers and associated woodlands, provided high quality habitats both for roosting and foraging.

6.2.6.1. Results of the First Bat Survey

During the first survey; more than 20,000 calls were recorded by the Anabat recorders from the eight sites of the study. Site No. 1 was excluded from the results as the recording Anabat experienced machine failure and only seven calls were recorded from the seven nights of recording.

The seven recording sites recorded a total of 20,295 bat calls, ranging from 248 calls at Site No. 8 to 5,089 calls at Site No. 2, over the seven nights of recording. The majority of sites registered over 1,500 calls over the seven nights.

No attempt was made to separate the number of calls for each species of the common bats as such a process is time and effort consuming and would add little knowledge to the abundant species. Calls of threatened species were identified and the number of calls recorded counted. Given that the number of bat calls recorded on an Anabat system is not a measure of abundance, the higher the amount of bat calls from one point may reflect a relative measure of the importance of that area to bats at any given point. For example if an Anabat system had a high number of bat calls from any given location, that area is likely to be highly utilised by bats and is therefore an important area for bats in general.

During the first survey, 12 species of bats were recorded from the eight sites. The list included nine common and secured bat species, one uncommon but widely spread species and two threatened forms.

Table 13 presents the bat species recorded in the study area during the first survey and the number of nights in which species were recorded. The table shows that common species were recorded almost at every night of recording and in all the sites of study. Long-eared bats (*Nyctophilus*) were not possible to identify to species level, with the exception of Corben's Long-eared Bat which can be differentiated from other members in the genus based on its call frequency. All other species in this group have therefore been lumped together for the purpose of this assessment.

Detailed results of the first bat survey are provided in Appendix 8.

Threatened bats

Of the 12 species of bats recorded for the study area during the first survey, two species listed below are considered as threatened:

- **Corben's Long-eared Bat** (EPBC – vulnerable, FFG listed, DSE – vulnerable, TSC – vulnerable) and
- **Yellow-bellied Sheathtail Bat** (FFG listed, TSC – vulnerable).

The number of bat calls recorded for these species during the first survey is presented in Table 14.

Table 13: Bat species, status and number of nights recorded during the first bat survey within the study area

Common names	Scientific name	No. nights Recorded at sites								Ecological status		
		1	2	3	4	5	6	7	8	Victoria	NSW	EPBC
Gould's Wattle Bird	<i>Chalinolobus gouldii</i>		7	5	7	7	7	7	7	Common-secured	Common-secured	
Chocolate Wattle Bat	<i>Chalinolobus morio</i>		7	7	7	7	7	7	6	Common-secured	Common-secured	
Southern Freetail bat (spp. 2)	<i>Mormopterus spp. 2</i>		7	4	6	7	6	7	7	Common-secured	Common-secured	
Southern Freetail bat (spp. 4)	<i>Mormopterus spp. 4</i>		7	7	7	7	7	7	2	Common-secured	Common-secured	
Long-eared Bat	<i>Nyctophilus spp.</i>		7	7	7	7	7	7	7	Common-secured	Common-secured	
Inland Broad-nosed Bat	<i>Scotorepens balstoni</i>		7	4	7	7	5	7	6	Uncommon but widespread	Common-secured	
Yellow-bellied Sheath-tail Bat	<i>Saccolaimus flaviventris</i>		7	2	7	7	1	7	3	Threatened	Vulnerable	
White-striped Freetail Bat	<i>Tadarida australis</i>		7	7	7	7	7	7	7	Common-secured	Common-secured	
Large Forest Bat	<i>Vespadelus darlingtoni</i>	1*	7	7	7	7	7	7	7	Common-secured	Common-secured	
Southern Forest Bat	<i>Vespadelus regulus</i>		7	2	5	7	0	7	0	Common-secured	Common-secured	
Little Forest Bat	<i>Vespadelus vulturnus</i>		7	7	7	7	7	7	7	Common-secured	Common-secured	
Corben's Long-eared Bat**	<i>Nyctophilus corbeni</i>		0	1	2	4	0	0	0	Vulnerable	Vulnerable	Vulnerable

* There was only one call during the seven nights of recording at Site 1; possible equipment failure.

** The bat previously known as the Greater Long-eared Bat *N. timoriensis*, and also occasionally referred as the South-eastern Long-eared Bat

Table 14: Threatened bat species and the number of calls recorded within the study area during the first survey

Threatened Bat Species	Total number of calls for the seven nights of recording at each site														Overall total
	2		3		4		5		6		7		8		
Corben’s Long-eared Bat	0		1	0-1	3	0-2	7	0-3	0	-	0	-	0	-	11
Yellow-bellied Sheathtail Bat	32	3-7	7	0-4	40	4-8	13	0-4	2	0-2	32	3-8	3	0-1	129

6.2.6.2. Results of the Second Bat Survey

During the second survey, three of the recording sites (sites 2, 3, and 7) failed to record due to unusual heavy rains and partial flooding in the area. The remaining five sites (Sites 1, 4, 5, 6 and 8) recorded a total of 11,276 files, ranging from 35 files at Site No. 6 to 8424 files at Site No. 4, over the ten nights of recording. The recording sites were three in Victoria (1, 4 and 5) and two in NSW (6 and 8).

No attempt was made to separate the number of calls for each species of the common bats as such a process is time and effort consuming and would add little knowledge to the abundant species. Calls of threatened species were identified and the amounts were counted. Although bat calls are not a measure of abundance, they may reflect a relative measure of the importance of bats in a given area.

During the second survey, 13 species of bats were recorded from the five sites. The list included ten common and secured bat species, one uncommon but widely spread species and two threatened forms.

Table 15 below presents the bat species recorded in the study area during the second survey and the number of nights in which species were recorded. The table shows that common species were recorded almost at every night of recording and in all the sites of study.

The species recorded in the second survey were the same as that of the first survey, with one additional common species, the Little Broad-nosed Bat. This species is suspected to undergo seasonal movements or change in foraging behaviour (Churchill 2008), which may explain the absence of this species in the first bat survey in November. The Little Broad-nosed Bat was not previously recorded for Victoria (Menkhorst 1995).

Despite the reduction of recording sites in the second survey, the findings were generally the same as the first bat survey with the majority of bat call files being that of the common species.

Detailed results of the second bat survey are provided in Appendix 9.

Threatened bats

The two threatened bat species recorded during the first survey were again recorded during the second survey with little change in the number of calls recorded (Tables 16 and 17).

Table 15: Bat species, status and number of nights recorded during the second bat survey within the study area

Common name	Scientific name	Recording sites*					Conservation status		
		1	4	5	6	8	Vic.	NSW	EPBC
Gould's Wattle Bird	<i>Chalinolobus gouldii</i>	8	10	4	1	2	Common-secured	Common-secured	
Chocolate Wattle Bat	<i>Chalinolobus morio</i>	4	10	10	5	4	Common-secured	Common-secured	
Southern Freetail bat (spp. 2)	<i>Mormopterus ridei</i>	7	10	10	1	1	Common-secured	Common-secured	
Southern Freetail bat (spp. 4)	<i>Mormopterus spp. 4</i>	10	10	10	3	0	Common-secured	Common-secured	
Long-eared Bat	<i>Nyctophilus spp.</i>	6	10	10	3	3	Common-secured	Common-secured	
Inland Broad-nosed Bat	<i>Scotorepens balstoni</i>	6	6	10	2	1	Uncommon but widespread	Common-secured	
Yellow-bellied Sheathtail Bat	<i>Saccolaimus flaviventris</i>	0	4	3	0	0	Threatened	Vulnerable	
White-striped Freetail Bat	<i>Tadarida australis</i>	2	10	10	3	0	Common-secured	Common-secured	
Large Forest Bat	<i>Vespadelus darligtoni</i>	9	10	10	5	10	Common-secured	Common-secured	
Southern Forest Bat	<i>Vespadelus rugulus</i>	3	5	5	1	5	Common-secured	Common-secured	
Little Forest Bat	<i>Vespadelus vulturnus</i>	8	10	10	1	9	Common-secured	Common-secured	
Corben's Long-eared Bat	<i>Nyctophilus corbeni</i>	1	6	4	0	1	Vulnerable	Vulnerable	Vulnerable
Little Broad-nosed Bat	<i>Scotorepens greyi</i>	0	10	0	0	0	Common-secured	Common-secured	

* Sites 2, 3 and 7 failed to record the bat calls due to Anabat failure.

Table 16: Threatened bat species and the number of calls recorded within the study area during the second survey

Threatened bat species	Number of calls and range recorded at recording sites										Total	Av. call/night*
	1		4		5		6		8			
Corben's Long-eared Bat	1	0-1	20	0, 6	7	0, 3	0	0	1	0, 1	29	2.9
Yellow-bellied Sheathtail Bat	0	0	13	0, 6	4	0, 2	0	0	0	0	17	1.7

* Over 10 nights.

Table 17: Comparison of threatened bat species number of calls recorded between first and second bat survey

Site	Corben's Long-eared Bat				Yellow-bellied Sheathtail Bat			
	First survey		Second survey		First survey		Second survey	
	No. of calls	Av./night*	No. of calls	Av./night**	No. of calls	Av./night*	No. of calls	Av./night**
1	***	-	1	0.1	***	-	0	0
2	0	0	***	-	32	4.6	***	-
3	1	0.1	***	-	7	1.0	***	-
4	3	0.4	20	2.0	40	5.7	13	1.3
5	7	1.0	7	0.7	13	1.9	4	0.4
6	0	0.0	0	0	2	0.3	0	0
7	0	0.0	***	-	32	4.6	***	-
8	0	0.0	1	0.1	3	0.4	0	0
Totals	11	1.6	29	2.9	129	18.4	17	1.7

* First survey, n = 7 nights, ** Second survey, n = 10 nights; *** -failure of recording at the site.

6.2.6.3. Results for threatened bats recorded within the study area

This section discusses the habitats, results of surveying and potential impacts for the two threatened bat species recorded within the study area during both the first and second bat surveys.

Corben's Long-eared Bat

Originally the Corben's Long-eared bat was considered a subspecies of the Greater Long-eared Bat, *Nyctophilus timoriensis*. Recent studies from 2009 resulted in the description of it as a separate species, Corben's Long-eared Bat, (*Nyctophilus corbeni*), occasionally also referred to as South-eastern Long-eared Bat.

The Corben's Long-eared Bat is considered as Vulnerable in NSW (TSC Act), Vulnerable in Victoria (DSE 2007) and nationally Vulnerable under the EPBC Act. The species has a limited distribution that is restricted around the Murray-Darling Basin in south-eastern Australia. Even within this region the species' distribution is scattered and has been rarely recorded (Turbill & Ellis 2006). The species inhabits a variety of inland woodland vegetation types, including mallee, Bulloke and box eucalypt dominated communities; they roost in tree hollows, crevices, and under loose bark.

Capture rates vary across the states of the species' distribution with the highest rates being in the Brigalow belt and Nandewar bioregion of New South Wales (capture rate of 7 to 9%). Capture rates are comparably lower in Victoria, at 2% around the Hattah-Kulkyne National Park and 0.04% in other parts of Victoria (Schulz and Lumsden 2010).

Records of the species are very limited in Victoria with the closest two records occurring approximately 40 kilometres west of Echuca near Terrick Terrick National Park. These records date from 1992. Other records in Victoria as sourced from the Atlas of Victorian Wildlife include in Hattah-Kulkyne National Park, Murray-Sunset National Park and in Kaniva, near Little Desert National Park.

Corben's Long-eared Bat was recorded during both surveys. The species was positively identified during this study based on its call which approached 30 KH (Greg Richards; Pers. Comm.).

First survey results

During the first survey, only 11 calls were recorded from three of the seven sites of recording constituting 0.05% of total bat calls over the seven nights of recording. This number of calls indicates that there were between 1 and 11 Corben's Long-eared Bats utilising the study area during the first bat survey (Table 14). It is considered likely that this figure is due to repeat calls from a small number of bats.

Second survey results

During the second bat survey, 29 calls were recorded from three of the five sites of recording constituting 0.26% of total bat calls over the ten nights of recording. This number of calls indicates that there were between 1 and 29 Corben's Long-eared Bats utilising the study area during the second bat survey (Table 12). It is considered likely that this figure is due to repeat calls from a small number of

bats. The calls were mainly restricted to Site no. 4 which occurs in an area of mixed eucalypt and Callitris Pine woodland (Table 12).

The number of calls during the second survey slightly increased over that recorded during the first survey (Table 17). This increase however, is not significant and confirmed the findings of the first survey in that the Corben's Long-eared Bat occurs at the site in very low activity.

Yellow-bellied Sheathtail Bat

The Yellow-bellied Sheathtail Bat is listed as threatened under the Victorian FFG Act and as vulnerable in NSW (TSC Act). The species is not listed on DSEs advisory list of threatened vertebrates (DSE 2007).

The Yellow-bellied Sheathtail Bat is a wide-ranging species found across northern and eastern Australia. In the most southerly part of its range, it is a rare visitor in summer and autumn. They roost singularly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. Seasonal movements are unknown; there is speculation about a migration to southern Australia in late summer and autumn.

First survey results

During the first survey, the Yellow-bellied Sheathtail Bat was recorded on 129 occasions from the seven recording sites over the seven nights of the survey. The number of calls varied between the sites (Table 14). Between two to 40 calls were recorded over seven nights. The total calls of this bat constitute only 0.63% of the total calls of bats recorded, indicating low activity compared to the other common bats found in the study area.

Second survey results

During the second survey, the Yellow-bellied Sheathtail Bat was recorded on 17 occasions from the five recording sites over the ten nights of the second survey. Calls were recorded from sites 4 and 5 and were recorded on seven nights out of the 20 nights of recording.

The numbers of calls recorded indicate low activity of this species at this time of year (February to March 2012) compared to the number of calls recorded during the first survey undertaken in November 2011 (See Table 13). This is likely to be due to the seasonal movements of the species, which is known to be a rare visitor in the southern part of its range during summer and autumn (Churchill 2008).

7. PROPOSED DEVELOPMENT DETAILS AND IMPACTS

7.1. Project Background

VicRoads is proposing to develop a new road alignment across the Murray River to provide a new link between Echuca and Moama. The existing bridge connecting Echuca and Moama was built in 1878, and in 1989 a rail bridge was built parallel to the historic bridge. This existing Murray River crossing provides an important link for local traffic between Echuca and Southern New South Wales. This is the only crossing in the Echuca-Moama area, the nearest alternative bridge is at Barmah.

Agricultural production is the major economic activity at Echuca-Moama, involving both dryland and irrigated farming, with milk and rice being significant contributors to total agricultural production. Tourism is also a significant contributor to the economy of the area, with the historic Port of Echuca, river-based activities and recreation being the main attractions.

There are three major highways that intersect at Echuca-Moama; the Northern Highway and the Murray Valley Highway in Victoria, and the Cobb Highway in New South Wales. These highways are all significant transport routes. The existing bridge structure is narrow with one lane in each direction and has little capacity to cater for the long term traffic needs of the region.

The existing bridge is unable to provide a suitable level of service for the increasing volume of traffic in the area. Population growth, accompanied by growth in business, tourism, jobs and personal travel, all combine to indicate significant future ongoing growth in travel across the river at Echuca-Moama. The existing bridge has operational limitations in that traffic flow over the bridge is often delayed during peak tourist periods, and when wide loads or agricultural machinery need to cross the river and the traffic has to be stopped because of the narrow width of the bridge. Over dimensional vehicles are prohibited from crossing the bridge during morning, lunch and evening peak periods. This is inconvenient and costly for business operations. The existing bridge also requires extensive rehabilitation which would result in partial closure of the bridge, while work is being carried out.

The proposed second Murray River crossing will act as an alternative access between Echuca and Moama and provide relief for congestion on the existing bridge. It represents an improvement to the existing road network in the Echuca region. It will be a stand-alone project and there are no other works associated with the Echuca Road network that will be undertaken in conjunction with it.

7.2. Project Development Details

The proposed second Murray River crossing will involve the construction of a new road between the intersection of the Murray Valley Highway and Warren Street in Echuca, and the Cobb Highway and Perricoota Road intersection in Moama. The new road alignment extends approximately 4.5 kilometres in length and will include bridges over both the Campaspe River and Murray River. Bridges over these rivers will be constructed using piers at either side of the river bank. It is understood that there will no interruption to river for the construction and/or operational phases of the project.

Two alignment options are currently being considered for the project, with the differences in the two alignments occurring in the Victorian section of the study area. Alignment Option 2A utilises the northern part of the investigation corridor in Victoria while Option 2B utilises the southern part of the corridor (See Figure 25 and 26). The alignment in the New South Wales section of the study area is fixed across both options.

7.3. Design Response and Recommendations

BL&A originally undertook flora and fauna investigations on a previous corridor (the Mid-West corridor) between 2008 and 2011 (BL&A Report 8194 [2.6]). Following the assessment of various alignment options, it was considered that a new corridor (the Mid-West 2 corridor) was to be assessed for flora and fauna. This corridor comprises the study area for the current investigation.

Field assessments within the Mid-west 2 corridor were undertaken during 2011 and 2012. Initially, four alignment route options were considered (2A, 2B, 2C and 2D), for which impacts upon native vegetation and fauna habitat was compared. These impacts were presented in detail in a previous version of this report (BL&A Report 8194 [3.7]). Since then, several alterations in the design have been undertaken to result in the two alignment options that are currently being considered for the road development (2A and 2B).

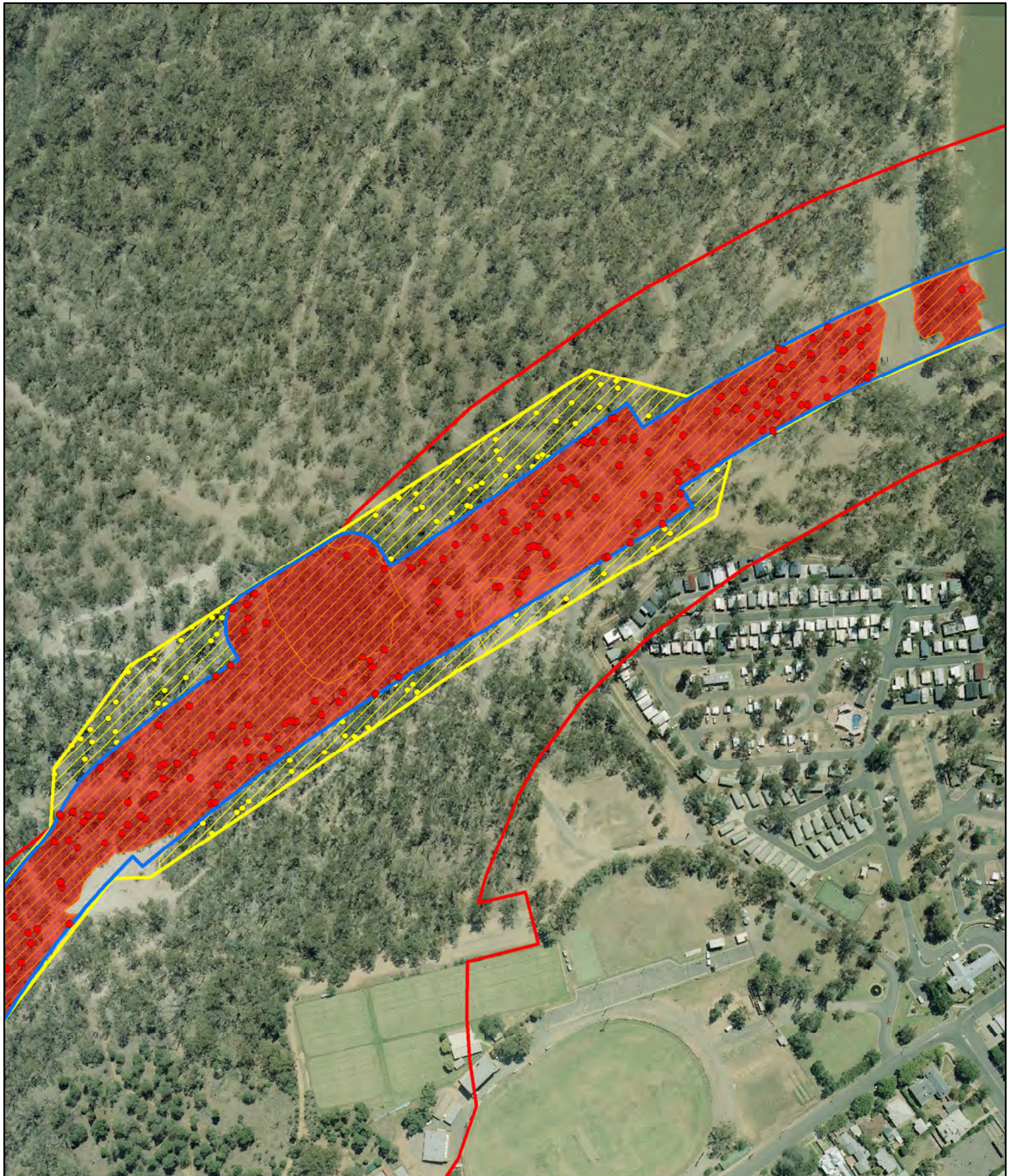
Recent design changes, namely the narrowing of the ultimate development footprint, have resulted in a large reduction in the impact to ecological values in the study area as detailed below (when compared with impacts presented in BL&A Report 8194 [3.7]).

- Reduction in removal of remnant patch native vegetation in Victoria by between 9.18 and 9.78 hectares (between 5.23 and 5.76 habitat hectares).
- Reduction in removal of Large Old Tree's (LOTs) in Victoria by between 130 and 187 trees.
- Reduction in removal of remnant patch native vegetation in NSW by 1.13 hectares.
- Reduction in removal of hollow bearing trees in NSW by three trees.
- Reduction in removal of scattered trees across Victoria and NSW by 13 trees.

An example of where there has been large reduction in proposed impacts on native vegetation is shown in Figure 24.

As such, the project has shown application of the three step approach detailed in Victoria's Native Vegetation Management Framework. As impacts to native vegetation cannot be **avoided** for the project, several design changes have been made to **minimise** these impacts. Impacts of the two alignment options currently being considered for the ultimate road development (2A and 2B) are presented in this report, along with the **offsets** required to achieve a net gain.

Recommendations to further mitigate impacts on ecological values are provided in Section 11.2.



Legend

- Study area
- Current alignment option 2A**
- Current alignment option 2A
- Native vegetation to be removed
- Trees to be removed
- Previous alignment option 2A**
- Previous alignment option 2A
- Native vegetation to be removed
- Trees to be removed

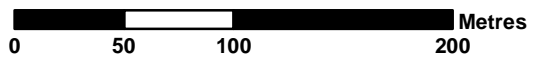


Figure 24: Native vegetation impact comparison		
Project: Murray River Crossing Echuca		
Client: VicRoads		
Project No.: 8194	Date: 12/04/2013	Created By: J. Sullivan / M. Ghasemi
Brett Lane & Associates Pty. Ltd. Ecological Research & Management		
<ul style="list-style-type: none"> ● Experience ● Knowledge ● Solutions 	25 Burwood Rd, Hawthorn PO Box 74, Richmond VIC 3121 Australia	ph (03) 9815 2111 fax (03) 9815 2685 blane@ecologicalresearch.com.au www.ecologicalresearch.com.au

7.4. Project Development Impacts

7.4.1. Impacts to native vegetation

The proposed road development will result in the removal of native vegetation and fauna habitat in both Victoria and New South Wales. Native vegetation in the form of Remnant Patches and Scattered Trees will be required for removal as well as several Large Old Trees within patches and hollow-bearing trees.

Native vegetation that would be impacted by the various proposed alignment options is shown in Figures 24 to 26 for Alignment Options 2A to 2B respectively. It is to be noted that the differences in the two alignment options occur in the Victorian section of the study area only. Impacts in the New South Wales section of the study area are fixed across both alignment options.

The area of remnant patch native vegetation being impacted within each alignment option is detailed below.

- Alignment Option 2A – Removal of **21.38 hectares** of native vegetation including 16.19 ha in Victoria and 5.19 ha in NSW.
- Alignment Option 2B – Removal of **20.71 hectares** of native vegetation including 15.53 ha in Victoria and 5.19 ha in NSW.

In addition both alignment options will result in the removal of six Scattered Trees (outside of patches) including four in Victoria and two in NSW.

7.4.2. Impacts to habitat for fauna

The main type of fauna habitat being removed in the study area is treed habitat.

Information collected on trees within the study area was undertaken in line with the requirements of each state. As such, in Victoria, all Large Old Trees (LOTs) within patches of native vegetation were mapped. This was not undertaken in NSW. Of the 1408 LOT's recorded in the Victorian section of the study area, the following are proposed for removal under the various alignment options:

- Alignment Option 2A – Removal of **298 Large Old Trees (LOTs) in Victoria.**
- Alignment Option 2B – Removal of **284 Large Old Trees (LOTs) in Victoria.**

Another important habitat feature for fauna is hollow bearing trees. Hollow tree mapping was undertaken in NSW. In the Victorian section of the study area, hollow tree mapping was not undertaken, though mapping of large and very large trees was undertaken in detail. During this assessment it was noted that tree hollows were mostly limited to old River Red-gums, and were predominantly not recorded in Black Box or Murray Pine (as similarly noted in NSW). As such, hollow trees in Victoria are considered to be mainly limited to large and very large old River Red-gums (Habitat Zones 6A, 8, 9, 11, 13, 14, 15, 15A, 18, 21 and 23). Based on the two options for the ultimate road alignment in Victoria, varying numbers of hollow trees will be required to be removed. In Victoria a total of 1408 large old trees were recorded. As discussed above, of the 1408 large trees in Victoria, 223 are in vegetation dominated by River Red-gum and considered to potentially support hollows.

Based on this information, the number of hollow-bearing trees to be removed in the study area is detailed below.

- Alignment Option 2A – Removal of **60 hollow bearing trees** including potentially 51 in Victoria and nine in NSW.
- Alignment Option 2B – Removal of **33 hollow bearing trees** including potentially 24 in Victoria and nine in NSW.

Other impacts on fauna from the proposed development include habitat fragmentation and increase to the chance of road mortality.

7.4.3. *Potential impacts*

Potential impacts that may affect threatened fauna and communities are presented in Table 18. These potential impacts can be minimised by insuring mitigations measures are undertaken (Section 11.2).

Indirect impacts that have the potential to occur include:

- Sedimentation and erosion;
- Increased rate of water runoff from the road;
- Shading of water from the bridge; and
- Weed and pathogen outbreaks in construction zone and bordering habitats.

No direct impacts are considered to occur to the Campaspe River or Murray River. Piers will be constructed as the main supports for the bridges at either side of the river and no permanent bridge infrastructure will occur within the rivers themselves, therefore there will be no alterations to natural river flows.

Erosion controls will be adopted for the Campaspe River and Murray River during the construction and post-construction phases of the project to ensure that there is no change in water quality and flow. Catch traps will be used during bridge construction to eliminate the spillage of any construction materials into the rivers. Section 11.2 presents the mitigation measures that will aid in minimising any potential impacts.

Table 18: Potential impacts to threatened fauna and ecological communities

Species	Breeding habitat loss	Foraging habitat loss	Increased road mortality	Sedimentation and erosion	Shading
Azure Kingfisher		X	X	X	
Barking Owl	X	X	X		
Black-chinned Honeyeater	X	X	X		
Brown Quail	X	X	X		
Brown Treecreeper	X	X	X		
Bush Stone-curlew	X	X	X		
Diamond Firetail	X	X	X		
Grey-crowned Babbler	X	X	X		
Hooded Robin	X	X	X		
Intermediate Egret		X	X	X	

Masked Owl	X	X	X		
Nankeen Night Heron	X	X	X	X	
Rainbow Bee-eater		X	X		
Royal Spoonbill		X	X	X	
Specked Warbler	X	X	X		
Superb Parrot	X	X	X		
Swift Parrot		X	X		
Turquoise Parrot		X	X		
Varied Sittella	X	X	X		
White-bellied Sea-Eagle				X	X
Corben's Long-eared Bat	X	X	X		
Koala	X	X	X		
Large-footed Myotis	X	X	X	X	X
Squirrel Glider	X	X	X		
Yellow-bellied Sheath-tail Bat	X	X	X		
Murray River Tortoise	X	X	X	X	X
Growling Grass Frog	X	X	X	X	X
Golden Perch	X	X		X	X
Macquarie Perch	X	X		X	X
Murray Cod	X	X		X	X
Murray Hardyhead	X	X		X	X
Silver Perch	X	X		X	X
Trout Cod	X	X		X	X
Murray River EEC	X	X		X	X

Potential impacts on the Corben's Long-eared bat

Previous records and capture rates of the Corben's Long-eared Bat (discussed above in Section 6.3) suggest the species occurs at a very low abundance rate in Victoria in comparison to areas of recording in New South Wales. While the results of the current study suggest the presence of the species in the study area, the low recording rate obtained during both surveys suggests that the species low activity rate in the area compared to other bat species.

Notably, the majority of calls of the species were recorded from the central part of the study area from Sites 4 and 5 (Figure 2), an area which comprised of a mixture of Black Box, River Red-gum and Murray Pine woodland. Black Box and River Red-gum woodland is common throughout the Murray Fans bioregion, being associated with the floodplain of the main waterway. Therefore the removal of some of this habitat type in the study area is not considered to result in a significant loss of habitat for the species.

One of the main known habitat requirements for the long-eared bat group is the presence of tree hollows for roosting. Trees supporting hollows in the study area were mainly limited to large old River Red-gums and hollows were predominantly

not recorded in the Black Box or Murray Pines. Large hollow River Red-gums are common all along the Murray River and removal of a small number of hollow trees is not considered to result in a significant loss of this habitat for the species.

Based on the information above, no significant habitat features for the species are considered to distinguish the study area from the habitats in the adjacent region. It is for this reason that the project is not considered to have a significant impact on the Corben's Long-eared Bat. While a small amount of habitat for the species will be removed for the project, there is a large amount of similar habitat adjacent and within the region that would support the species.

The implications for the project based on these findings are further discussed in the following section under the EPBC Act. Mitigation measures including the reduction in removal of hollow bearing trees, as well as guidelines for tree clearing to avoid direct impacts to this species are provided in Section 9.2.

Potential impacts on the Yellow-bellied Sheathtail Bat

This species is known to occur over a wide range of habitats, from wet and dry sclerophyll woodlands to open woodlands, acacia shrublands, mallee, grasslands and deserts (Churchill 2008). They are therefore not limited to the habitats on the Murray River.

Based on the widespread availability of habitat for this species, any impacts on the local populations of this bat would almost be negligible, as the removal of a small section of woodland habitat along the alignment compared with available habitat in the region would have little impact on the species. Furthermore, this bat would be likely to move and occupy other habitats in the region or migrate away from the region during the warmer months of the year further reducing impacts on the species.

7.4.4. Alignment Rating Comparison

Based on the available information comparable for each alignment option a rating system has been provided below.

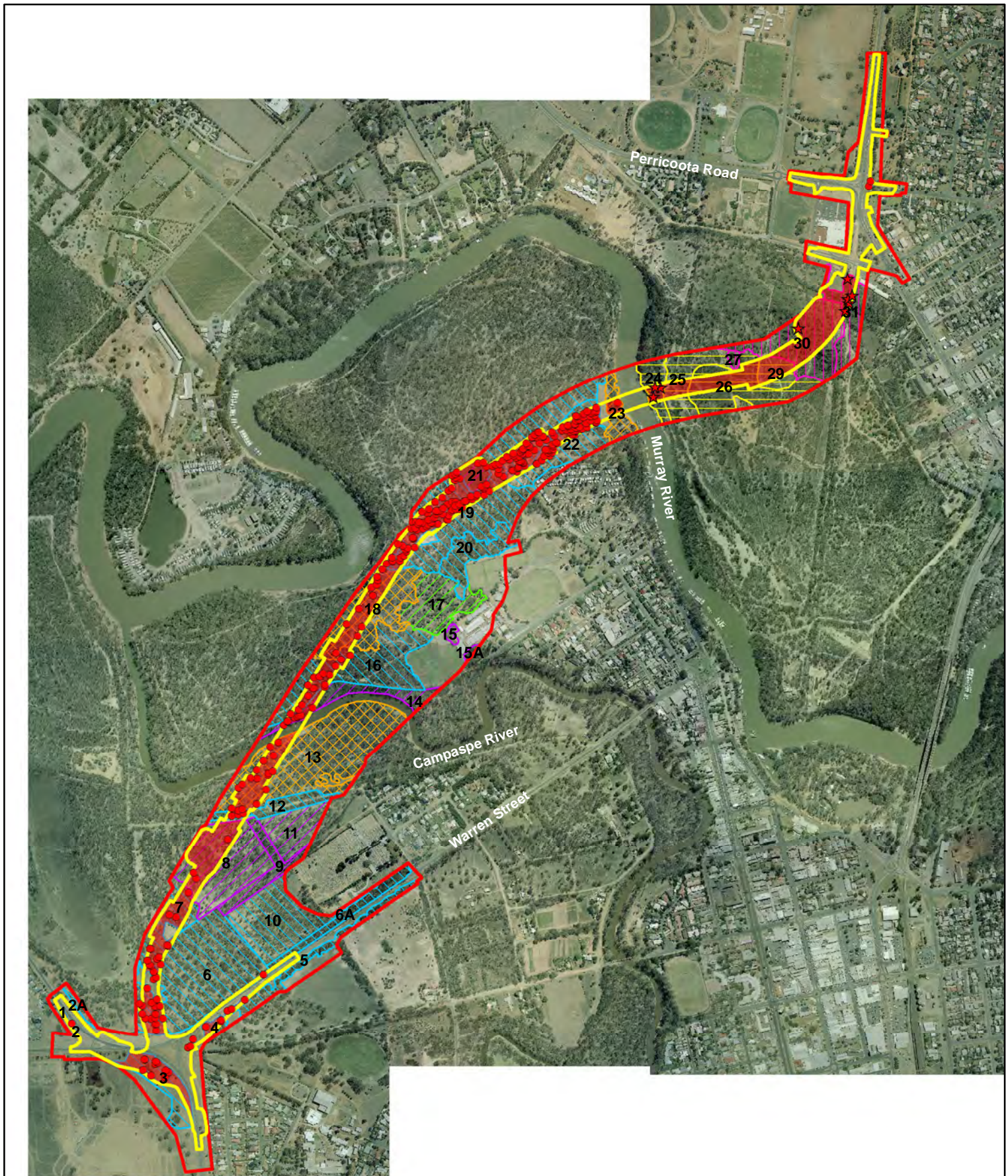
Alignment Option 2A – Avoids the locally significant Murray Pines in the Sandhill and avoids a large proportion of HZ 6, the area of highest quality Black Box Woodland. Impacts on a large number of large Black Box trees in HZ 19. Impacts on the largest area of native vegetation, largest number of Large Old Trees and largest number of hollow bearing trees. **Highest impact to native vegetation.**

Alignment Option 2B – Utilises most existing disturbed areas including the tennis courts and Sports oval in Echuca. Avoids most removal of large old trees in HZ 13, avoids impacts to HZ 16 and 18 and avoids removal of a large proportion of Murray Pines in the Sandhill. Impacts on the second highest area of native vegetation, second highest number of Large Old Trees, and the second highest number of hollow bearing trees. **Second highest impact to native vegetation.**

Based on the above summary, Alignment Option 2A has the highest impact on native vegetation and fauna habitat followed. Ultimate Alignment Option 2B is therefore the preferred option in regards to ecological impacts.

Native vegetation impacted by Alignment Option 2A is shown in Figure 25 and impacts of Alignment Option 2B are shown in Figure 26. Implications of the

proposed road development are detailed in the following sections under the various relevant federal and state legislation and policy (Sections 8, 9 and 10).



Legend

Native Vegetation

Victoria

- Grassy Riverine Forest (EVC 106)
- Riverine Chenopod Woodland (EVC 103)
- Riverine Grassy Woodland (EVC 295)
- Semi-arid Woodland (EVC 97)

New South Wales

- River Red Gum - herbaceous tall open forest
- River Red Gum - Black Box woodland

- Study Area
- Alignment Option 2A
- Trees to be removed
- Hollow bearing trees to be removed
- Habitat Zones
- Native vegetation to be removed

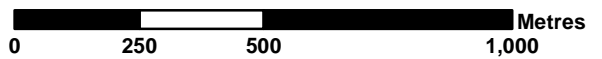


Figure 25: Native vegetation removed by alignment option 2A

Project: Murray River Crossing Echuca

Client: VicRoads

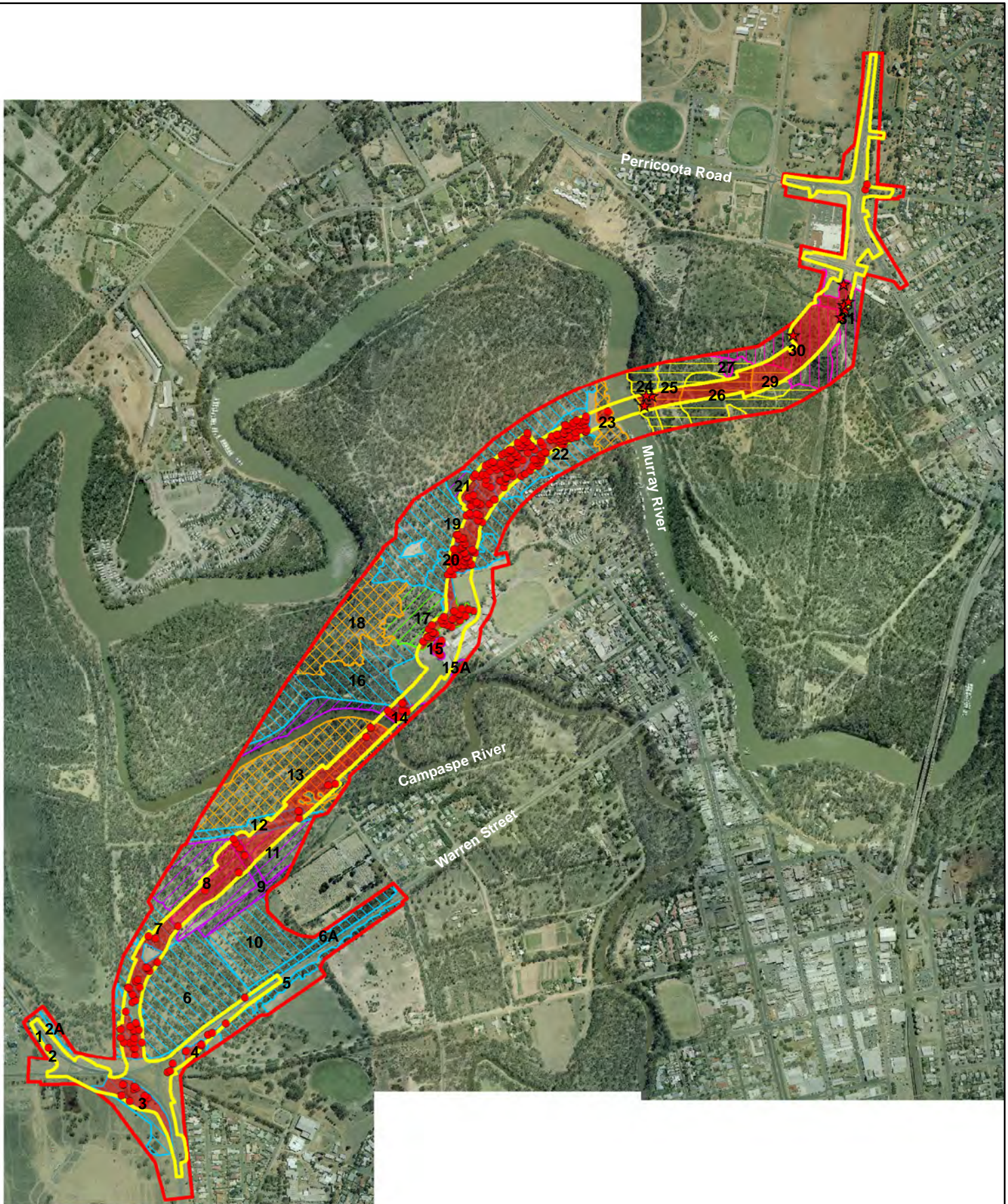
Project No.: 8194 Date: 12/04/2013 Created By: J. Sullivan / M. Ghasemi



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Legend

Native Vegetation

Victoria

- Grassy Riverine Forest (EVC 106)
- Riverine Chenopod Woodland (EVC 103)
- Riverine Grassy Woodland (EVC 295)
- Semi-arid Woodland (EVC 97)

New South Wales

- River Red Gum - herbaceous tall open forest
- River Red Gum - Black Box woodland

- Study Area
- Alignment Option 2B
- Trees to be removed
- Hollow bearing trees to be removed
- Habitat Zones
- Native vegetation to be removed

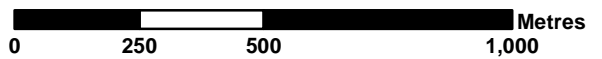


Figure 26: Native vegetation removed by alignment option 2B

Project: Murray River Crossing Echuca

Client: VicRoads

Project No.: 8194 Date: 12/04/2013 Created By: J. Sullivan / M. Ghasemi



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8. COMMONWEALTH IMPACTS AND REGULATORY IMPLICATIONS

8.1. EPBC Act

The *Environment Protection and Biodiversity Conservation Act 1999* contains a list of threatened species and ecological communities that are considered to be of national conservation significance. Any impacts on these species considered significant requires the approval of the Australian Minister for the Environment. If there is a possibility of a significant impact on nationally threatened species or communities or listed migratory species, a Referral under the EPBC Act should be considered. The Minister will decide after 20 business days whether the project will be a 'controlled action' under the EPBC Act, in which case it cannot be undertaken without the approval of the Minister. This approval depends on a further assessment and approval process lasting up to six to nine months.

8.1.1. *Threatened ecological communities*

No EPBC Act listed ecological communities were recorded and none is considered likely to occur.

8.1.2. *Threatened flora species*

No EPBC Act listed flora species were recorded during the current investigation and none is considered likely to occur.

8.1.3. *Threatened fauna species*

Twelve EPBC Act listed threatened fauna species were predicted to occur within or near the study area, including five birds, two mammals, one reptile, one frog and three fish. Species likely to occur are discussed below; those not likely to occur in the study area are not discussed further (Table 12).

No bird species listed as threatened under the EPBC Act were observed during the assessment; however, the **Swift** and **Superb Parrots** were species considered likely to utilise the habitats occasionally whilst moving between core habitat areas. However, such utilisation would only be for short periods and no impacts are expected on their populations from changes to habitats in the study area arising from the proposed crossing.

Among mammals, the EPBC Act threatened **Corben's Long-eared Bat** was recorded within the study area. Records were mostly from mixed woodlands in the Victorian part of the study area. The bat is largely restricted in its distribution to the Murray–Darling Basin (Churchill 2008) and removal of hollow trees that could serve as its roosting sites is considered to result in a low level of habitat loss. Based on the current investigation, there are no significant habitat features for the species that are considered to distinguish the study area from the habitats in the adjacent region. Hence the removal of a small amount of habitat in comparison to the available habitat in the region is not considered to have a significant impact on the species.

While not recorded during the aquatic survey undertaken in the study area (GHD 2012), the **Macquarie Perch**, **Murray Cod** and **Murray Hardyhead** are known to inhabit and travel along the Murray River and are considered likely to pass

through the study area. Provided bridge infrastructure is limited to the river banks, and that appropriate erosion controls are adopted during the construction, impacts to these threatened fish species are considered to be negligible.

8.1.4. *Migratory bird species*

Twelve EPBC Act listed migratory bird species were predicted to occur within or near the study area. Species likely to occur are discussed below; those not likely to occur in the study area are not discussed further (Table 12).

Among the EPBC Act listed migratory species, the **Rainbow Bee-eater** was recorded within the study area throughout the survey period. This species is a common, widespread species in inland Australia including along the Murray River valley, and the potential removal of a small proportion of its habitat, is not considered to be a significant impact.

Another migratory species likely to pass through the study area is the **White-bellied Sea-eagle**. This species might occasionally travel inland over large wetlands and rivers. There are no known breeding sites within the study area or nearby. As its presence in the study area would be temporary, no impacts are expected on its population.

8.1.5. *Key Threatening Processes under the EPBC Act*

The following Key Threatening Processes are considered relevant for the project:

- Infection of amphibians with Chytrid fungus resulting in chytridiomycosis;
- Land clearance;
- Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants.

Mitigation measures in Section 11.2 identify specific actions required to manage these key threatening processes.

8.1.6. *Implications*

Under the EPBC Act a Referral is required to the Commonwealth Government for proposed actions that have the potential to significantly impact on matters of national environmental significance.

The Corben's Long-eared Bat is a value of national environmental significance that is considered to be potentially impacted by the proposed road development. Based on the current investigation, there are no significant habitat features for the species that are considered to distinguish the study area from the habitats in the adjacent region. Hence the removal of a small amount of habitat is not considered to have a significant impact on the species. Based on the amount of native vegetation and fauna habitat proposed to be removed under either option, it is considered prudent that a referral under the EPBC Act be prepared for the project. Based on the details presented above, it is recommended that the project be referred as 'Not a Controlled Action'. An EPBC Act referral is currently being prepared for the project.

9. VICTORIAN IMPACTS AND REGULATORY IMPLICATIONS

9.1. Planning controls

9.1.1. State provisions

Destruction, lopping or removal of native vegetation on allotments of 0.4 hectares or more requires a planning permit under Clause 52.17 of all Victorian Planning Schemes. This includes the removal of dead trees with a DBH of 40 centimetres or greater, native degraded treeless vegetation and/or any individual scattered native plants.

A permit is required under Clause 52.17 of the Campaspe Planning Scheme for the removal of native vegetation as part of the development of the Second Bridge Crossing at Echuca-Moama.

Before issuing a planning permit, Responsible Authorities are obligated to refer to Clause 12.01 (Biodiversity) in the Planning Scheme. This refers in turn to Victoria's Native Vegetation Management Framework – a Framework for Action, discussed in the following section.

9.1.2. Local provisions

The study area is subject to several overlays in the Campaspe Planning Scheme, one of which, the Heritage Overlay (H079) is relevant to this assessment. The purpose and implications of this overlay are discussed in this section.

Heritage Overlay (H079)

The purpose of the Heritage Overlay is to conserve and enhance heritage places of natural or cultural significance. Heritage Overlay 79 (H079) aims specifically for the conservation and enhancement of the Stand of Murray Pine, north-west of Echuca Tennis Club.

A permit is required under H079 to carry out works and/or remove trees within this area. Therefore a permit under H079 is required to undertake any development within the area of the overlay. This report provides the required information to inform the permit application for the removal of vegetation under H079.

9.2. Native Vegetation Management Framework

9.2.1. How the Framework operates

Any proposal to remove native vegetation from the study area must demonstrate that the three-step approach of 'Net Gain' outlined in the Framework has been applied. This approach is hierarchical and includes the following steps:

- **Step 1:** As a priority, **avoid** adverse impacts on native vegetation, particularly through clearance;

If the removal of native vegetation cannot be avoided:

- **Step 2:** **Minimise** impacts through appropriate consideration in the planning process and expert input to project design or management; and
- **Step 3:** Identify appropriate **offset** options.

A combination of project design and offsetting should aim to achieve a net gain in the area and quality of native vegetation across Victoria.

Responses to planning permit applications to remove native vegetation vary depending on the conservation significance of the vegetation proposed for removal. Conservation significance determines both the likelihood of approval and, importantly, the scale of the required offset. This is summarised in Table 19.

Table 19: Likely response to applications for removal of intact native vegetation

Framework conservation significance	Likely response to application for clearing	Likely offset requirements
VERY HIGH	Clearing not permitted unless exceptional circumstances apply. Offset Management Plan to be submitted with application.	Substantial Net Gain At least 2 X calculated loss in habitat hectares plus a large tree protection and replacement offset if any large trees are removed
HIGH	Clearing generally not permitted	Net Gain At least 1.5 X calculated loss in habitat hectares plus a large tree protection and replacement offset if any large trees are removed
MEDIUM	Clearing generally not permitted	Equivalent Gain At least 1 X calculated loss in habitat hectares plus a large tree protection and replacement offset if any large trees are removed
LOW	Clearing may be permitted but only as part of an appropriate sustainable use response	Equivalent Gain At least 1 X calculated loss in habitat hectares

Offset targets are directly related to the habitat hectare value of the removed vegetation. They can comprise indigenous vegetation retained for conservation purposes within the study area, or vegetation elsewhere, secured on a case-by-case basis by the proponent or through the DSE Bush Broker scheme.

Clause 66.02 of the planning scheme determines the role of the DSE in the assessment of indigenous vegetation removal planning permit applications. If an application is referred to the DSE then the Responsible Authority must follow that department's recommendation in relation to that permit application. The criteria presented in Table 20 indicate when the DSE becomes a referral authority.

The proposed road development would trigger a referral to DSE due to the proposed removal of more than one hectare of remnant patch native vegetation in either alignment option (See Table 20).

Table 20: Application referral criteria

Applications will be referred to the Department of Sustainability and Environment under the following circumstances:
<p>Scattered Trees</p> <ul style="list-style-type: none"> ▪ To remove or destroy more than 15 native trees if each tree has a trunk diameter of less than 40 centimetres at a height of 1.3 metres above ground level (DBH = diameter at 1.3 metres above ground). ▪ To remove or destroy more than 5 native trees if each tree has a trunk diameter of 40 centimetres or more at a height of 1.3 metres above ground level.
<p>Remnant Patch Vegetation (may include trees)</p> <ul style="list-style-type: none"> ▪ To remove or destroy native vegetation which is in an Ecological Vegetation Class that has a Bioregional Conservation Status of Endangered, Vulnerable or Rare if the area to be cleared is more than 0.5 hectare. ▪ To remove or destroy native vegetation which is in an Ecological Vegetation Class that has a Bioregional Conservation Status of Depleted or Least Concern if the area to be cleared is more than 1 hectare.
<p>Crown Land</p> <ul style="list-style-type: none"> ▪ To remove, destroy or lop native vegetation on Crown land which is occupied or managed by the responsible authority.

Details of how the proposed development has applied the three step approach of the Framework is provided in Section 7.3. Offsets for each option in Victoria are presented in the following section.

9.2.2. *Offset targets for removal from habitat zones*

Offsets for the removal of native vegetation from habitat zones are directly related to the habitat hectare value of the removed vegetation. These may include the permanent protection (e.g. Section 173 agreement under the *Planning and Environment Act 1987*) for conservation purposes of other existing remnant vegetation. Offsets may be located within the study area or offsite. The offset site must be actively managed to achieve a gain for a period of 10 years and subsequently maintained in perpetuity. Offsite offsets may be identified on a case-by-case basis by the proponent or through the DSE Bush Broker scheme.

Offsets must be of a like-for-like nature as outlined in the Framework. Like-for-like requirements are summarised in Table 21. Offset targets for removal of native vegetation from habitat zones in Victoria within both alignment option are presented in Tables 22a-b, including additional offset targets for removal of large trees from within habitat zones.

Table 21: Like-for-like requirements for offsetting removal of remnant patch native vegetation

Like-for-like criteria	Conservation significance			
	Very high	High	Medium	Low
Type of vegetation that may be used for offsets	Same EVC	Same EVC OR <i>very high</i> conservation significance vegetation within the same bioregion	Any EVC in the same bioregion OR <i>very high</i> or <i>high</i> conservation significance vegetation in an adjacent bioregion	
Minimum quality of the existing vegetation proposed as the basis of an offset	90% of the quality in the area being lost	75% of the quality in the area being lost	50% of the quality in the area being lost	
Maximum proportion of the offset target (in Habitat Hectares) that may be achieved through revegetation	10%	25%	50%	100%

Table 22a: Native vegetation removal and offset targets for Alignment Option 2A in Victoria

Habitat Hectares								Large Old Tree's (LOTs)				
Habitat Zone	Habitat Score (out of 1)	EVC	Conservation Significance	Area of Removal (ha)	Habitat hectare Loss (Hha)	Net Gain Multiplier	Net Gain Target (Hha)	No. of LOT's removed	Protect		Recruit	
									Multiplier	Target (trees)	Multiplier	Target (plants)
1	0.33	103	High	0.017	0.01	1.5	0.01	0	4	0	20	0
2	0.33	103	High	0.013	0.00	1.5	0.01	0	4	0	20	0
2A	0.47	103	High	0	0	1.5	0	0	4	0	20	0
3	0.47	103	High	1.125	0.53	1.5	0.79	10	4	40	20	200
4	0.45	103	High	0.199	0.09	1.5	0.13	3	4	12	20	60
5	0.57	103	Very High	0.094	0.05	2	0.11	3	8	24	40	120
6	0.71	103	Very High	1.665	1.18	2	2.36	30	8	240	40	1200
6A	0.51	103	Very High	0.049	0.02	2	0.05	0	8	0	40	0
7	0.69	103	Very High	0.725	0.50	2	1.00	3	8	24	40	120
8	0.51	295	Very High	1.916	0.98	2	1.95	3	8	24	40	120
9	0.56	295	Very High	0	0	2	0	0	8	0	40	0
10	0.5	103	Very High	0	0	2	0	0	8	0	40	0
11	0.57	295	Very High	0	0	2	0	0	8	0	40	0
12	0.58	103	Very High	0.146	0.08	2	0.17	4	8	32	40	160
13	0.49	106	Very High	1.542	0.76	2	1.51	16	8	128	40	640
14	0.52	295	Very High	0.329	0.17	2	0.34	11	8	88	40	440
15	0.34	295	High	0	0	1.5	0	0	4	0	20	0
15A	0.38	295	High	0	0	1.5	0	0	4	0	20	0
16	0.55	103	Very High	0.943	0.52	2	1.04	15	8	120	40	600
17	0.6	97	Very High	0	0	2	0	0	8	0	40	0
18	0.44	106	Very High	1.829	0.80	2	1.61	16	8	128	40	640
19	0.67	103	Very High	3.611	2.42	2	4.84	122	8	976	40	4880
20	0.56	103	Very High	0	0	2	0	0	8	0	40	0
21	0.66	295	Very High	0.626	0.41	2	0.83	4	8	32	40	160
22	0.49	103	Very High	1.153	0.56	2	1.13	57	8	456	40	2280
23	0.37	106	High	0.208	0.08	1.5	0.12	1	4	4	20	20
Totals				16.19	9.18		18.00	298		2328		11640

Table 23b: Native vegetation removal and offset targets for Alignment Option 2B in Victoria

Habitat Zone	Habitat Hectares							Large Old Tree's (LOTs)				
	Habitat Score (out of 1)	EVC	Conservation Significance	Area of Removal (ha)	Habitat hectare Loss (Hha)	Net Gain Multiplier	Net Gain Target (Hha)	No. of LOT's removed	Protect		Recruit	
									Multiplier	Target (trees)	Multiplier	Target (plants)
1	0.33	103	High	0.017	0.01	1.5	0.01	0	4	0	20	0
2	0.33	103	High	0.013	0.00	1.5	0.01	0	4	0	20	0
2A	0.47	103	High	0	0	1.5	0	0	4	0	20	0
3	0.47	103	High	1.124	0.53	1.5	0.79	10	4	40	20	200
4	0.45	103	High	0.199	0.09	1.5	0.13	3	4	12	20	60
5	0.57	103	Very High	0.094	0.05	2	0.11	3	8	24	40	120
6	0.71	103	Very High	1.676	1.19	2	2.38	28	8	224	40	1120
6A	0.51	103	Very High	0.049	0.02	2	0.05	0	8	0	40	0
7	0.69	103	Very High	0.574	0.40	2	0.79	3	8	24	40	120
8	0.51	295	Very High	1.78	0.91	2	1.82	2	8	16	40	80
9	0.56	295	Very High	0.283	0.16	2	0.32	4	8	32	40	160
10	0.5	103	Very High	0	0	2	0	0	8	0	40	0
11	0.57	295	Very High	0.74	0.42	2	0.84	0	8	0	40	0
12	0.58	103	Very High	0.571	0.33	2	0.66	3	8	24	40	120
13	0.49	106	Very High	2.04	1.00	2	2.00	5	8	40	40	200
14	0.52	295	Very High	0.283	0.15	2	0.29	6	8	48	40	240
15	0.34	295	High	0.163	0.06	1.5	0.08	4	4	16	20	80
15A	0.38	295	High	0	0	1.5	0	0	4	0	20	0
16	0.55	103	Very High	0.094	0.05	2	0.10	2	8	16	40	80
17	0.6	97	Very High	0.696	0.42	2	0.84	27	8	216	40	1080
18	0.44	106	Very High	0	0	2	0	0	8	0	40	0
19	0.67	103	Very High	2.78	1.86	2	3.73	96	8	768	40	3840
20	0.56	103	Very High	0.671	0.38	2	0.75	26	8	208	40	1040
21	0.66	295	Very High	0.207	0.14	2	0.27	2	8	16	40	80
22	0.49	103	Very High	1.266	0.62	2	1.24	59	8	472	40	2360
23	0.37	106	High	0.208	0.08	1.5	0.12	1	4	4	20	20
Totals				15.53	8.86		17.33	284		2200		11000

Impacts to native vegetation differ for each alignment option in Victoria (Table 22a-b). The impacts of these options are discussed below.

Ultimate Alignment Option 2A

This option will result in the removal of 16.19 hectares (9.18 habitat hectares) of native vegetation in Victoria as well as the loss of 298 large old trees within patches. This will result in an offset target of 18 habitat hectares as well as the protection of 2,328 large old trees and recruitment of 11,640 new plants.

Ultimate Alignment Option 2B

This option will result in the removal of 15.53 hectares (8.86 habitat hectares) of native vegetation in Victoria as well as the loss of 284 large old trees within patches. This will result in an offset target of 17.33 habitat hectares as well as the protection of 2,200 large old trees and recruitment of 11,000 new plants.

Additional offsets common to both alignment options

Additional offsets, namely the protection of four trees (very large) and recruitment of 50 new plants OR the recruitment of 180 new plants are required for the removal of four scattered trees in Victoria. The offsets required to compensate for the removal of these four scattered trees in Victoria are common to both alignment options.

Comparison

Alignment Option 2A would result in the highest loss of remnant patch native vegetation as well as the highest loss of large old trees in Victoria. Alignment Option 2A therefore has the highest overall offset required in Victoria.

An appropriate third party offset site (i.e. site located on another property) would need to be identified through discussions with the Responsible Authority or with the DSE BushBroker coordinator to meet the offset requirements in Victoria for this project.

9.2.3. *Offset targets for removal of scattered trees*

Any approved removal of scattered trees will attract an offset target comprising protection and recruitment components, whereby a prescribed number of trees of the same size class must be protected and recruitment (planting or assisted regeneration) of indigenous plants undertaken. The scale of the offset is determined by the size of the trees proposed to be removed. Alternatively, in the event that the protection of existing trees is considered not to be feasible, a 'recruit only' offset for tree removal may apply, subject to negotiation with the Responsible Authority.

Scattered Tree removal is the same for each alignment option in both Victoria and New South Wales. Offset targets for approved removal of scattered trees in Victoria, as determined by the Framework and the North Central Native Vegetation Plan (NCCMA 2005), are presented in Table 23 below.

These offsets could also be identified through BushBroker.

Table 24: Offset targets for scattered tree removal in Victoria

Conservation Significance	Size Class	Trees to be Removed	Protect and Recruit Option				Recruit Only Option
			Protect		Recruit		
			Multiplier	Offset Total	Multiplier	Offset Total	
Medium	Very large	1	x 4	4	x 20	20	150
Low	Small	3	N/A	N/A	x 10	30	30
Totals		4		4		50	180

*Note: The same offsets for scattered trees in Victoria apply to all alignment options.

9.3. FFG Act

The Victorian *Flora and Fauna Guarantee Act 1988* lists threatened flora and fauna species to provide for their protection and management. The FFG Act has limited direct application to private land. However, Clause 12.01 of the Planning Scheme makes reference to this Act. The local planning authority is likely to consider impacts on FFG Act-listed species and communities when deciding on planning permit applications.

The removal of threatened species or communities, or protected flora under the FFG Act from public land requires a licence under the Act. This licence is obtained from the Department of Sustainability and Environment.

9.3.1. Threatened ecological communities

One area of native vegetation recorded in the study area, namely the stand of Murray Pines on the sand hill may meet the criteria of the FFG Act listed threatened ecological community, the Semi-arid Herbaceous Pine Woodland Community. Very little information is available on this community. It is considered based on the weed infested nature of this part of the site that this area would not be considered the listed community and no further consideration has been given to this.

9.3.2. Threatened/protected flora species

One flora species, Weeping Myall, listed as threatened under the FFG Act was recorded in the Victorian side of the study area.

The following flora, while not listed as threatened, are listed as protected under the FFG Act and were recorded on public land within the study area:

- Asteraceae (Daisy Family):
 - Blue-burr Daisy;
 - Common Cudweed;
 - Common Sneezeweed;

- Cotton Fireweed;
 - Drooping Cassinia;
 - Jersey Cudweed;
 - New Holland Daisy;
 - Shiny Everlasting; and
 - Woodland Swamp Daisy.
- Acacia (Wattles):
 - Gold-dust Wattle; and
 - Golden Wattle.

A license under the FFG Act will be required for their removal.

9.3.3. *Threatened fauna species*

Apart from species discussed under the EPBC Act above, 19 additional threatened fauna (11 birds, three mammals, two reptiles, no frogs and three fish) were FFG Act listed species and were recorded on the AVW.

Four fauna species listed under the FFG were recorded during the current field surveys. These were the Masked Owl, Squirrel Glider, Yellow-bellied Sheathtail Bat and Corben's Long-eared bat. The implications pertaining to Corben's Long-eared bat are discussed above under the EPBC Act.

- **Masked Owl:** Although the single individual masked Owl was recorded in the NSW component of the study area (Figure 22), it would be considered to also occur in the Victorian component of the study area. The removal of native vegetation within the study area is likely to have a negative impact on this species, namely through the reduction of suitable habitat.
- **Squirrel Glider:** Although the single individual was recorded in the NSW component of the study area, it is considered likely to also inhabit the Victorian component. This species is likely to be impacted by the project, and mitigation measures have been included in Section 11.2.
- **Yellow-bellied Sheathtail Bat:** While this species was recorded in the study area, there is considered to be widespread availability of habitat for this species in the region, and any impacts on the local populations of this bat would almost be negligible. This species is highly mobile and would be likely to move away from the region during the warmer months of the year further reducing impacts on the species.

Eleven further species are considered likely to occur within the study area:

- **Barking Owl:** The species is a well known raptor that inhabits riparian forests and woodlands. The owl is likely to inhabit the large River Red-gum and Black Box, particularly those with large suitable hollows. The species was not detected in earlier (BL&A 2011) or current targeted surveys undertaken as part of this investigation. As this species was not recorded during these targeted surveys, it is now considered unlikely to use the study area regularly and is not likely to be impacted by the project.

- **Bush Stone–Curlew:** Similar to the owl, the curlew was not recorded in earlier (BL&A 2011) or current targeted surveys undertaken as part of this investigation. As this species was not recorded during these targeted surveys it is now considered unlikely to use the study area regularly and is not likely to be impacted by the project.
- **Grey–crowned Babbler:** The Babbler inhabits dry woodlands and forests with a shrub layer and a groundcover of leaf litter and fallen timber. This babbler is likely to inhabit the woodlands and forests within the study area. During the 2009 site survey no evidence was found of its occurrence (BL & A 2011) and none was recorded during the current survey. Therefore the species is considered to be an occasional visitor in the study area and it is unlikely that the proposed development would have an adverse effect on this species.
- **Eastern Great and Intermediate Egrets:** Both species are likely to inhabit river margins and billabongs within the study area. However, the bird populations of these two species are not likely to be impacted by development, as the birds could avoid disturbance by moving away from the site along the Murray River.
- Four bushbirds, namely the **Turquoise parrot, Speckled Warbler, Hooded Robin** and **Diamond Firetail** are likely to occur in the study area, particularly within the Black box Woodland. Clearing of large sections of the woodland might impact on their population, but as only a few individuals are likely to use these woodlands at any one time, the impacts would be minimal.
- **Murray River Turtle and Silver Perch:** These inhabit and travel along the Murray River. Provided impacts on the river do not prejudice movement opportunities for the turtle and the native fish then impacts are considered to be negligible to these aquatic fauna.

9.3.4. *Key Threatening Processes under the FFG Act*

The following Key Threatening Processes are considered relevant for the project:

- Degradation of native riparian vegetation along Victorian rivers and streams.
- Habitat fragmentation as a threatening process for fauna in Victoria.
- Infection of amphibians with Chytrid Fungus, resulting in chytridiomycosis.
- Input of toxic substances into Victorian rivers and streams.
- Invasion of native vegetation by “environmental weeds”.
- Loss of coarse woody debris from Victorian native forests and woodlands.
- Loss of hollow-bearing trees from Victorian native forests.

Mitigation measures in Section 11.2 identify specific actions required to manage these key threatening processes.

9.3.5. *Implications*

A Protected Flora Licence under the FFG Act would be required from DSE to remove the abovementioned FFG Act protected flora from public land. The responsible authority will consider impacts on the listed threatened values when assessing the planning application.

9.4. EE Act

The “Ministerial Guidelines for Assessment of Environmental Effects under the *Environment Effects Act 1978*” (DSE 2006), identifies the following criteria related to flora and fauna which assist in determining whether a Referral to the State Minister for Planning is required:

- Potential clearing of ten hectares or more of native vegetation from an area with endangered EVC, or vegetation that is or is likely to be, of very high conservation significance according to Victoria’s Native Vegetation Management Framework, except where authorised under an approved Forest Management Plan or Fire Protection Plan;
- Potential long-term loss of a significant proportion (1 to 5% depending upon conservation status of species concerned) of known remaining habitat or population of a threatened species in Victoria;
- Potential long-term change to a wetland’s ecological character, where that wetland is Ramsar listed, or listed in ‘A Directory of Important Wetlands in Australia’;
- Potential major effects upon the biodiversity of aquatic ecosystems over the long term;
- Potential significant effects on matters listed under the *Flora and Fauna Guarantee Act 1988*.

Based on the proposed level of removal of very high conservation significance vegetation in Victoria, the first criterion is met for either of the two alignment options. A Referral to the Victorian Minister for Planning who will determine if an EES is required is therefore considered to be necessary for the project.

9.5. DSE advisory lists

Rare and threatened species advisory lists administered by the Department of Sustainability and Environment include flora and fauna species known to be rare or threatened throughout the state. Although the advisory list has no statutory status, the Responsible Authority will consider impacts on any species on the list when assessing a planning application.

Three flora species from the *DSE Advisory List of Rare and Threatened Plants in Victoria* (DSE 2007b), Blue-burr Daisy, Pale Flax-lily (Riverina) and Weeping Myall were recorded in the study area and are susceptible to impacts from the proposed development.

The following fauna species listed on the *DSE Advisory List of Threatened Vertebrate Fauna in Victoria* (DSE 2007c) are vulnerable to impacts from the proposed development.

- ***Fauna recorded within the study area:*** The Black-Chinned Honeyeater, Brown Treecreeper, Azure Kingfisher, Brown Quail and Nankeen Night Heron were recorded in the Victorian section of the study area. Impacts on these species vary depending on their habitats. The Black Box woodland inhabitants including Black-chinned Honeyeater, Brown Treecreeper and the Brown Quail would be more affected if parts of their habitat are to be removed. This would be more so for the treecreeper as a thriving breeding population was found to occupy the woodlands of the study area. The Nankeen Night Heron and the

Azure Kingfisher are species associated with streams and rivers and are less likely to be impacted upon by habitat manipulation.

Two additional listed species, the Squirrel Glider and Masked Owl, were recorded in the NSW component of the study area, and they are also considered likely to be inhabiting the Victorian component.

The species discussed above could avoid disturbance by moving along the Murray River where there is extensive available suitable habitat remaining. Population level impacts of the project are therefore not considered to be significant for these species.

- ***Species likely to occur:*** Two additional species likely to occur (not discussed above) include Royal Spoonbill and Golden Perch. Both species are aquatic and restricted to the river or its billabongs. As the case with other wetland species discussed above, little impact is expected on their populations as the extent of habitat affected is limited to the river banks.

10. NEW SOUTH WALES IMPACTS & REGULATORY IMPLICATIONS

10.1. Planning Controls

10.1.1. *State Environmental Planning Policy (Infrastructure) 2007*

The New South Wales State Environmental Planning Policy (Infrastructure) 2007 (ISEPP) aims to facilitate the effective delivery of infrastructure across the State. Clause 94 of ISEPP permits development on any land for the purpose of a road or road infrastructure facilities to be carried out by or on behalf of a public authority without consent.

As the proposal is for the construction of new road infrastructure and is to be carried out by the Roads and Maritime Services (RMS) Transport Department, it is assessed under Part 5 of the *Environmental Planning and Assessment Act 1979* (EPA Act) and development consent from council is not required. The implications of the EPA Act are discussed in Section 10.3.

10.1.2. *State Environmental Planning Policy No. 44 (Koala Habitat)*

State Environmental Planning Policy No. 44 requires Councils to take into consideration impacts on the Koala before taking a decision about a proposed project. Specifically, it “aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas to ensure a permanent free-living population over their present range and reverse the current trend of koala population decline”.

Murray Shire is listed in Schedule 1 of the SEPP as a shire to which the policy applies.

The policy identifies Koala habitat as either:

- **“Core koala habitat** is an area of land with a resident population of koalas, evidenced by attributes such as breeding females (that is, females with young) and recent sightings of and historical records of a population; or
- **Potential koala habitats** are areas of native vegetation where the trees of the types listed in Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component.”

River Red Gum (*E. camaldulensis*) is identified in Schedule 2 of SEPP No. 44 as a Koala feed tree species. As more than 15% of the trees in the affected area belong to this species, the habitat is ‘potential koala habitat’. Given this, the SEPP calls for a determination to be made on whether the habitat is core koala habitat. This is discussed below.

No Koalas have been detected in the Echuca region in any of the extensive flora and fauna field investigations for this project since 2008. Review of the occurrence of this species in the search region (within 10 kilometers of the proposed development site) in the Atlas of Victorian Wildlife indicates that there are no historical records of the species. The nearest records of the Koala to the study area are from a site approximately 10 kilometers to the west along the Murray River (one record) and the Barmah Forest, approximately 20 kilometers to the east.

This indicates that there is no evidence of either a current or historical population of the Koala in the study area. Therefore, the habitat is not 'core koala habitat' as defined in the SEPP and the provisions of this SEPP therefore do not apply.

10.1.3. *Other State Environmental Planning Policy*

The proposal is not located on land reserved under the *National Parks and Wildlife Act 1974* and does not affect land or development regulated by *State Environmental Planning Policy No. 14 - Coastal Wetlands* or *State Environmental Planning Policy No. 26 - Littoral Rainforests*.

10.2. **Native Vegetation Act 2003**

Development consent is not required under the New South Wales *Native Vegetation Act 2003* for the project as it will be assessed under Part 5 of the *Environmental Planning and Assessment Act 1979*.

10.3. **Fisheries Management Act 1994**

The FM Act lists threatened fauna and ecological communities that are threatened and provides policy and guidelines to protect threatened species habitats.

10.3.1. *Threatened fish species*

The following threatened species listed under the FM Act are considered likely to occur at the study area:

- Macquarie Perch;
- Murray Hardyhead; and
- Trout Cod.

More detailed assessments are required for these species once a detailed development footprint has been agreed upon to determine if a significant impact on them is likely. These assessments will be included in the REF.

10.3.2. *Endangered ecological community*

The Fisheries Scientific Committee established under Part 7a of the FM Act made a recommendation to list the *Aquatic Ecological Community in the Natural Drainage System of the Lower Murray River Catchment* (Murray River EEC) as an EEC in Part 3 of Schedule 4 of the FM Act. This EEC is listed as endangered by the NSW Department of Primary Industries (DPI 2007) and has been identified as occurring in the study area (Figure 10). Within the study area the Murray River Channel and the Flooded Woodland wetland area meet the selection criteria of the lower Murray aquatic ecological community.

The endangered listing of this EEC affords all indigenous aquatic biota within the bounds of that ecological community legal protection under the NSW FM Act. Potential threats to this EEC include modification to natural river flows and sedimentation (Section 7.3) and mitigation measures will be implemented to address these potential impacts (Section 11.2).

Within the flooded woodland wetland in the study area, an impact on this EEC protected indigenous aquatic biota is likely due to the likely development in this

area. Assessments of significance will be required for the lower Murray aquatic ecological community when the REF is prepared. Impacts on this community's indigenous aquatic biota will be considered during the permit application process.

10.4. Environmental Planning and Assessment Act 1979

10.4.1. Native Vegetation

Native vegetation proposed for removal in New South Wales

River Red Gum - Black Box woodland of the semi-arid (warm) climatic zone is estimated to be 45% cleared in the Murray Catchment, and River Red Gum - herbaceous tall open forest of the Riverina and Murray Darling Depression Bioregions is estimated to be 10% cleared in this catchment. Both these vegetation types fall below the 70% threshold for an 'overcleared vegetation type' based on the NSW BioMetric tool.

The area of native vegetation impacted in NSW totals 5.19 hectares (Table 24). This is the same for all alignment options as the alignment in the NSW section of the study area is fixed. Two scattered trees are also required for removal in New South Wales. These are detailed in Appendix 4.

Table 25: Proposed native vegetation losses in New South Wales

Site ID	Vegetation Type	Area of native vegetation removed (ha)
24	River Red Gum - Black Box woodland	0.25
25	River Red Gum - Black Box woodland	0.38
26	River Red Gum - Black Box woodland	1.18
27	River Red Gum - herbaceous tall open forest	0
29	River Red Gum - Black Box woodland	0.68
30	River Red Gum - herbaceous tall open forest	2.13
31	River Red Gum - herbaceous tall open forest	0.56
Totals		5.19

Impacts to hollow-bearing trees in NSW have also been quantified and are discussed in Table 26.

As the project will be assessed under Part 5 of the *Environmental Planning and Assessment* in NSW, formal offsetting is not required, and BioBanking is not relevant (pers comms. Steve Hall, Senior Vegetation Officer, Murray CMA, September 2012). Rather, offsets could be achieved through the protection of like-for-like native vegetation within the Murray CMA. Recommendations for appropriate offsets are provided in the recommendations (Section 11).

It is understood that a Review of Environmental Factors (REF) will be required to be prepared at a later date when more information is available to assess all potential impacts to the environment.

10.4.2. *Threatened Species*

The *Environmental Planning and Assessment Act 1979* (EPA Act) sets out a Seven Part Test that determines whether a Species Impact Statement should be prepared under the *Threatened Species Conservation Act 1995* (TSC Act) for a development. The aim of the Seven Part Test is to ascertain whether a proposed project is likely to lead to a significant impact on a threatened species or community that requires more detailed assessment under the TSC Act.

A full copy of the Seven Part Test criteria is provided in Appendix 7. The various criteria are relevant to specific values. These are presented separately below.

Threatened Species are considered under Criteria A, D and F of the Seven Part Test. The Seven Part Test should be undertaken for a threatened species whenever the presence of a threatened species listed on the TSC Act in an affected area is confirmed or likely. The relevant criteria for the Seven Part Test are addressed in Table 26, for all TSC Act listed species recorded or deemed likely to occur in the study area. The following threatened species have been subjected to the relevant criteria of the Seven Part Test in this section (Table 26):

- Flora:
 - Slender Darling-pea
 - Small Scurf-pea
 - River Swamp Wallaby-grass and
 - Western Water Starwort
- Fauna:

<ul style="list-style-type: none"> ○ Barking Owl ○ Masked Owl ○ Bush Stone-Curlew ○ Black-chinned Honeyeater ○ Brown Treecreeper ○ Diamond Firetail ○ Grey-crowned Babbler ○ Hooded Robin ○ Speckled warbler ○ Superb Parrot ○ Swift Parrot 	<ul style="list-style-type: none"> ○ Turquoise Parrot ○ Varied Sittella ○ Corben's Long-eared Bat ○ Yellow-bellied Sheath-tail Bat ○ Squirrel Glider ○ Koala ○ Growling Grass Frog ○ Macquarie Perch ○ Murray Hardyhead ○ Trout Cod
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10.4.3. *Endangered Populations*

Endangered populations are considered under Criteria B and D of the Seven Part Test. No endangered populations of flora or fauna currently listed under Schedule 1 Part 2 of the TSC Act occur in the NSW search region (OEH 2011). Therefore, none is considered to be affected by the proposed development.

Table 26: Summary of responses to the criteria of the Seven Part Test for threatened species

Species listed under the TSC Act with potential to occur within the study area	(a) whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,	(d) (i) the extent to which habitat is likely to be removed or modified (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species.	(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,
Slender Darling-pea, Small Scurf-pea, River Swamp Wallaby-grass, Western Water-starwort	Some suitable habitat present in Forested Wetland in New South Wales considered being limited to Habitat Zones 27 and 30. Species not recorded during targeted survey, therefore the proposed action is unlikely to have an adverse effect.	Few areas of suitable habitat for these species occur in the corridor. Furthermore these species were not recorded during targeted surveying in the peak flowering period. As such, the removal or modification of this habitat is not considered to have a long-term effect on the survival of these species in the local area.	No recovery plan exists for these species.
Barking Owl	Occurs in River Red-gum forests and woodlands, particularly among large trees with suitable hollows. Targeted surveys failed to locate the species within the study area. Therefore the project is not considered to have an adverse impact on this species.	Potential Barking Owl habitat is likely to be removed within the proposed bridge construction alignments. Potential threatened fauna habitat is likely to become fragmented where native vegetation is proposed for removal within the alignments. Although potential habitat will become fragmented, no core or breeding habitat will be fragmented or isolated. There is limited overall potential habitat for the Barking Owl in the study area due to the absence of individuals.	A recovery plan exists for the Barking Owl (NSW NPWS 2003). The proposed action meets objective 3, <i>Action 3.2</i> (Assist with the protection of Barking Owl habitat from disturbance due to developments and activities). Previous surveys for this species were carried out in early January 2009 (BL&A 2011) and a recent survey in November 2011 did not locate the species.
Masked Owl	During frog surveying in the study area there was an incidental sighting of a Masked Owl. The species is known to occur in open woodlands and forests that provide dense and tall tree cover, and adjoining open habitats such as cleared farmlands. Dense and tall tree cover is a minor habitat component of the study, and would therefore not be considered core habitat for the species. The proposed bridge could impact this species through habitat fragmentation; however it would not place the local population at risk of extinction.	While some Masked Owl habitat is likely to be removed and fragmented to facilitate construction of the proposed bridge, it is not considered to pose any threat to the long-term existence of the species.	A recovery plan exists for the Masked Owl (DEC 2006). The plan cites 'clearing of native vegetation' and 'removal of dead wood and dead trees' as having an adverse affect on the Masked Owl. The proposed action will likely result in both of the above. However, the removal of a small area of non-core habitat for the species is not considered to contravene the objectives of the recovery plan.
Bush-stone Curlew	A small population of the Bush-stone Curlew may be present in River Red-gum woodland/forest habitat. No individuals or its nests were found during targeted searches for the species. The proposed action is not likely to have an adverse impact.	Potential Bush-stone Curlew habitat is likely to be removed within the proposed bridge construction alignments. Potential threatened fauna habitat is likely to become fragmented where native vegetation is proposed for removal within the alignment. Although potential habitat will become fragmented, no core or breeding habitat will be fragmented or isolated. There is limited overall potential habitat for the Bush-stone Curlew in the study area due to the absence of individuals. Therefore this area of native vegetation is unlikely to provide important habitat for a local population of the species.	A recovery plan exists for the Bush-stone Curlew (DEC 2006). The proposed action meets Objective 6 of this recovery plan: (ensure that impacts on Bush-stone Curlews and their habitat are accurately assessed during planning and environmental processes). Recommended surveys for this species were carried out in early January 2009 and repeated in November 2011. As a result of these surveys, the Bush-stone Curlew is considered unlikely to regularly utilise the study area.

Species listed under the TSC Act with potential to occur within the study area	(a) whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,	(d) (i) the extent to which habitat is likely to be removed or modified (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species.	(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,
Brown Treecreeper	A large population of Brown Treecreeper was observed on the Victorian side in Black Box, but only few individuals were seen in the New South Wales. The proposed bridge could impact this species through habitat fragmentation. However, impacts would not significantly affect its population as its core habitat lies across the Murray River in the Victorian section of the study area.	Sub-optimal habitat for the Brown Treecreeper will be removed within the proposed bridge construction alignments. Some potential threatened fauna habitat is likely to become fragmented where native vegetation is proposed for removal within the alignments. No core or breeding habitat will be fragmented or isolated in the NSW section. The area to be affected is unlikely to provide core breeding habitat for Brown Treecreeper.	No recovery plan exists for the Brown Treecreeper
Grey-crowned Babbler	During both earlier (BL&A 2011) and current surveys no evidence was found of its occurrence, in particular no nests were located and no birds were found. Therefore the species is considered to be most likely an occasional visitor in the study area and it is unlikely that the proposed action would have an adverse effect on the life cycle of this species.	Sub-optimal habitat for the Grey-crowned Babbler will be removed within the proposed bridge construction alignments, leading to minor fragmentation in the vicinity of the alignment. No core or breeding habitat will be fragmented or isolated. The area to be affected is unlikely to provide core nesting habitat for Grey-crowned Babbler, since none of their distinctive nests was found despite active searching.	No recovery plan exists for the Grey-crowned Babbler
Black-chinned Honeyeater, Hooded Robin, Diamond Firetail, Speckled Warbler Varied Sittella	Suitable habitat exists in River Red-gum and Black Box woodland. Black chinned-honeyeater and Varied Sittella were recorded during the investigation. Impacts to these species are likely to be minimal due to their low numbers and lack of core habitats.	Some habitat of these species is proposed to be removed. This would result in some habitat fragmentation; however this would have negligible effect due to the species' low abundance and lack of consistent records from and therefore occurrence in the study area.	No recovery plan exists for any of the four species.
Swift Parrot	May occasionally occur in River Red-gum woodland/forest habitat in small numbers. Although the study area contains potential foraging habitat, the preferred food trees of the species, such as Red Ironbark, Grey Box, Yellow Gum and White Box, are absent. Therefore the species is considered to be most likely an occasional visitor when searching for flowering Eucalypts during migration. It is unlikely that the proposed bridge construction would have an adverse effect on the life cycle of this species.	Sub-optimal habitat for the Swift Parrot will be removed within the proposed bridge construction alignment. Since the habitat is at present not known to regularly support Swift Parrot, there is not expected to be a significant impact from this proposal.	A recovery plan exists for the Swift Parrot (Swift Parrot Recovery Parrot 2001). The proposed action can meet Action Plan 1 of this recovery plan: Action 1. Identify the extent and quality of foraging habitat. As limited foraging habitat for this species occurs in the study area, it is unlikely to be present regularly or in significant numbers during migration. Therefore potential threats to the species within the study area have been identified as part of the flora and fauna assessment.
Superb Parrot, Turquoise parrot	Both species may occasionally occur in the River Red-gum. Both species are considered as unusual visitors and it is unlikely that the proposed bridge construction would have an adverse effect on these two species.	Sub-optimal habitat for the parrots will be removed within the proposed bridge construction alignments. Since the River Red-gum forest is not considered to regularly support both parrots, there is not expected to be a significant impact from this proposal.	No recovery plan exists for the two parrots.

Species listed under the TSC Act with potential to occur within the study area	(a) whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,	(d) (i) the extent to which habitat is likely to be removed or modified (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species.	(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,
Squirrel Glider	During frog surveying in the study area there was an incidental sighting of a Squirrel Glider. The species is likely to be restricted to the large River Red-gums and wattles in the River Red-gum woodland/forest habitat. However, due to the paucity of <i>Acacia</i> species in the understory throughout the study area and limited denning and nesting trees, a significant population is unlikely to be present. The proposed action is not likely to place the local population at risk of extinction.	Sub-optimal habitat for the Squirrel Glider will be removed within the proposed bridge construction alignments. Better quality habitat was identified on the Victorian side of the Murray River. Potential Squirrel Glider habitat is likely to become fragmented where native vegetation is proposed for removal within the alignments. This will likely result in increased road mortality, as individuals may be forced to come to ground to cross the proposed road. Mitigation recommendations including the installation of rope crossings have been provided in Section 11.2 to assist in minimising Squirrel Glider road mortality.	No recovery plan exists for the Squirrel Glider
Koala	The AVW contained no records of the species and the ANSWW contained one record from the search region approximately 10 kilometres west of the study area, It is therefore unlikely that a viable population of the species exists in the study area and the proposed action will therefore not adversely affect it.	No core habitat for the Koala will be removed within the proposed bridge construction alignments. Since the River Red-gum forest is not considered as core habitat for the species, little impact is expected on the wider population of the Koala.	There is an approved Recovery Plan for the Koala. This plan calls for Koala management activities to be implemented in areas where key populations of the Koala occur. As the study area does not support a population of the Koala, the proposed project will not prejudice achievement of the objectives and actions in the Koala Recovery Plan.
Corben's Long-eared Bat	This species was recorded at low abundance in mixed Black Box-River Red-gum woodlands on the Victorian side of the Murray River. One call of this species was recorded in New South Wales section of the study area. Due to the very low abundance of the species suggested by the two bat surveys in the study area, the project is not considered likely to place the species at risk of extinction.	Habitat requirements for the Long-eared bats are known to be the presence of tree hollows and loose bark for roosting. The areas where the Corben's Long-eared Bat was recorded in the study area consist of mixed Black Box, River Red-gum and Murray Pine woodlands. Hollow trees in the study area are considered to be mostly limited to the large old River Red-gums. These vegetation types are common adjacent to the study area and throughout the Murray Fans bioregion. The removal of a small area of habitat for the species is not considered to result in fragmentation.	<i>The draft National Recovery Plan for the South-eastern Long-eared Bat (Corben's Long-eared Bat)</i> aims to secure the long-term protection of the species through a reduction in the impact of threatening processes and to improve the standard of information available to guide recovery. This involves identifying key populations and protecting them from habitat loss and fragmentation. The removal of a small area of habitat for the species is not considered to result in fragmentation.
Yellow-bellied Sheathtail Bat	A viable population of the species was recorded at the study area on both sides of the Murray River. A much lower number of calls were recorded for this species in the second survey (Feb-March 2012) as compared to the first survey (Nov 2011). This data supports the known seasonal movements and mobility of the species. Therefore the project is not likely to impact on the species.	Habitat for the Yellow-bellied Sheathtail Bat occurs across a range of woodland vegetation types. Based on the widespread availability of habitat for this species, any impacts on the local populations of these bats would almost be negligible. The removal of a small area of habitat for the species is not considered to result in fragmentation as the species are highly mobile.	No recovery plan exists for this species

Species listed under the TSC Act with potential to occur within the study area	(a) whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,	(d) (i) the extent to which habitat is likely to be removed or modified (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species.	(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,
Growling Grass Frog (also known as Southern Bell Frog in NSW)	Targeted surveys have been undertaken for this species within the limited areas of suitable habitat within the study area. As no Growling Grass Frogs were recorded in the limited areas of suitable habitat, it is considered unlikely that the species is a permanent resident at the site. Therefore, it is unlikely that the proposed development will place any population of this species at risk of extinction.	Suitable habitat for the Growling Grass Frog is limited to two small aquatic habitats in the NSW section of the study area. Both these areas are likely to be impacted for the proposed development. Given the result of the targeted surveys, this is not considered to impact on the Growling Grass Frog, as they are considered unlikely to be a permanent resident at the site.	Fourteen priority actions exist for the recovery of the species in NSW. These actions are considered irrelevant to the proposed development as the species is unlikely to be a permanent resident at the site.
Macquarie perch, Murray Hardyhead and Trout Cod	These fish species are known to occur within the Murray River but are unlikely to be significantly impacted by the proposed development as all permanent infrastructure will be limited to the river banks.	Providing the bridge infrastructure will be limited to the river banks and appropriate erosion controls are put in place during the construction phase of the project, water quality and natural flows should not be altered. On this basis, any impacts to these threatened fish species will be negligible.	No recovery plan exists for these fish species.

10.4.4. *Endangered and Critically Endangered Communities*

Endangered and critically endangered communities are considered under Criteria C and D of the Seven Part Test. Five endangered ecological communities listed under Schedule 1 Part 3 occur in the NSW search region. None of these listed communities was recorded in the New South Wales section of the study area. No critically endangered ecological communities listed under Schedule 1A Part 2 of the TSC Act occur in the NSW search region or the study area.

Other listed endangered ecological communities

One other listed EEC, The Murray River EEC, was recorded in the NSW component of the study area. This community is listed as endangered by the NSW Department of Primary Industries (DPI 2007). This EEC has been discussed above in Section 10.3.2.

Within the flooded woodland wetland in the study area, an impact on this EEC protected indigenous aquatic biota is likely due to the likely development in this area. Assessments of significance will be required for the Murray River EEC when the REF is prepared. Impacts on this community's indigenous aquatic biota will be considered during the permit application process.

10.4.5. *Critical Habitat*

Critical Habitat is considered under Criterion E of the Seven Part Test. All critical habitat listed under the TSC Act in NSW is shown on the Critical Habitat Register (OEH 2013). The habitat recorded within the study area does not meet any of the Critical Habitat listed in the Register. No such habitat is therefore affected by the proposed project.

10.4.6. *Threatening Processes*

Threatening processes are considered under Criteria G of the Seven Part Test. Key Threatening Processes as listed under Schedule 3 of the TSC Act (1995) relevant to the development proposal include the following:

- Invasion of native plant communities by exotic perennial grasses
- Clearing of native vegetation
- Removal of dead wood and dead trees
- Infection of frogs by amphibian Chytrid causing the disease chytridiomycosis
- Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands
- Loss of Hollow-bearing Trees:

The loss of hollow-bearing trees in the NSW component of the study area has been quantified for the project. Specific losses of these trees are presented in Table 26 below, and their locations presented in Figure 23.

As shown in Table 26, a total of nine hollow-bearing trees will be removed in NSW.

Table 27: Loss of hollow-bearing trees in the NSW component of the study area

Tree no.	Remove/Retain
1 to 17	Retain
18	Remove
19	Remove
20	Remove
21 to 26	Retain
27	Remove
28	Remove
29	Remove
30	Remove
31	Retain
32	Remove
33 & 34	Retain
35	Remove
Total No. of hollow trees to be removed	9

Mitigation measures in Section 11.2 identify specific actions required to manage these above listed key threatening processes. Provided these mitigation measures are implemented, no increase in threatening processes is anticipated as a consequence of the proposed development.

10.4.7. Conclusion

Twenty-one fauna species listed under the NSW TSC Act and FM Act were recorded or considered likely to occur in the study area due to the availability of suitable habitat (Table 12 and above in Section 10.4.2). In the addition to these threatened fauna species one EEC was also identified as occurring within the study area.

While some habitat will be impacted to facilitate the proposed development, impacts are not considered to result in the extinction of any local populations or reduce the long-term existence of any of these species. A Species Impact Statement is therefore not considered to be required for the project. A Review of Environmental Factors (REF) will be required to be prepared at a later date when more information is available to assess all potential impacts to the environment.

10.5. Noxious Weeds Act 1993

Under the *Noxious Weeds Act 1993*, all listed noxious weeds in the relevant council area must be controlled to the level stated on the NSW DPI Noxious Weeds database (Appendix 17).

Paterson's Curse is the only noxious weed species recorded in the NSW section of the study area and must be controlled to the level specified in Appendix 17.

11. CONCLUSIONS AND RECOMMENDATIONS

11.1. Conclusions

Commonwealth

- One EPBC Act listed species; the Corben’s Long-eared Bat was recorded in the study area at a low abundance. Despite the occurrence of the species in the area, the removal of a small amount of habitat is not considered to have a significant impact on the species. Based on the amount of native vegetation proposed to be removed under either two options it is considered prudent that a referral under the EPBC Act be prepared for the project. Based on the details presented above, it is recommended that the project be referred as ‘Not a Controlled Action’.

Victoria

- A permit will be required under Clause 52.17 of the Campaspe Shire Planning Scheme for the removal of native vegetation in Victoria.
- The current proposal will trigger a referral to the Victorian DSE due to the amount of native vegetation proposed for removal in Victoria.
- Approval will be required by the Victorian Minister for Environment for the removal of very high conservation significance vegetation within the study area.
- The removal of native vegetation within the study area will require offsetting in accordance with Victoria’s Native Vegetation Management Framework. Offset targets are detailed as followed for each alignment option:
 - Alignment Option 2A: This option will result in the removal of 16.19 hectares (9.18 habitat hectares) of native vegetation in Victoria as well as the loss of 298 large old trees within patches. This will result in an offset target of 18 habitat hectares as well as the protection of 2,328 large old trees and recruitment of 11,640 new plants.
 - Alignment Option 2B: This option will result in the removal of 15.53 hectares (8.86 habitat hectares) of native vegetation in Victoria as well as the loss of 284 large old trees within patches. This will result in an offset target of 17.33 habitat hectares as well as the protection of 2,200 large old trees and recruitment of 11,000 new plants.
 - Additional offsets, namely the protection of four trees (very large) and recruitment of 50 new plants OR the recruitment of 180 new plants are required for the removal of these four scattered trees in Victoria. The offsets required to compensate for the removal of these four scattered trees in Victoria are common to both alignment options.
- Based on the proposed level of removal of very high conservation significance vegetation in Victoria, the first criterion is met for each of the two alignment options. A Referral to the Victorian Minister for Planning who will determine if an EES is required is therefore considered to be necessary for the project.
- One flora species (Weeping Myall) and four fauna species (Masked Owl, Squirrel Glider, Yellow-bellied Sheathtail Bat and Corben’s Long-eared Bat)

listed as threatened on the **FFG Act** were recorded in the study area. The responsible authority will consider impacts on these species when assessing the planning application.

- Three flora species (Weeping Myall, Blue-burr Daisy and Pale Flax-lily) and eight fauna species (Azure Kingfisher, Black chinned Honeyeater, Brown Quail, Brown Treecreeper, Masked Owl, Nankeen Night-heron, Corben’s Long-eared Bat and Squirrel Glider) listed under the **DSE Advisory Lists** were recorded in the study area. The responsible authority will consider impacts on these values when assessing the planning application.

New South Wales

- The alignment in the New South Wales section of the study area is fixed and will result in the removal of 5.19 hectares of native vegetation, including nine hollow-bearing trees. An additional two scattered trees will also require removal in NSW.
- As the project will be assessed under Part 5 of the *Environmental Planning and Assessment* in NSW, formal offsetting is not required, and BioBanking is not relevant (pers comms. Steve Hall, Senior Vegetation Officer, Murray CMA, September 2012). While development consent is not required for the project under the EPA Act, the NSW Roads and Maritime Services department (RMS) has developed its own internal guidelines to assist in the determination of when an offset for the removal of vegetation is warranted for general Part 5 projects. Based on the RMS ‘Guideline for Biodiversity Offsets’ (RMS 2011b), consideration is to be given to biodiversity offsets under the following criteria:
 - Works involving clearing of >5 hectares of native vegetation containing potential habitat for threatened species.
 - Works involving clearing of >1 hectare of native vegetation of a vegetation type that is more than 70% cleared, supports a threatened ecological community in moderate to good condition or contains threatened species or their habitat that cannot withstand any loss in the Catchment.
 - Works involving clearing of any native vegetation of a vegetation type that is more than 90% cleared, that would likely result in local extinctions of communities/species or would impact on Type 1 or 2 key fish habitat (NSW Fisheries).
 - Works other than clearing that would lead to an impact on the long term survival of a species in the region.
- Based on the RMS offset decision guidelines as set out above, offsets in New South Wales for the project would therefore only be considered on the basis of removal of >5 hectares of native vegetation that supports habitat for threatened species. The area of native vegetation to be removed in New South Wales is 5.19 hectares. Given that this vegetation provides habitat for threatened species including the recorded Squirrel Glider, Masked Owl, Yellow-bellied Sheathtail Bat and Corben’s Long-eared Bat, it is recommended that an offset be considered. Offsets could therefore be achieved through the protection of like-for-like native vegetation within the Murray CMA. This would be subject to agreement with VicRoads, RMS and Murray CMA.

- A total of 21 fauna species listed under the NSW TSC Act and FM Act were recorded or considered likely to occur in the study area due to the availability of suitable habitat (Table 12). In the addition to these threatened fauna species one EEC was also identified as occurring within the study area.
- While some threatened species and EEC habitat will be impacted to facilitate the proposed development, impacts are not considered to result in the extinction of any local populations or reduce the long-term existence of any of these species. A Species Impact Statement is therefore not considered to be required for the project. A Review of Environmental Factors (REF) will be required to be prepared at a later date when more information is available to assess all potential impacts to the environment.
- Additional surveys to what has been undertaken for this assessment may be required when preparing the Review of Environmental Factors in NSW. The following implications would pertain to the current development proposal.

11.2. Mitigation Recommendations

Consideration should be given to including the mitigation measures described below in a construction and operational environmental management plan for the project:

Pre-construction:

- Option 2B is recommended as the preferred option as it has the least impact to native vegetation and fauna habitat in Victoria. This alignment option takes the route of least disturbance to native vegetation by utilising existing disturbed areas including the tennis courts and sports oval in Echuca.
- Avoid the removal of large hollow-bearing trees where possible. Hollow trees such as large old River Red-gums support roosting habitat for the Squirrel Glider and bat species including the threatened Corben's Long-eared Bat recorded in the study area. The highest density of large old hollow River Red-gums was observed along an old linear reserve in Victoria identified as Habitat Zone 9.
- In order to minimise Squirrel Glider road mortality and facilitate ease of movement across the proposed road, it is recommended that crossing zones be established. These areas should be approximately one hundred metres long and incorporate the following features:
 - Suitable Squirrel Glider vegetation to be retained as close to the road as practical;
 - Artificial land/launch poles to be strategically placed to facilitate glider road crossing; and/or
 - Aerial rope bridges to be constructed over the road to facilitate glider road crossing.

Crossing zones should be designed in consultation with Rodney Van der Ree, of the Centre for Urban Ecology, Royal Melbourne Botanical Gardens, Melbourne. Rodney is an expert on Squirrel Glider ecology and has been involved in similar projects, such as the Hume Highway Upgrade – Woomargama Bypass in NSW.

- In accordance with the Victorian *Catchment and Land Protection Act 1994*, the noxious weed species listed below, which were recorded in the study area, must be controlled using precision methods (e.g. spot spraying by hand) that avoid off-target impacts. This method of control should be implemented throughout the project for the species listed below.
 - African Box-thorn;
 - Horehound;
 - Patterson’s Curse; and
 - Prickly Pear.
- All employees should be inducted into an environmental management program for construction works.
- All environmental controls should be checked for compliance on a regular basis, following the completion of the Construction Environmental Management Plan for the project.

Construction phase:

- The proposed development should be designed in a way that does not alter the hydrology of the Campaspe or Murray Rivers. It is understood that no direct impacts are considered to occur to the Campaspe River or Murray River. Piers will be constructed as the main supports for the bridges at either side of the river and no permanent bridge infrastructure will occur within the rivers themselves. Erosion controls must be adopted for these areas during construction to ensure that there is no change in water quality and flow.
- Catch traps are to be used during bridge construction to eliminate the spillage of any construction materials into the rivers. Such measures are required to ensure that aquatic habitat continuity is maintained in the Murray River during construction to avoid impacts on fish movement and migration.
- During construction, careful consideration should be given to minimise impacts on bats in general and on threatened bat species in particular.

Greg Richards (G. Richards and Associates; Australian bat fauna specialist, ACT) has developed a ***Tree clearance protocol in relation to bat colonies*** to be closely adhered to when removing vegetation that supports bats. This protocol should be undertaken when removing any hollow trees such as large old River Red-gums that may support roosting habitat for the Corben’s Long-eared Bat. The protocols are provided below:

1. Survey during the daytime the area to be cleared for trees with potential bat roost hollows, mark with flagging tape or painted number. Bird nests can also be recorded at this stage if there are avifauna issues.
2. Fell unmarked trees (without hollows) – this creates disturbed habitat, some colonies may depart to roosts elsewhere, leave trees in situ overnight.
3. If threatened bats have been recorded during surveys in the area, it may be prudent to detect under potential roosts to see if a colony emerges.

4. If EPBC species have been recorded during surveys, a bat specialist should be contacted for further advice, as the tree or roost itself may have to be relocated.
5. Fell marked trees with largest bulldozer available (the machine takes the weight of the tree so it can be felled slowly – a D9 is a suitable size).
6. For large trees, use dozer's ripper to tear large roots underground around tree.
7. Push trunk of tree with lower edge of blade, approximately one metre above ground and *with the potential roost facing the operator*.
8. Tree should still stay upright, push trunk a metre or so with bulldozer until roots are broken and dislodged.
9. Before tree starts to fall, drop blade to ground level to catch roots, hold tree.
10. Lower the tree by slowly raising the blade until it lies on the ground, and the roost should be facing upwards.
11. Push tree along ground a few metres to crush upper branches – trunk must lie flat on the ground so that it won't roll over when being inspected.
12. Inspect potential roost/s with torch to ensure that nothing is present inside.
13. Leave tree on ground for 24 hours to allow anything still inside to escape, then remove tree from site.

These additional recommendations should be considered during the construction phase of the project.

- Environmentally sensitive areas to be retained should be identified at two metres from the perimeter and appropriately signed. All machinery and earthworks are to be excluded from these areas.
- Any tree pruning should be undertaken by an experienced arborist to prevent disease or unnecessary damage to trees or disturbance to understorey vegetation during tree trimming.
- Any stockpiling must occur outside retained native vegetation and away from any drainage lines.
- All machinery should enter and exit works sites along defined routes that do not impact on native vegetation or cause soil disturbance and weed spread.
- All machinery brought on site should be weed and pathogen free. This is important for environmental and agricultural protection. Weeds and/or pathogens can be easily transported by machinery.
- Chytrid Fungus is a frog disease that can be easily transported by machinery and personnel. To ensure that this disease is not spread, all machinery and personnel working involved in the construction of the project should be weed and pathogen free prior to entering the site. Wash down methods including disinfecting of footwear and machinery tyres is recommended when working in or adjacent to areas of native vegetation or wetlands

- All machinery wash down, lay down and personnel rest areas should be defined (fenced) and located in disturbed areas well away from wetlands and waterway banks.
- Best practice erosion control should be established where an erosion hazard is identified.

Post-construction phase:

- Weed control should be carried out along disturbed areas after construction to control any weed outbreaks in adjacent areas of native vegetation.
- Any areas of temporary disturbance along the Campaspe and Murray Rivers should be revegetated with appropriate indigenous plants of local genetic provenance following construction. This measure is aimed at minimising any potential long-term adverse impacts that the proposed development may have on the health and functionality of these watercourses.
- The use of local indigenous plant species, (from seed and plant species sourced within a given radius of 50 kilometres of the site), should be considered in the landscaping of any development on the site. Locally indigenous species generally have low water-use requirements, high survival rates and provide habitat to local fauna species.

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Appendix 1: Flora species recorded in the study area and threatened species known (or with the potential) to occur in the search region

Origin	Common Name	Scientific Name	Family Name	EPBC	TSC	FFG	DSE	Recorded
*	African Box-thorn	<i>Lycium ferocissimum</i>	Solanaceae					X
*	Annual Veldt-grass	<i>Ehrharta longiflora</i>	Poaceae					X
	Ausfeld's Wattle	<i>Acacia ausfeldii</i>	Mimosaceae				v	
	Austral Trefoil	<i>Lotus australis var. australis</i>	Fabaceae				k	
	Australian Carrot	<i>Daucus glochidiatus</i>	Apiaceae					X
*	Barley	<i>Hordeum vulgare s.l.</i>	Poaceae					X
	Basalt Podolepis	<i>Podolepis sp. 1</i>	Asteraceae				e	
	Berry Saltbush	<i>Atriplex semibaccata</i>	Chenopodiaceae					X
	Black Box	<i>Eucalyptus largiflorens</i>	Myrtaceae					X
*	Black Nightshade	<i>Solanum nigrum sensu Willis (1972)</i>	Solanaceae					X
	Black-anther Flax-lily	<i>Dianella revoluta</i>	Hemerocallidaceae					X
	Blue Burr-daisy	<i>Calotis cuneifolia</i>	Asteraceae				r	X
	Bluebell	<i>Wahlenbergia spp.</i>	Campanulaceae					X
	Bluish Raspwort	<i>Haloragis glauca f. glauca</i>	Haloragaceae				k	
*	Bridal Creeper	<i>Asparagus asparagoides</i>	Asparagaceae					X
	Brown-back Wallaby-grass	<i>Rytidosperma duttonianum</i>	Poaceae					X
	Buloke	<i>Allocasuarina luehmannii</i>	Casuarinaceae			f		
	Buloke Mistletoe	<i>Amyema linophylla subsp. orientale</i>	Loranthaceae				v	
*	Cape Weed	<i>Arctotheca calendula</i>	Asteraceae					X
*	Clover	<i>Trifolium spp.</i>	Fabaceae					X
	Common Blown-grass	<i>Lachnagrostis filiformis s.l.</i>	Poaceae					X
	Common Cudweed	<i>Euchiton involucratus s.l.</i>	Asteraceae					X
*	Common Heron's-bill	<i>Erodium cicutarium</i>	Geraniaceae					X
	Common Nardoo	<i>Marsilea drummondii</i>	Marsileaceae					X

Origin	Common Name	Scientific Name	Family Name	EPBC	TSC	FFG	DSE	Recorded
*	Common Peppergrass	<i>Lepidium africanum</i>	Brassicaceae					X
	Common Rice-flower	<i>Pimelea humilis</i>	Thymelaeaceae					X
	Common Sneezeweed	<i>Centipeda cunninghamii</i>	Asteraceae					X
*	Common Sow-thistle	<i>Sonchus oleraceus</i>	Asteraceae					X
	Common Spike-sedge	<i>Eleocharis acuta</i>	Cyperaceae					X
	Common Tussock-grass	<i>Poa labillardierei</i>	Poaceae					X
*	Common Vetch	<i>Vicia sativa</i>	Fabaceae					X
	Cotton Fireweed	<i>Senecio quadridentatus</i>	Asteraceae					X
	Dark Roly-poly	<i>Sclerolaena muricata</i> var. <i>semiglabra</i>	Chenopodiaceae				k	
*	Desert Ash	<i>Fraxinus angustifolia</i> subsp. <i>angustifolia</i>	Oleaceae					X
	Dock	<i>Rumex</i> spp.	Polygonaceae					X
*	Drain Flat-sedge	<i>Cyperus eragrostis</i>	Cyperaceae					X
	Drooping Cassinia	<i>Cassinia arcuata</i>	Asteraceae					X
	Dwarf Amaranth	<i>Amaranthus macrocarpus</i> var. <i>macrocarpus</i>	Amaranthaceae				v	
	Dwarf Bitter-cress	<i>Rorippa eustylis</i>	Brassicaceae				r	
*	Fan Palm	<i>Washingtonia</i> spp.	Arecaceae					X
	Feather Spear-grass	<i>Austrostipa elegantissima</i>	Poaceae					X
	Ferny Small-flower Buttercup	<i>Ranunculus pumilio</i>	Ranunculaceae					X
*	Flatweed	<i>Hypochaeris radicata</i>	Asteraceae					X
*	Fleabane	<i>Conyza</i> spp.	Asteraceae					X
*	Fog-fruit	<i>Phyla canescens</i>	Verbenaceae					X
	Frosted Goosefoot	<i>Chenopodium desertorum</i> subsp. <i>virosum</i>	Chenopodiaceae				k	
	Galvanized Burr	<i>Sclerolaena birchii</i>	Chenopodiaceae				k	
	Gold-dust Wattle	<i>Acacia acinacea</i>	Mimosaceae					X
	Golden Wattle	<i>Acacia pycnantha</i>	Mimosaceae					X

Origin	Common Name	Scientific Name	Family Name	EPBC	TSC	FFG	DSE	Recorded
*	Golden Wreath Wattle	<i>Acacia saligna</i>	Mimosaceae					X
*	Great Brome	<i>Bromus diandrus</i>	Poaceae					X
	Grey Parrot-pea	<i>Dillwynia cinerascens</i>	Fabaceae					X
	Grey Roly-poly	<i>Sclerolaena muricata var. villosa</i>	Chenopodiaceae					X
*	Hair Grass	<i>Aira spp.</i>	Poaceae					X
	Hairy Tails	<i>Ptilotus erubescens</i>	Amaranthaceae			f		
#	Hedge Saltbush	<i>Rhagodia spinescens</i>	Chenopodiaceae					X
	Hoary Rush	<i>Juncus radula</i>	Juncaceae					X
	Hop Bush	<i>Dodonaea spp.</i>	Sapindaceae					X
*	Horehound	<i>Marrubium vulgare</i>	Lamiaceae					X
	Jersey Cudweed	<i>Pseudognaphalium luteoalbum</i>	Asteraceae					X
	Lesser Joyweed	<i>Alternanthera denticulata s.l.</i>	Amaranthaceae					X
*	Lesser Quaking-grass	<i>Briza minor</i>	Poaceae					X
	Lightwood	<i>Acacia implexa</i>	Mimosaceae					X
	Long Eryngium	<i>Eryngium paludosum</i>	Apiaceae				v	
	Murray Pine	<i>Callitris gracilis subsp. murrayensis</i>	Cupressaceae					X
	Myoporum	<i>Myoporum spp.</i>	Scrophulariaceae					X
	Native Flax	<i>Linum marginale</i>	Linaceae					X
	Native Mint	<i>Mentha spp.</i>	Lamiaceae					X
	Native Verbena	<i>Verbena officinalis var. gaudichaudii</i>	Verbenaceae				k	
	New Holland Daisy	<i>Vittadinia spp.</i>	Asteraceae					X
	Nightshade	<i>Solanum spp.</i>	Solanaceae					X
	Nitre Goosefoot	<i>Chenopodium nitrariaceum</i>	Chenopodiaceae					X
	Nodding Saltbush	<i>Einadia nutans subsp. nutans</i>	Chenopodiaceae					X
*	Oat	<i>Avena spp.</i>	Poaceae					X

Origin	Common Name	Scientific Name	Family Name	EPBC	TSC	FFG	DSE	Recorded
*	Olive	<i>Olea europaea</i>	Oleaceae					X
*	Onion Grass	<i>Romulea rosea</i>	Iridaceae					X
	Pale Flax-lily	<i>Dianella sp. aff. longifolia (Riverina)</i>	Hemerocallidaceae				v	X
	Pale-fruit Ballart	<i>Exocarpos strictus</i>	Santalaceae					X
*	Patterson's Curse	<i>Echium plantagineum</i>	Boraginaceae					X
	Pepper Grass	<i>Panicum laevinode</i>	Poaceae				v	
*	Pepper Tree	<i>Schinus molle</i>	Anacardiaceae					X
*	Perrenial Veldt-grass	<i>Ehrharta calycina</i>	Poaceae					X
	Poong'ort	<i>Carex tereticaulis</i>	Cyperaceae					X
*	Prickly Lettuce	<i>Lactuca serriola</i>	Asteraceae					X
*	Prickly Pear	<i>Opuntia spp.</i>	Cactaceae					X
	Prickly Saltwort	<i>Salsola tragus subsp. tragus</i>	Chenopodiaceae					X
*	Radiata Pine	<i>Pinus radiata</i>	Pinaceae					X
	Raspwort	<i>Haloragis spp.</i>	Haloragaceae					X
*	Red Sand-spurrey	<i>Spergularia rubra s.l.</i>	Caryophyllaceae					X
	Red Swainson-pea	<i>Swainsona plagiotropis</i>	Fabaceae	V	V	f	e	
*	Ribwort	<i>Plantago lanceolata</i>	Veronicaceae					X
	Ridged Spider-orchid	<i>Caladenia tensa</i>	Orchidaceae	E			v	
	Ridged Water-milfoil	<i>Myriophyllum porcatum</i>	Haloragaceae	V		f	v	
	River Red-gum	<i>Eucalyptus camaldulensis</i>	Myrtaceae					X
	River Swamp Wallaby-grass	<i>Amphibromus fluitans</i>	Poaceae	V	V			
	Riverina Bitter-cress	<i>Cardamine moirensis</i>	Brassicaceae				r	
*	Rough Sow-thistle	<i>Sonchus asper s.l.</i>	Asteraceae					X
	Rough Spear-grass	<i>Austrostipa scabra</i>	Poaceae					X
	Ruby Saltbush	<i>Enchylaena tomentosa var. tomentosa</i>	Chenopodiaceae					X

Origin	Common Name	Scientific Name	Family Name	EPBC	TSC	FFG	DSE	Recorded
	Rush	<i>Juncus spp.</i>	Juncaceae					X
*	Rye Grass	<i>Lolium spp.</i>	Poaceae					X
	Sand Brome	<i>Bromus arenarius</i>	Poaceae				r	
	Scaly Mantle	<i>Eriochlamys squamata</i>	Asteraceae				v	
	Shiny Everlasting	<i>Xerochrysum viscosum</i>	Asteraceae					X
	Silky Blue-grass	<i>Dichanthium sericeum subsp. sericeum</i>	Poaceae					X
	Silky Swainson-pea	<i>Swainsona sericea</i>	Fabaceae		V	f	v	
	Silver Wattle	<i>Acacia dealbata</i>	Mimosaceae					X
	Slender Darling-pea	<i>Swainsona murrayana</i>	Fabaceae	V	V	f	e	
	Slender Knotweed	<i>Persicaria decipiens</i>	Polygonaceae					X
	Small Loosestrife	<i>Lythrum hyssopifolia</i>	Lythraceae					X
	Small Scurf-pea	<i>Cullen parvum</i>	Fabaceae		E	f	e	
	Small Vanilla-lily	<i>Arthropodium minus</i>	Anthericaceae					X
*	Small-flower Onion-grass	<i>Romulea minutiflora</i>	Iridaceae					X
	Small-leaf Bluebush	<i>Maireana microphylla</i>	Chenopodiaceae				e	
	Small-leaf Swainson-pea	<i>Swainsona microphylla</i>	Fabaceae				r	
	Smooth Minuria	<i>Minuria integerrima</i>	Asteraceae				r	
*	Soursob	<i>Oxalis pes-caprae</i>	Oxalidaceae					X
	Southern Swainson-pea	<i>Swainsona behriana</i>	Fabaceae				r	
	Spear Grass	<i>Austrostipa spp.</i>	Poaceae					X
*	Spear Thistle	<i>Cirsium vulgare</i>	Asteraceae					X
	Spider Grass	<i>Enteropogon acicularis</i>	Poaceae					X
	Spiny Rice-flower	<i>Pimelea spinescens subsp. spinescens</i>	Thymelaeaceae	C		f	e	
	Spreading Eutaxia	<i>Eutaxia microphylla var. diffusa</i>	Fabaceae					X
*	Sugar Gum	<i>Eucalyptus cladocalyx</i>	Myrtaceae					X

Origin	Common Name	Scientific Name	Family Name	EPBC	TSC	FFG	DSE	Recorded
	Swamp Wallaby-grass	<i>Amphibromus spp.</i>	Poaceae					X
#	Sweet Pittosporum	<i>Pittosporum undulatum</i>	Pittosporaceae					X
	Tangled Lignum	<i>Muehlenbeckia florulenta</i>	Polygonaceae					X
*	Toowoomba Canary-grass	<i>Phalaris aquatica</i>	Poaceae					X
	Tufted Burr-daisy	<i>Calotis scapigera</i>	Asteraceae					X
	Turnip Copperburr	<i>Sclerolaena napiformis</i>	Chenopodiaceae	E	E	f	e	
*	Variable Plantain	<i>Plantago varia</i>	Veronicaceae					X
*	Variegated Thistle	<i>Silybum marianum</i>	Asteraceae					X
	Wallaby Grass	<i>Rytidosperma spp.</i>	Poaceae					X
*	Water Buttons	<i>Cotula coronopifolia</i>	Asteraceae					X
	Water Milfoil	<i>Myriophyllum spp.</i>	Haloragaceae					X
	Water Ribbons	<i>Triglochin procera s.l.</i>	Juncaginaceae					X
#	Weeping Myall	<i>Acacia pendula</i>	Mimosaceae			f	e	X
	Weeping Pittosporum	<i>Pittosporum angustifolium</i>	Pittosporaceae					X
	Western Water-starwort	<i>Callitriche cyclocarpa</i>	Veronicaceae	V	V	f	v	
*	White Fumitory	<i>Fumaria capreolata</i>	Fumariaceae					X
	Windmill Grass	<i>Chloris truncata</i>	Poaceae					X
	Wingless Bluebush	<i>Maireana enchylaenoides</i>	Chenopodiaceae					X
	Wire-grass	<i>Aristida spp.</i>	Poaceae					X
	Woodland Swamp-daisy	<i>Brachyscome basaltica var. gracilis</i>	Asteraceae					X
	Yakka Grass	<i>Sporobolus caroli</i>	Poaceae				r	
	Yarran Wattle	<i>Acacia omalophylla</i>	Mimosaceae			f	e	
	Yellow Box	<i>Eucalyptus melliodora</i>	Myrtaceae					X
	Yellow-tongue Daisy	<i>Brachyscome chrysoglossa</i>	Asteraceae			f	v	

* = introduced species; # = native species occurring outside of natural range; L = listed as threatened; EPBC = status under EPBC Act; TSC = status under TSC Act; FFG = status under FFG Act; DSE = status under DSE’s Advisory List; C = critically endangered; E, e = endangered; V, v = vulnerable; R, r = rare; k = insufficiently known

Appendix 2: Vertebrate fauna species that occur or are likely to occur in the study area

Common Name	Scientific name	AWW	BA	ANSWW	TPFSRV	Recorded
Australasian Darter	<i>Anhinga novaehollandiae</i>	X	X			X
Australasian Grebe	<i>Tachybaptus novaehollandiae</i>	X	X			X
Australasian Pipit	<i>Anthus novaeseelandiae</i>	X	X			X
Australian Hobby	<i>Falco longipennis</i>	X	X			
Australian Owlet-nightjar	<i>Aegotheles cristatus</i>	X		X		X
Australian Magpie	<i>Gymnorhina tibicen</i>	X	X	X		X
Australian Pelican	<i>Pelecanus conspicillatus</i>	X	X			
Australian Raven	<i>Corvus coronoides</i>	X	X	X		X
Australian Reed-Warbler	<i>Acrocephalus australis</i>		X	X		X
Australian Shelduck	<i>Tadorna tadornoides</i>	X	X			X
Australian White Ibis	<i>Threskiornis molucca</i>	X	X	X		X
Australian Wood Duck	<i>Chenonetta jubata</i>	X	X	X		X
Azure Kingfisher	<i>Alcedo azurea</i>	X	X			X
Barking Owl	<i>Ninox connivens</i>		X			
Black Kite	<i>Milvus migrans</i>	X	X			X
Black Swan	<i>Cygnus atratus</i>	X	X	X		
Black-chinned Honeyeater	<i>Melithreptus gularis</i>		X			X
Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>	X	X			X
Black-fronted Dotterel	<i>Euseyonis melanops</i>	X	X			
Black-shouldered Kite	<i>Elanus axillaris</i>	X	X			X
Black-tailed Native-hen	<i>Gallinula ventralis</i>	X	X			
Blue-faced Honeyeater	<i>Entomyzon cyanotis</i>	X	X	X		X
Brown Falcon	<i>Falco berigora</i>	X	X			
Brown Goshawk	<i>Accipiter fasciatus</i>		X			X

Common Name	Scientific name	AWW	BA	ANSWW	TPFSRV	Recorded
Brown Quail	<i>Coturnix ypsilophora</i>	X	X	X		X
Brown Thornbill	<i>Acanthiza pusilla</i>	X	X			X
Brown Treecreeper	<i>Climacteris picumnus victoriae</i>	X	X	X		X
Brown-headed Honeyeater	<i>Melithreptus brevirostris</i>	X	X			X
Buff-rumped Thornbill	<i>Acanthiza reguloides</i>	X	X			X
Bush Stone-curlew	<i>Burhinus grallarius</i>	X				
Chestnut Teal	<i>Anas castanea</i>	X	X			
Chestnut-crowned Babbler	<i>Pomatostomus ruficeps</i>		X			
Chestnut-rumped Thornbill	<i>Acanthiza uropygialis</i>	X				
Collared Sparrowhawk	<i>Accipiter cirrhocephalus</i>	X	X			
Common Blackbird	<i>Turdus merula</i>	X	X	X		X
Common Bronzewing	<i>Phaps chalcoptera</i>	X	X			X
Common Myna	<i>Acridotheres tristis</i>	X	X			X
Common Starling	<i>Sturnus vulgaris</i>	X	X	X		X
Crested Pigeon	<i>Ocyphaps lophotes</i>	X	X	X		X
Crested Shrike-tit	<i>Falcunculus frontatus</i>	X	X	X		
Crimson (Yellow) Rosella	<i>Platycercus elegans elegans</i>	X	X	X		X
Diamond Dove	<i>Geopelia cuneata</i>	X	X			
Diamond Firetail	<i>Stagonopleura guttata</i>	X	X	X		
Dollarbird	<i>Eurystomus orientalis</i>	X	X			X
Dusky Moorhen	<i>Gallinula tenebrosa</i>	X	X	X		X
Dusky Woodswallow	<i>Artamus cyanopterus</i>	X	X			X
Eastern Great Egret	<i>Ardea modesta</i>	X	X			
Eastern Rosella	<i>Platycercus eximius</i>	X	X	X		X
Eastern Yellow Robin	<i>Eopsaltria australis</i>		X			X

Common Name	Scientific name	AWW	BA	ANSWW	TPFSRV	Recorded
Eurasian Coot	<i>Fulica atra</i>	X	X	X		
European Goldfinch	<i>Carduelis carduelis</i>	X	X			
Fan-tailed Cuckoo	<i>Cacomantis flabelliformis</i>	X	X	X		X
Flame Robin	<i>Petroica phoenicea</i>	X	X			
Galah	<i>Eolophus roseicapilla</i>	X	X	X		X
Golden Whistler	<i>Pachycephala pectoralis</i>	X	X			X
Golden-headed Cisticola	<i>Cisticola exilis</i>	X				
Great Cormorant	<i>Phalacrocorax carbo</i>	X	X			
Grey Currawong	<i>Strepera versicolor</i>		X			X
Grey Fantail	<i>Rhipidura albiscarpa</i>	X	X	X		X
Grey Shrike-thrush	<i>Colluricincla harmonica</i>	X	X	X		X
Grey Teal	<i>Anas gracilis</i>	X		X		X
Grey-crowned Babbler	<i>Pomatostomus temporalis</i>		X	X		
Gull-billed Tern	<i>Gelochelidon nilotica</i>	X				
Hardhead	<i>Aythya australis</i>	X	X			
Hoary-headed Grebe	<i>Poliiocephalus poliocephalus</i>	X				
Hooded Robin	<i>Melanodryas cucullata</i>			X		
Horsfield's Bronze-Cuckoo	<i>Chrysococcyx basalis</i>	X	X			X
House Sparrow	<i>Passer domesticus</i>	X	X			X
Intermediate Egret	<i>Ardea intermedia</i>	X	X	X		
Jacky Winter	<i>Microeca fascinans</i>	X	X	X		X
Laughing Kookaburra	<i>Dacelo novaeguineae</i>	X	X	X		X
Letter-winged Kite	<i>Elanus scriptus</i>	X				
Little Black Cormorant	<i>Phalacrocorax sulcirostris</i>	X	X			X
Little Corella	<i>Cacatua sanguinea</i>	X	X	X		X

Common Name	Scientific name	AWW	BA	ANSWW	TPFSRV	Recorded
Little Eagle	<i>Hieraaetus morphnoides</i>	X	X	X		
Little Friarbird	<i>Philemon citreogularis</i>	X	X			X
Little Grassbird	<i>Megalurus gramineus</i>	X	X	X		X
Little Pied Cormorant	<i>Microcarbo melanoleucos</i>	X	X	X		X
Little Raven	<i>Corvus mellori</i>	X	X			X
Little Wattlebird	<i>Anthochaera chrysoptera</i>	X	X			X
Long-billed Corella	<i>Cacatua tenuirostris</i>	X	X	X		X
Magpie-lark	<i>Grallina cyanoleuca</i>	X	X	X		X
Masked Lapwing	<i>Vanellus miles</i>	X	X			X
Masked Owl	<i>Tyto novaehollandiae</i> race <i>novaehollandiae</i>	X		X		X
Mistletoebird	<i>Dicaeum hirundinaceum</i>	X	X			X
Musk Duck	<i>Biziura lobata</i>	X				
Musk Lorikeet	<i>Glossopsitta concinna</i>	X	X			
Nankeen Kestrel	<i>Falco cenchroides</i>	X	X	X		X
Nankeen Night Heron	<i>Nycticorax caledonicus</i>	X	X			X
Noisy Friarbird	<i>Philemon corniculatus</i>	X	X	X		X
Noisy Miner	<i>Manorina melanocephala</i>	X	X	X		X
Pacific Barn Owl	<i>Tyto javanica</i>	X				
Pacific Black Duck	<i>Anas superciliosa</i>	X	X	X		X
Painted Button-quail	<i>Turnix varia</i>	X	X			X
Pallid Cuckoo	<i>Cuculus pallidus</i>	X	X			
Peaceful Dove	<i>Geopelia striata</i>	X	X			X
Peregrine Falcon	<i>Falco peregrinus</i>		X			
Pied Butcherbird	<i>Cracticus nigrogularis</i>	X	X			X
Pied Cormorant	<i>Strepera graculina</i>		X			

Common Name	Scientific name	AWW	BA	ANSWW	TPFSRV	Recorded
Pied Currawong	<i>Strepera graculina</i>	X	X			
Pink Robin	<i>Petroica rodinogaster</i>					
Purple Swamphen	<i>Porphyrio porphyrio</i>	X	X			X
Rainbow Bee-eater	<i>Merops ornatus</i>	X	X			X
Red Wattlebird	<i>Anthochaera carunculata</i>	X	X	X		X
Red-browed Finch	<i>Neochmia temporalis</i>	X	X	X		X
Red-capped Robin	<i>Petroica goodenovii</i>	X	X			X
Red-rumped Parrot	<i>Psephotus haematonotus</i>	X	X	X		X
Restless Flycatcher	<i>Myiagra inquieta</i>	X	X			
Rock Dove	<i>Columba livia</i>	X	X	X		X
Rose Robin	<i>Petroica rosea</i>					X
Royal Spoonbill	<i>Platalea regia</i>	X	X			
Rufous Fantail	<i>Rhipidura rufifrons</i>		X			X
Rufous Songlark	<i>Cincloramphus mathewsi</i>					X
Rufous Whistler	<i>Pachycephala rufiventris</i>	X	X	X		X
Sacred Kingfisher	<i>Todiramphus sanctus</i>	X	X	X		X
Scarlet Robin	<i>Petroica boodang</i>		X			
Shining Bronze-Cuckoo	<i>Chrysococcyx lucidus</i>	X	X			X
Silver Gull	<i>Chroicocephalus novaehollandiae</i>	X	X			
Silvereye	<i>Zosterops lateralis</i>	X	X	X		X
Singing Honeyeater	<i>Lichenostomus virescens</i>		X			
Southern Boobook	<i>Ninox novaeseelandiae</i>	X	X			X
Southern Whiteface	<i>Aphelocephala leucopsis</i>		X			
Speckled Warbler	<i>Pyrrhalaemus saggitatus</i>			X		
Spotted Dove	<i>Streptopelia chinensis</i>	X	X			X

Common Name	Scientific name	AWW	BA	ANSWW	TPFSRV	Recorded
Spotted Pardalote	<i>Pardalotus punctatus</i>	X	X	X		X
Straw-necked Ibis	<i>Threskiornis spinicollis</i>	X	X			X
Striated Pardalote	<i>Pardalotus striatus</i>	X	X	X		X
Striated Thornbill	<i>Acanthiza lineata</i>	X	X			X
Sulphur-crested Cockatoo	<i>Cacatua galerita</i>	X	X	X		X
Superb Fairy-wren	<i>Malurus cyaneus</i>	X	X	X		X
Superb Parrot	<i>Polytelis swainsonii</i>		X	X		
Tawny Frogmouth	<i>Podargus strigoides</i>	X	X			X
Tree Martin	<i>Hirundo nigricans</i>	X	X	X		X
Turquoise Parrot	<i>Neophema pulchella</i>	X				X
Varied Sittella	<i>Daphoenositta chrysoptera</i>	X	X			X
Wedge-tailed Eagle	<i>Aquila audax</i>		X	X		X
Weebill	<i>Smicronis brevirostris</i>	X	X			X
Welcome Swallow	<i>Hirundo neoxena</i>	X	X	X		X
Western Gerygone	<i>Gerygone fusca</i>	X	X	X		X
Whiskered Tern	<i>Chlidonias hybridus</i>	X	X			
Whistling Kite	<i>Haliastur sphenurus</i>	X	X	X		X
White-backed Swallow	<i>Cheramoeca leucosterna</i>		X			
White-bellied Cuckoo-shrike	<i>Coracina papuensis</i>	X				
White-bellied Sea-Eagle	<i>Haliaeetus leucogaster</i>	X				
White-breasted Woodswallow	<i>Artamus leucorhynchus</i>	X	X	X		
White-browed Babbler	<i>Pomatostomus superciliosus</i>	X	X			
White-browed Woodswallow	<i>Artamus superciliosus</i>	X				
White-eared Honeyeater	<i>Lichenostomus leucotis</i>		X			

Common Name	Scientific name	AWW	BA	ANSWW	TPFSRV	Recorded
White-faced Heron	<i>Egretta novaehollandiae</i>	X	X	X		X
White-necked Heron	<i>Ardea pacifica</i>	X	X			X
White-plumed Honeyeater	<i>Lichenostomus penicillatus</i>	X	X	X		X
White-throated Needletail	<i>Hirundapus caudacutus</i>	X	X	X		
White-throated Treecreeper	<i>Cormobates leucophaeus</i>	X	X	X		X
White-winged Chough	<i>Corcorax melanorhamphos</i>	X	X	X		X
White-winged Triller	<i>Lalage sueurii</i>	X	X			X
Willie Wagtail	<i>Rhipidura leucophrys</i>	X	X	X		X
Yellow Thornbill	<i>Acanthiza nana</i>	X	X			X
Yellow-billed Spoonbill	<i>Platalea flavipes</i>	X	X			
Yellow-plumed Honeyeater	<i>Lichenostomus ornatus</i>	X	X			X
Yellow-rumped Thornbill	<i>Acanthiza chrysorrhoa</i>	X	X	X		X
Zebra Finch	<i>Taeniopygia guttata</i>	X	X			
Mammals						
Black Rat	<i>Rattus rattus</i>			X		X
Black Wallaby	<i>Walabia bicolor</i>					X
Chocolate Wattled Bat	<i>Chalinolobus morio</i>	X		X		X
Common Brushtail Possum	<i>Trichosurus vulpecula</i>	X		X		X
Common Ringtail Possum	<i>Pseudocheirus peregrinus</i>	X		X		X
Corben's Long-eared Bat	<i>Nyctophilus corbeni</i>			X		X
Eastern Grey Kangaroo	<i>Macropus giganteus</i>	X		X		X
European Hare	<i>Lepus europeus</i>	X				X
European Rabbit	<i>Oryctolagus cuniculus</i>	X				X
Gould's Wattled Bat	<i>Chalinolobus gouldii</i>	X		X		X

Common Name	Scientific name	AWW	BA	ANSWW	TPFSRV	Recorded
House Mouse	<i>Mus musculus</i>	X				X
Inland Broad-nosed Bat	<i>Scotorepens balstoni</i>	X				X
Large Forest Bat	<i>Vespadelus darlingtoni</i>	X		X		X
Lesser Long-eared Bat	<i>Nyctophilus geoffroyi</i>	X		X		
Little Forest Bat	<i>Vespadelus vulturnus</i>	X		X		X
Long-eared Bat	<i>Nyctophilus spp.</i>					X
Platypus	<i>Ornithorhynchus anatinus</i>	X				
Red Fox	<i>Vulpes vulpes</i>	X		X		X
Southern Forest Bat	<i>Vespadelus regulus</i>	X		X		X
Southern Freetail Bat	<i>Mormopterus sp. 1 , 2 & 4</i>	X				X
Squirrel Glider	<i>Petaurus norfolcensis</i>	X		X		X
Sugar Glider	<i>Petaurus breviceps</i>	X		X		X
Water Rat	<i>Hydromys chrysogaster</i>	X				
White-striped Freetail-bat	<i>Tadarida australis</i>			X		X
Yellow-bellied Sheath-tail Bat	<i>Saccoliamus flaviventris</i>					X
Yellow-footed Antechinus	<i>Antechinus flavipes</i>	X		X		
Reptiles						
Bandy Bandy	<i>Vermicella annulata</i>	X				
Carnaby's Skink	<i>Cryptoblepharus carnabyi</i>					X
Eastern Brown Snake	<i>Pseudonaja textilis</i>	X				X
Garden Skink	<i>Lampropholis guichenoti</i>	X				X
Marbled Gecko	<i>Christinus marmoratus</i>	X		X		
Murray River Turtle	<i>Emydura macquarii</i>	X				
Prong-snouted Blind Snake	<i>Rumphyotyphlops bituberculatus</i>			X		
Red-bellied Black Snake	<i>Pseudechis porphyriacus</i>			X		

Common Name	Scientific name	AVW	BA	ANSWW	TPFSRV	Recorded
Tiger Snake	<i>Notechis scutatus</i>	X				
Tree Skink	<i>Egernia striolata</i>					X
Frogs						
Eastern Banjo Frog (Pobblebong)	<i>Lymnodynastes dumerili</i>					X
Barking Marsh Frog	<i>Lymnodynastes fletcheri</i>					X
Common Froglet	<i>Crinia signifera</i>	X				X
Peron's Tree Frog	<i>Litoria peronii</i>	X				X
Plains Froglet	<i>Crinia parinsignifera</i>	X				X
Spotted Marsh Frog	<i>Limnodynastes tasmaniensis</i>	X		X		X
Fish						
Australian Smelt	<i>Retropinna semoni</i>	X				
Bony Herring	<i>Nematalosa erebi</i>	X				
Common Carp	<i>Cyprinus carpio</i>	X				X
Eastern Gambusia	<i>Gambusia holbrooki</i>	X				X
Flat-headed Gudgeon	<i>Philypnodon grandiceps</i>	X				
Golden Perch	<i>Macquaria ambigua</i>	X				
Goldfish	<i>Carassius auratus</i>	X				
Murray Cod	<i>Maccullochella peelii</i>				X	
Redfin Perch	<i>Perca fluviatilis</i>	X				
Short-headed Lamprey	<i>Mordacia mordax</i>	X				
Silver Perch	<i>Bidyanus bidyanus</i>	X				
Trout Cod	<i>Maccullochella macquariensis</i>				X	

AVW: list from Atlas of Victorian Wildlife; **BA:** list from the New Atlas of Australian Birds (Birds Australia); **ANSWW:** list from the Atlas of NSW Wildlife; **TPFSRV:** Recorded on the Threatened and Protected Fish Species Records Viewer; **X:** Recorded.

Appendix 3: Detailed habitat hectare assessment results

Habitat Zone (Site ID)		1	2	2A	3	4	5	6	6A	7	8	9	10	11	
EVC Name (Initials)		RCW	RCW	RCW	RCW	RCW	RCW	RCW	RCW	RCW	RGW	RGW	RCW	RGW	
EVC Number		103	103	103	103	103	103	103	103	103	295	295	103	295	
Total area of Habitat Zone (ha)		0.02	0.02	0.27	1.88	0.33	1.63	9.65	1.36	1.23	5.29	1.44	4.20	2.08	
Site Condition	Large Old Trees	/10	0	0	0	7	9	9	9	9	7	1	8	2	2
	Canopy Cover	/5	0	0	4	2	2	4	4	4	4	4	1	4	4
	Lack of Weeds	/15	9	9	9	9	9	9	9	4	13	2	2	4	9
	Understorey	/25	15	15	15	15	5	10	15	10	15	15	15	15	15
	Recruitment	/10	0	0	0	1	3	3	10	3	6	5	6	3	3
	Organic Matter	/5	3	3	3	3	3	3	3	3	3	5	5	3	5
	Logs	/5	0	0	0	2	0	5	5	2	5	3	3	3	3
	Total site condition score		27	27	31	39	31	43	55	35	53	35	40	34	41
	Possible site condition score		75	75	75	75	75	75	75	75	75	75	75	75	75
Landscape Context	Online DSE Landscape Context Score (NV2005_QUAL, DSE 2008)	/25	6	6	16	8	14	14	16	16	16	16	16	16	
Total Habitat Score		/100	33	33	47	47	45	57	71	51	69	51	56	50	57
Habitat score out of 1			0.33	0.33	0.47	0.47	0.45	0.57	0.71	0.51	0.69	0.51	0.56	0.50	0.57
Habitat Hectares in Habitat Zone#			0.01	0.01	0.13	0.89	0.15	0.93	6.85	0.69	0.85	2.70	0.81	2.10	1.19
Bioregion			Vic. Riverina	Vic. Riverina	Vic. Riverina	Vic. Riverina	Vic. Riverina	Vic. Riverina	Vic. Riverina	Vic. Riverina	Vic. Riverina	Vic. Riverina	Vic. Riverina	Vic. Riverina	Vic. Riverina
EVC Conservation Status			Vulnerable	Vulnerable	Vulnerable	Vulnerable	Vulnerable	Vulnerable	Vulnerable	Vulnerable	Vulnerable	Vulnerable	Vulnerable	Vulnerable	Vulnerable
Conservation Significance	Conservation Status x Habitat Score		High	High	High	High	High	Very High	Very High	Very High	Very High	Very High	Very High	Very High	Very High
	Threatened Species Rating		High	High	High	High	High	High	Very High	Very High	Very High	High	N/A	Very High	N/A
	Other Site Attribute Rating		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Overall Conservation Significance (highest)		High	High	High	High	High	Very High	Very High	Very High	Very High	Very High	Very High	Very High	Very High
No. Large Old Trees^ in Habitat Zone			0	0	0	10	4	27	187	22	5	8	26	7	5

* = Modified approach to habitat scoring - refer to Table 14 of DSE's Vegetation Quality Assessment Manual (DSE, 2004); ** = May increase following targeted searches for threatened species; # = Habitat hectares (habitat score/100 X area [ha]); ^Large and Very Large Trees.

Habitat Zone (Site ID)		12	13	14	15	15A	16	17	18	19	20	21	22	23	
EVC Name (Initials)		RCW	GRF	RGW	RGW	RGW	RCW	SAW	GRF	RCW	RCW	RGW	RCW	GRF	
EVC Number		103	106	295	295	295	103	97	106	103	103	295	103	106	
Total area of Habitat Zone (ha)		1.24	9.31	1.83	0.16	0.11	5.39	2.78	4.63	10.43	1.88	0.63	3.17	1.00	
Site Condition	Large Old Trees	/10	9	3	8	9	8	9	9	4	9	9	4	9	5
	Canopy Cover	/5	4	4	4	4	2	2	4	3	4	2	2	4	2
	Lack of Weeds	/15	2	0	0	2	7	0	0	0	9	0	11	2	6
	Understorey	/25	15	10	10	0	0	15	15	5	15	15	15	15	5
	Recruitment	/10	6	6	6	0	0	5	6	6	6	6	10	0	0
	Organic Matter	/5	3	5	3	3	5	3	5	5	3	3	3	3	3
	Logs	/5	3	5	5	0	0	5	5	5	5	5	5	0	0
	<i>Total site condition score</i>			42	33	36	18	22	39	44	28	51	40	50	33
<i>Possible site condition score</i>			75	75	75	75	75	75	75	75	75	75	75	75	75
Landscape Context	Online DSE Landscape Context Score (NV2005_QUAL, DSE 2008)	/25	16	16	16	16	16	16	16	16	16	16	16	16	16
Total Habitat Score		/100	58	49	52	34	38	55	60	44	67	56	66	49	37
Habitat score out of 1			0.58	0.49	0.52	0.34	0.38	0.55	0.60	0.44	0.67	0.56	0.66	0.49	0.37
Habitat Hectares in Habitat Zone#			0.72	4.56	0.95	0.06	0.04	2.96	1.67	2.04	6.99	1.06	0.42	1.55	0.37
Bioregion			Vic. Riverina	Vic. Riverina	Murray Fans	Murray Fans	Murray Fans	Murray Fans	Murray Fans	Murray Fans	Murray Fans	Murray Fans	Murray Fans	Murray Fans	Murray Fans
EVC Conservation Status			Vulnerable	Depleted	Vulnerable	Vulnerable	Vulnerable	Endangered	Vulnerable	Depleted	Endangered	Endangered	Vulnerable	Endangered	Depleted
Conservation Significance	Conservation Status x Habitat Score		Very High	Medium	Very High	High	High	Very High	Very High	Medium	Very High	Very High	Very High	Very High	Medium
	Threatened Species Rating		High	Very High	High	High	High	Very High	High	Very High	Very High	Very High	High	Very High	High
	Other Site Attribute Rating		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Overall Conservation Significance (highest)		Very High	Very High	Very High	High	High	Very High	Very High	Very High	Very High	Very High	Very High	Very High	High
No. Large Old Trees^ in Habitat Zone			16	66	29	4	3	124	137	47	404	104	4	155	14

* = Modified approach to habitat scoring - refer to Table 14 of DSE's Vegetation Quality Assessment Manual (DSE, 2004); ** = May increase following targeted searches for threatened species; # = Habitat hectares (habitat score/100 X area [ha]); ^Large and Very Large Trees.

Appendix 4: Scattered trees in the study area

Tree no.	Common Name	DBH (cm)	State	Size Class (Vic only)	Conservation Significance (Vic only)	Remove /Retain	Offset target (Vic Only)		
							Protect and Recruit		Recruit Only (no. plants)*
							Protect (no. trees)	Recruit (no. plants)*	
1	Black Box	94	NSW	N/A	N/A	Retain	N/A	N/A	N/A
2	Black Box	117	NSW	N/A	N/A	Retain	N/A	N/A	N/A
3	Black Box	113	NSW	N/A	N/A	Retain	N/A	N/A	N/A
4	Black Box	80	NSW	N/A	N/A	Remove	N/A	N/A	N/A
5	Yellow Box	45	NSW	N/A	N/A	Remove	N/A	N/A	N/A
7	Black Box	38	NSW	N/A	N/A	Retain	N/A	N/A	N/A
8	Black Box	53	NSW	N/A	N/A	Retain	N/A	N/A	N/A
9	Black Box	118	NSW	N/A	N/A	Retain	N/A	N/A	N/A
10	River Red-gum	32	NSW	N/A	N/A	Retain	N/A	N/A	N/A
11	Black Box	151	Vic	Very Large	Medium	Retain	N/A	N/A	N/A
12	Black Box	97	Vic	Very Large	Medium	Retain	N/A	N/A	N/A
13	Black Box	29	Vic	Small	Low	Retain	N/A	N/A	N/A
14	Black Box	20	Vic	Small	Low	Remove	N/A	10	10
15	Black Box	52	Vic	Large	Medium	Retain	N/A	N/A	N/A
16	Black Box	22	Vic	Small	Low	Remove	N/A	10	10
17	Black Box	90	Vic	Very Large	Medium	Remove	4	20	150
18	Black Box	24	Vic	Small	Low	Remove	N/A	10	10
19	Black Box	133	Vic	Very Large	Medium	Retain	N/A	N/A	N/A
20	Black Box	116	Vic	Very Large	Medium	Retain	N/A	N/A	N/A
21	River Red Gum	75	Vic	Very Large	Medium	Retain	N/A	N/A	N/A
22	Yellow Box	127	NSW	N/A	N/A	Retain	N/A	N/A	N/A
23	Black Box	78	NSW	N/A	N/A	Retain	N/A	N/A	N/A
Totals							4	50	180

*Note: Tree 6 has been removed from this assessment as it falls beyond the study area

Appendix 5: EVC Benchmarks

- Victorian Riverina:
 - Riverine Chenopod Woodland (EVC 103)
 - Grassy Riverine Forest (EVC 106)
 - Riverine Grassy Woodland (EVC 295)
- Murray Fans:
 - Semi-arid Woodland (EVC 97)
 - Riverine Chenopod Woodland (EVC 103)
 - Grassy Riverine Forest (EVC 106)
 - Riverine Grassy Woodland (EVC 295)

EVC/Bioregion Benchmark for Vegetation Quality Assessment

Victorian Riverina bioregion

EVC 103: Riverine Chenopod Woodland

Description:

Eucalypt woodland to 15 m tall with a diverse shrubby and grassy understorey occurring on most elevated riverine terraces. Confined to heavy clay soils on higher level terraces within or on the margins of riverine floodplains (or former floodplains), naturally subject to only extremely infrequent incidental shallow flooding from major events if at all flooded.

Large trees:

Species	DBH(cm)	#/ha
<i>Eucalyptus</i> spp.	50 cm	5/ha

Tree Canopy Cover:

%cover	Character Species	Common Name
10%	<i>Eucalyptus largiflorens</i>	Black Box

Understorey:

Life form	#Spp	%Cover	LF code
Immature Canopy Tree		5%	IT
Understorey Tree or Large Shrub	1	5%	T
Medium Shrub	3	30%	MS
Small Shrub	5	25%	SS
Prostrate Shrub	1	1%	PS
Medium Herb	5	5%	MH
Small or Prostrate Herb*	5	10%	SH
Medium to Small Tufted Graminoid	2	5%	MTG
Soil Crust	na	10%	S/C

* Largely seasonal life form

Total understorey projective foliage cover 65%

LF Code	Species typical of at least part of EVC range	Common Name
T	<i>Acacia stenophylla</i>	River Coobah
MS	<i>Atriplex nummularia</i>	Old-man Saltbush
MS	<i>Chenopodium nitrariaceum</i>	Nitre Goosefoot
MS	<i>Eremophila divaricata</i> ssp. <i>divaricata</i>	Spreading Emu-bush
SS	<i>Sclerolaena tricuspis</i>	Streaked Copperburr
SS	<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	Ruby Saltbush
SS	<i>Atriplex lindleyi</i>	Flat-top Saltbush
SS	<i>Rhagodia spinescens</i>	Hedge Saltbush
PS	<i>Sclerochlamys brachyptera</i>	Short-wing Saltbush
MH	<i>Einadia nutans</i> ssp. <i>nutans</i>	Nodding Saltbush
MH	<i>Calocephalus sonderi</i>	Pale Beauty-heads
MH	<i>Senecio glossanthus</i>	Slender Groundsel
MH	<i>Brachyscome lineariloba</i>	Hard-head Daisy
SH	<i>Disphyma crassifolium</i> ssp. <i>clavellatum</i>	Rounded Noon-flower
SH	<i>Maireana pentagona</i>	Hairy Bluebush

Recruitment:

Continuous

Organic Litter:

5% cover

Logs:

5 m/0.1 ha.

Weediness:

LF Code	Typical Weed Species	Common Name	Invasive	Impact
T	<i>Olea europaea</i> subsp. <i>europaea</i>	Olive	low	high
MS	<i>Lycium ferocissimum</i>	Boxthorn	low	high
LH	<i>Sisymbrium erysimoides</i>	Smooth Mustard	high	high
LH	<i>Critesion</i> spp.	Barley-grass	high	low
LH	<i>Gazania linearis</i>	Gazania	high	high
LH	<i>Opuntia</i> spp.	Prickly Pear	low	high
LH	<i>Sisymbrium irio</i>	London Mustard	high	high
LH	<i>Psilocalon granulicaule</i>	Noon-flower	high	high
MH	<i>Limonium sinuatum</i>	Notch-leaf Sea-lavender	high	high
MH	<i>Limonium lobatum</i>	Winged Sea-lavender	high	high
MH	<i>Trifolium arvense</i> var. <i>arvense</i>	Hare's-foot Clover	high	low
MH	<i>Mesembryanthemum nodiflora</i>	Ice-plant	high	high
MH	<i>Carrichtera annua</i>	Ward's Weed	high	high
MH	<i>Marrubium vulgare</i>	Horehound	high	high
MH	<i>Carpobrotus aequilaterus</i>	Angled Pigface	low	high
MH	<i>Silene apetala</i> var. <i>apetala</i>	Sand Catchfly	high	low
MH	<i>Medicago</i> spp.	Medic	high	low
MH	<i>Oxalis pes-caprae</i>	Soursob	high	high
MH	<i>Silene gallica</i>	French Catchfly	high	low
MH	<i>Silene nocturna</i>	Mediterranean Catchfly	high	low
SH	<i>Mesembryanthemum crystallinum</i>	Common Ice-plant	high	high
MTG	<i>Vulpia bromoides</i>	Squirrel-tail Fescue	high	high
MTG	<i>Lolium rigidum</i>	Wimmera Rye-grass	high	low
MTG	<i>Asphodelus fistulosus</i>	Onion Weed	high	high
MNG	<i>Bromus rubens</i>	Red Brome	high	high
MNG	<i>Vulpia myuros</i>	Rat's-tail Fescue	high	low
MNG	<i>Bromus</i> spp.	Brome	high	high
MNG	<i>Schismus barbatus</i>	Arabian Grass	high	low
SC	<i>Asparagus asparagoides</i>	Bridal Creeper	high	high

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EVC/Bioregion Benchmark for Vegetation Quality Assessment

Victorian Riverina bioregion

EVC 106: Grassy Riverine Forest

Description:

Occurs on the floodplain of major rivers, in a slightly elevated position where floods are infrequent, on deposited silts and sands, forming fertile alluvial soils. River Red Gum forest to 25 m tall with a groundlayer dominated by graminoids. Occasional tall shrubs present.

Large trees:

Species	DBH(cm)	#/ha
<i>Eucalyptus</i> spp.	90 cm	20 / ha

Tree Canopy Cover:

%cover	Character Species	Common Name
30%	<i>Eucalyptus camaldulensis</i>	River Red-gum

Understorey:

Life form	#Spp	%Cover	LF code
Immature Canopy Tree		5%	IT
Understorey Tree or Large Shrub	1	10%	T
Large Herb	2	10%	LH
Medium Herb	3	10%	MH
Medium to Small Tufted Graminoid	3	25%	MTG
Medium to Tiny Non-tufted Graminoid	3	10%	MNG
Bryophytes/Lichens	na	10%	BL
Total understorey projective foliage cover		75%	

LF Code	Species typical of at least part of EVC range	Common Name
T	<i>Acacia stenophylla</i>	Eumong
LH	<i>Wahlenbergia fluminalis</i>	River Bluebell
LH	<i>Senecio quadridentatus</i>	Cotton Fireweed
MH	<i>Goodenia fascicularis</i>	Silky Goodenia
MH	<i>Eclipta platyglossa</i>	Yellow Twin-heads
MTG	<i>Setaria jubiflora</i>	Warrego Summer-grass
MNG	<i>Eleocharis acuta</i>	Common Spike-sedge

Recruitment:

Continuous

Organic Litter:

40 % cover

Logs:

30 m/0.1 ha.

Weediness:

LF Code	Typical Weed Species	Common Name	Invasive	Impact
LH	<i>Lactuca serriola</i>	Prickly Lettuce	high	low
LH	<i>Sonchus oleraceus</i>	Common Sow-thistle	high	low
LH	<i>Centaurea melitensis</i>	Malta Thistle	high	low
MH	<i>Hypochoeris glabra</i>	Smooth Cat's-ear	high	low
MH	<i>Trifolium arvense</i> var. <i>arvense</i>	Hare's-foot Clover	high	low
MH	<i>Reichardia tingitana</i>	False Sow-thistle	high	low
MH	<i>Phyla canescens</i>	Fog-fruit	high	high
MTG	<i>Vulpia bromoides</i>	Squirrel-tail Fescue	high	low
MNG	<i>Bromus rubens</i>	Red Brome	high	low

EVC 106: Grassy Riverine Forest – Victorian Riverina bioregion

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EVC/Bioregion Benchmark for Vegetation Quality Assessment

Victorian Riverina bioregion

EVC 295: Riverine Grassy Woodland

Description:

Occurs on the floodplain of major rivers, in a slightly elevated position where floods are infrequent, on deposited silts and sands, forming fertile alluvial soils. River Red Gum woodland to 20 m tall with a groundlayer dominated by graminoids. Occasional tall shrubs present.

Large trees:

Species	DBH(cm)	#/ha
<i>Eucalyptus</i> spp.	80 cm	15 / ha

Tree Canopy Cover:

%cover	Character Species	Common Name
20%	<i>Eucalyptus camaldulensis</i>	River Red-gum

Understorey:

Life form	#Spp	%Cover	LF code
Immature Canopy Tree		5%	IT
Understorey Tree or Large Shrub	1	5%	T
Small Shrub	1	1%	SS
Medium Herb	2	1%	MH
Small or Prostrate Herb	2	1%	SH
Large Tufted Graminoid	2	5%	LTG
Medium to Small Tufted Graminoid	5	20%	MTG
Medium to Tiny Non-tufted Graminoid	2	20%	MNG
Bryophytes/Lichens	na	10%	BL
Total understorey projective foliage cover		65%	

LF Code	Species typical of at least part of EVC range	Common Name
T	<i>Acacia dealbata</i>	Silver Wattle
MH	<i>Sida corrugata</i>	Variable Sida
MH	<i>Oxalis perennans</i>	Grassland Wood-sorrel
SH	<i>Chamaesyce drummondii</i>	Flat Spurge
SH	<i>Azolla filiculoides</i>	Pacific Azolla
LTG	<i>Austrostipa gibbosa</i>	Spurred Spear-grass
LTG	<i>Carex tereticaulis</i>	Hollow Sedge
MTG	<i>Chloris truncata</i>	Windmill Grass
MTG	<i>Themeda triandra</i>	Kangaroo Grass
MTG	<i>Aristida behriana</i>	Brush Wire-grass
MTG	<i>Elymus scaber</i> var. <i>scaber</i>	Common Wheat-grass
MNG	<i>Pseudoraphis spinescens</i>	Spiny Mud-grass
MNG	<i>Eleocharis acuta</i>	Common Spike-sedge

Recruitment:

Continuous

Organic Litter:

10 % cover

Logs:

20 m/0.1 ha.

Weediness:

LF Code	Typical Weed Species	Common Name	Invasive	Impact
LH	<i>Cirsium vulgare</i>	Spear Thistle	high	high
MTG	<i>Lolium rigidum</i>	Wimmera Rye-grass	high	low

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EVC/Bioregion Benchmark for Vegetation Quality Assessment

Murray Fans bioregion

EVC 97: Semi-arid Woodland

Description:

Non-eucalypt woodland or open forest to 12 m tall, of low rainfall areas. Occurs in a range of somewhat elevated positions not subject to flooding or inundation. The surface soils are typically light textured loamy sands or sandy loams.

Large trees:

Species	DBH(cm)	#/ha
<i>Casuarina</i> spp.	40 cm	20/ha
<i>Allocasuarina</i> spp.	40 cm	
<i>Callitris</i> spp.	40 cm	
<i>Myoporum platycarpum</i>	35 cm	

Tree Canopy Cover:

% cover	Character Species	Common Name
20%	<i>Casuarina pauper</i>	Belah
	<i>Allocasuarina luehmannii</i>	Buloke
	<i>Callitris gracilis</i> ssp. <i>murrayensis</i>	Slender Cypress-pine
	<i>Myoporum platycarpum</i>	Sugarwood

Understorey:

Life form	#Spp	%Cover	LF code
Immature Canopy Tree		5%	IT
Medium Shrub	5	15%	MS
Small Shrub	5	20%	SS
Large Herb*	2	5%	LH
Medium Herb*	7	5%	MH
Small or Prostrate Herb*	2	5%	SH
Medium to Small Tufted Graminoid	2	10%	MTG
Medium to Tiny Non-tufted Graminoid	1	1%	MNG
Bryophytes/Lichens	na	10%	BL
Soil Crust	na	20%	S/C

* Largely seasonal life form

Total understorey projective foliage cover 75%

LF Code	Species typical of at least part of EVC range	Common Name
MS	<i>Alectryon oleifolius</i> ssp. <i>canescens</i>	Cattle Bush
MS	<i>Acacia oswaldii</i>	Umbrella Wattle
MS	<i>Hakea tephrosperma</i>	Hooked Needlewood
MS	<i>Hakea leucoptera</i> ssp. <i>leucoptera</i>	Silver Needlewood
SS	<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	Ruby Saltbush
SS	<i>Sclerolaena diacantha</i>	Grey Copperburr
SS	<i>Olearia pimeleoides</i>	Pimelea Daisy-bush
SS	<i>Rhagodia spinescens</i>	Hedge Saltbush
MH	<i>Einadia nutans</i> ssp. <i>nutans</i>	Nodding Saltbush
MH	<i>Vittadinia dissecta</i> s.l.	Dissected New Holland Daisy
MH	<i>Calandrinia eremaea</i>	Small Purslane
MH	<i>Crassula colorata</i>	Dense Crassula
SH	<i>Actinobole uliginosum</i>	Flannel Cudweed
MTG	<i>Austrodanthonia caespitosa</i>	Common Wallaby-grass
MTG	<i>Austrostipa</i> spp.	Spear-grass
MNG	<i>Austrostipa elegantissima</i>	Feather Spear-grass

EVC 97: Semi-arid Woodland - Murray Fans bioregion

Recruitment:

Continuous

Organic Litter:

20% cover

Logs:

20m/0.1 ha.

Weediness:

LF Code	Typical Weed Species	Common Name	Invasive	Impact
LH	<i>Brassica tournefortii</i>	Mediterranean Turnip	high	high
LH	<i>Reichardia tingitana</i>	Reichardia	high	low
MH	<i>Silene</i> spp.	Catchfly	high	high
SH	<i>Medicago minima</i>	Little Medic	high	high
MTG	<i>Schismus barbatus</i>	Arabian Grass	high	high
MTG	<i>Pentaschistis airoides</i> ssp. <i>airoides</i>	False Hair-grass	high	high
MNG	<i>Bromus rubens</i>	Red Brome	high	high
MNG	<i>Vulpia myuros</i>	Rat's-tail Fescue	high	high
MNG	<i>Critesion murinum</i> subsp. <i>glaucum</i>	Blue Barley-grass	high	high
SC	<i>Asparagus asparagoides</i>	Bridal Creeper	high	high

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EVC/Bioregion Benchmark for Vegetation Quality Assessment

Murray Fans bioregion

EVC 103: Riverine Chenopod Woodland (*syn.* Black Box Chenopod Woodland)

Description:

Eucalypt woodland to 15 m tall with a diverse shrubby and grassy understorey occurring on most elevated riverine terraces. Confined to heavy clay soils on higher level terraces within or on the margins of riverine floodplains (or former floodplains), naturally subject to only extremely infrequent incidental shallow flooding from major events if at all flooded.

Large trees:

Species	DBH(cm)	#/ha
<i>Eucalyptus largiflorens</i>	40 cm	5/ha

Tree Canopy Cover:

%cover	Character Species	Common Name
10%	<i>Eucalyptus largiflorens</i>	Black Box
	<i>Acacia stenophylla</i>	River Coobah

Understorey:

Life form	#Spp	%Cover	LF code
Immature Canopy Tree		5%	IT
Medium Shrub	3	30%	MS
Small Shrub	5	25%	SS
Prostrate Shrub	1	1%	PS
Medium Herb	5	5%	MH
Small or Prostrate Herb*	5	10%	SH
Medium to Small Tufted Graminoid	2	5%	MTG

* Largely seasonal life form

Total understorey projective foliage cover 50%

LF Code	Species typical of at least part of EVC range	Common Name
MS	<i>Atriplex nummularia</i>	Old-man Saltbush
MS	<i>Chenopodium nitrariaceum</i>	Nitre Goosefoot
MS	<i>Eremophila divaricata</i> ssp. <i>divaricata</i>	Spreading Emu-bush
SS	<i>Sclerolaena tricuspis</i>	Streaked Copperburr
SS	<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	Ruby Saltbush
SS	<i>Atriplex lindleyi</i>	Flat-top Saltbush
SS	<i>Rhagodia spinescens</i>	Hedge Saltbush
PS	<i>Sclerochlamys brachyptera</i>	Short-wing Saltbush
MH	<i>Einadia nutans</i> ssp. <i>nutans</i>	Nodding Saltbush
MH	<i>Calocephalus sonderi</i>	Pale Beauty-heads
MH	<i>Senecio glossanthus</i>	Slender Groundsel
MH	<i>Brachyscome lineariloba</i>	Hard-head Daisy
SH	<i>Disphyma crassifolium</i> ssp. <i>clavellatum</i>	Rounded Noon-flower
SH	<i>Maireana pentagona</i>	Hairy Bluebush

Recruitment:

Continuous

Organic Litter:

5% cover

Logs:

5m/0.1 ha.

EVC 103: Riverine Chenopod Woodland (*syn.* Black Box Chenopod Woodland) - Murray Fans bioregion

Weediness:

LF Code	Typical Weed Species	Common Name	Invasive	Impact
T	<i>Olea europaea</i> subsp. <i>europaea</i>	Olive	low	high
MS	<i>Lycium ferocissimum</i>	Boxthorn	low	high
LH	<i>Sisymbrium erysimoides</i>	Smooth Mustard	high	high
LH	<i>Critesion</i> spp.	Barley-grass	high	low
LH	<i>Gazania linearis</i>	Gazania	high	high
LH	<i>Opuntia</i> spp.	Prickly Pear	low	high
LH	<i>Sisymbrium irio</i>	London Mustard	high	high
LH	<i>Psilocaulon granulicaule</i>	Noon-flower	high	high
MH	<i>Limonium sinuatum</i>	Notch-leaf Sea-lavender	high	high
MH	<i>Limonium lobatum</i>	Winged Sea-lavender	high	high
MH	<i>Trifolium arvense</i> var. <i>arvense</i>	Hare's-foot Clover	high	low
MH	<i>Mesembryanthemum nodiflora</i>	Ice-plant	high	high
MH	<i>Carrichtera annua</i>	Ward's Weed	high	high
MH	<i>Marrubium vulgare</i>	Horehound	high	high
MH	<i>Carpobrotus aequilaterus</i>	Angled Pigface	low	high
MH	<i>Silene apetala</i> var. <i>apetala</i>	Sand Catchfly	high	low
MH	<i>Medicago</i> spp.	Medic	high	low
MH	<i>Oxalis pes-caprae</i>	Soursob	high	high
MH	<i>Silene gallica</i>	French Catchfly	high	low
MH	<i>Silene nocturna</i>	Mediterranean Catchfly	high	low
SH	<i>Mesembryanthemum crystallinum</i>	Common Ice-plant	high	high
MTG	<i>Vulpia bromoides</i>	Squirrel-tail Fescue	high	high
MTG	<i>Lolium rigidum</i>	Wimmera Rye-grass	high	low
MTG	<i>Asphodelus fistulosus</i>	Onion Weed	high	high
MNG	<i>Bromus rubens</i>	Red Brome	high	high
MNG	<i>Vulpia myuros</i>	Rat's-tail Fescue	high	low
MNG	<i>Bromus</i> spp.	Brome	high	high
MNG	<i>Schismus barbatus</i>	Arabian Grass	high	low
SC	<i>Asparagus asparagoides</i>	Bridal Creeper	high	high

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EVC/Bioregion Benchmark for Vegetation Quality Assessment

Murray Fans bioregion

EVC 106: Grassy Riverine Forest

Description:

Occurs on the floodplain of major rivers, in a slightly elevated position where floods are infrequent, on deposited silts and sands, forming fertile alluvial soils. River Red Gum forest to 25 m tall with a groundlayer dominated by graminoids. Occasional tall shrubs present.

Large trees:

Species	DBH(cm)	#/ha
<i>Eucalyptus</i> spp.	90 cm	20 / ha

Tree Canopy Cover:

%cover	Character Species	Common Name
30%	<i>Eucalyptus camaldulensis</i>	River Red-gum

Understorey:

Life form	#Spp	%Cover	LF code
Immature Canopy Tree		5%	IT
Understorey Tree or Large Shrub	1	10%	T
Large Herb	2	10%	LH
Medium Herb	3	10%	MH
Medium to Small Tufted Graminoid	3	25%	MTG
Medium to Tiny Non-tufted Graminoid	3	10%	MNG
Bryophytes/Lichens	na	10%	BL
Total understorey projective foliage cover		75%	

LF Code	Species typical of at least part of EVC range	Common Name
T	<i>Acacia stenophylla</i>	Eumong
LH	<i>Wahlenbergia fluminalis</i>	River Bluebell
LH	<i>Senecio quadridentatus</i>	Cotton Fireweed
MH	<i>Goodenia fascicularis</i>	Silky Goodenia
MH	<i>Eclipta platyglossa</i>	Yellow Twin-heads
MTG	<i>Setaria jubiflora</i>	Warrego Summer-grass
MNG	<i>Eleocharis acuta</i>	Common Spike-sedge

Recruitment:

Continuous

Organic Litter:

40 % cover

Logs:

30 m/0.1 ha.

Weediness:

LF Code	Typical Weed Species	Common Name	Invasive	Impact
LH	<i>Lactuca serriola</i>	Prickly Lettuce	high	low
LH	<i>Sonchus oleraceus</i>	Common Sow-thistle	high	low
LH	<i>Centaurea melitensis</i>	Malta Thistle	high	low
MH	<i>Hypochaeris glabra</i>	Smooth Cat's-ear	high	low
MH	<i>Trifolium arvense</i> var. <i>arvense</i>	Hare's-foot Clover	high	low
MH	<i>Reichardia tingitana</i>	False Sow-thistle	high	low
MH	<i>Phyla canescens</i>	Fog-fruit	high	high
MTG	<i>Vulpia bromoides</i>	Squirrel-tail Fescue	high	low
MNG	<i>Bromus rubens</i>	Red Brome	high	low

EVC 106: Grassy Riverine Forest - Murray Fans bioregion

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EVC/Bioregion Benchmark for Vegetation Quality Assessment

Murray Fans bioregion

EVC 295: Riverine Grassy Woodland

Description:

Occurs on the floodplain of major rivers, in a slightly elevated position where floods are rare, on deposited silts and sands, forming fertile alluvial soils. River Red Gum woodland to 20 m tall with a groundlayer dominated by graminoids and sometimes lightly shrubby or with chenopod shrubs.

Large trees:

Species	DBH(cm)	#/ha
<i>Eucalyptus</i> spp.	80 cm	15 / ha

Tree Canopy Cover:

%cover	Character Species	Common Name
20%	<i>Eucalyptus camaldulensis</i>	River Red-gum
	<i>Eucalyptus largiflorens</i>	Black Box

Understorey:

Life form	#Spp	%Cover	LF code
Immature Canopy Tree		5%	IT
Small Shrub	4	10%	SS
Large Herb	4	10	LH
Medium Herb	2	10%	MH
Small or Prostrate Herb	5	10%	SH
Large Tufted Graminoid	1	1%	LTG
Medium to Small Tufted Graminoid	5	20%	MTG
Medium to Tiny Non-tufted Graminoid	2	5%	MNG
Bryophytes/Lichens	na	10%	BL
Total understorey projective foliage cover		75%	

LF Code	Species typical of at least part of EVC range	Common Name
SS	<i>Sclerolaena muricata</i> var. <i>villosa</i>	Grey Roly-poly
SS	<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	Ruby Saltbush
SS	<i>Maireana decalvans</i>	Black Cotton-bush
SS	<i>Chenopodium curvispicatum</i>	Cottony Saltbush
LH	<i>Wahlenbergia fuminalis</i>	River Bluebell
LH	<i>Rumex brownii</i>	Slender Dock
LH	<i>Senecio quadridentatus</i>	Cotton Fireweed
MH	<i>Einadia nutans</i> ssp. <i>nutans</i>	Nodding Saltbush
MH	<i>Atriplex semibaccata</i>	Berry Saltbush
MH	<i>Atriplex eardleyae</i>	Small Saltbush
MH	<i>Sida corrugata</i>	Variable Sida
MTG	<i>Austrodanthonia setacea</i>	Bristly Wallaby-grass
MTG	<i>Austrostipa scabra</i>	Rough Spear-grass
MTG	<i>Carex inversa</i>	Knob Sedge
MTG	<i>Juncus subsecundus</i>	Finger Rush

Recruitment:

Continuous

Organic Litter:

10 % cover

Logs:

20 m/0.1 ha.

EVC 295: Riverine Grassy Woodland – Murray Fans bioregion

Weediness:

LF Code	Typical Weed Species	Common Name	Invasive	Impact
MTG	<i>Bromus hordaceus</i> ssp. <i>hordaceus</i>	Soft Brome	high	high
MTG	<i>Critesion murinum</i> ssp. <i>leporinum</i>	Wall Barley-grass	high	high
MNG	<i>Bromus rubens</i>	Red Brome	high	high

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Appendix 6: Best / Remaining 50% habitat assessment for rare and threatened species in Victoria

Species	Rare/ Threatened Species	EVC	Habitat Zones	Assessment Process	Outcome	Con. Sig.
Blue-burr Daisy (r)	Rare	Riverine Chenopod Woodland (EVC 103)	19	A, B, E, F, No	Remaining 50% of habitat	Medium
Weeping Myall (e)	Threatened	Semi-arid Woodland (EVC 97)	17	A, B, E, F, No	Remaining 50% of habitat	High
		Riverine Chenopod Woodland (EVC 103)	4	A, B, E, F, No	Remaining 50% of habitat	High
Pale Flax-lily (v)	Threatened	Semi-arid Woodland (EVC 97)	17	A, B, E, F, No	Remaining 50% of habitat	High
		Riverine Chenopod Woodland (EVC 103)	4, 5, 6, 6A, 7, 12, 16, 19, 20, 22	A, B, E, F, No	Remaining 50% of habitat	High
		Grassy Riverine Forest (EVC 106)	13, 18	A, B, E, F, No	Remaining 50% of habitat	High

Species	Rare/ Threatened Species	EVC	Habitat Zones	Assessment Process	Outcome	Con. Sig.
		Riverine Grassy Woodland (EVC 295)	14, 21	A, B, E, F, No	Remaining 50% of habitat	High
Slender Darling-pea (e) Small Scurf-pea (e)	Threatened	Riverine Chenopod Woodland (EVC 103)	6, 6A, 16, 19, 20	A, D, F, No	Remaining 50% of habitat	High
Barking Owl (e)	Threatened	Riverine Grassy Woodland (EVC 295) Grassy Riverine Forest (EVC 106)	8, 13, 14,15, 15A, 18, 23	A, D, F, No	Remaining 50% of habitat	High
Bush Stone–Curlew (e)	Threatened	Riverine Chenopod Woodland (EVC 103)	6, 7, 10, 16, 19, 20, 22	A, B, E, F, Yes	Best 50 % of habitat	Very high
Grey Crowned Babbler (e)	Threatened	Riverine Chenopod Woodland (EVC 103) Grassy Riverine Forest (EVC 106)	1, 2, 2A, 3, 4, 6, 6A, 7, 10, 12, 13, 16, 18, 19, 20, 22, 23	A, D, F, No	Remaining 50% of habitat	High
Diamond Firetail (v) Speckled warbler (v)	Threatened	Riverine Chenopod Woodland (EVC 103)	1, 2, 2A, 3, 4, 6, 6A, 7, 10, 12, 16, 19, 20, 22	A, D, F, No	Remaining 50% of habitat	High

Species	Rare/ Threatened Species	EVC	Habitat Zones	Assessment Process	Outcome	Con. Sig.
Swift Parrot (e) Superb Parrot (v)	Threatened	Riverine Chenopod Woodland (EVC 103) Grassy Riverine Forest (EVC 106)	1, 2, 2A, 3, 4, 6, 6A, 7, 10, 12, 13, 16, 18, 19, 20, 22, 23	A, D, F, No	Remaining 50% of habitat	High
Eastern Great Egret (e) Intermediate Egret (ce) Royal Spoonbill (v)	Threatened	Either side of Murray and Campaspe Rivers (EVC 106 and 295)	13, 14, 23	A, D, F, No	Remaining 50% of habitat	High
White-bellied Sea- eagle (v)	Threatened	Either side of Murray and Campaspe Rivers (EVC 106 and 295)	13, 14, 23	A, D, F, No	Remaining 50% of habitat	High
Squirrel Glider (e)	Threatened	Riverine Chenopod Woodland (EVC 103) Grassy Riverine Forest (EVC 106)	3, 4, 6, 6A, 7, 10, 12, 13, 16, 18, 19, 20, 22, 23	A, D, F, No	Remaining 50% of habitat	High
Corben's Long-eared bat (v)	Threatened	Patches representing above average condition and landscape context	5, 6, 6A, 7, 9, 12, 13, 14, 16, 17, 18, 19, 21	A, B, E, F, Yes	Best 50 % of habitat	Very High
		Patches representing below average condition and landscape context	1, 2, 2A, 3, 4, 8, 10, 11, 15, 15A, 20, 22, 23	A, B, E, F, No	Remaining 50% of habitat	High

Notes: For habitat zones refer to Figure 7; Assessment process refers to Table 2 in the Guide for Assessment of referred planning permit applications (DSE 2007a)

Appendix 7: TSC Act Seven Part Test Criteria

TSC Act Seven Part Test Criteria

- (a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction;
- (b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.
- (c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
 - (i) Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction; or
 - (ii) Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.
- (d) In relation to the habitat of a threatened species, population or ecological community:
 - (i) The extent to which habitat is likely to be removed or modified as a result of the action proposed;
 - (ii) Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action;
 - (iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.
- (e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).
- (f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.
- (g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Appendix 8: Detailed Results of first bat survey

SITE 1	Only 1 bat call (<i>Vespadelus darlingtoni</i>) recorded; Probable equipment failure							Total calls identified
SITE 2	8-Nov	9-Nov	10-Nov	11-Nov	12-Nov	13-Nov	14-Nov	Total calls identified
Files generated	916	819	444	538	573	1439	355	5084
Gould's Wattled Bat	x	x	x	x	x	x	x	
Chocolate Wattled Bat	x	x	x	x	x	x	x	
Southern Freetail Bat sp 2 30k	x	x	x	x	x	x	x	
Southern Freetail Bat sp 4 28k	x	x	x	x	x	x	x	
Long-eared Bat	x	x	x	x	x	x	x	
Inland Broad-nosed Bat	x	x	x	x	x	x	x	
Yellow-bellied Sheathtail Bat 20k	5	3	7	3	5	5	4	32
White-striped Freetail-bat	x	x	x	x	x	x	x	
Large Forest Bat	x	x	x	x	x	x	x	
Southern Forest Bat	x	x	x	x	x	x	x	
Little Forest Bat	x	x	x	x	x	x	x	
Corben's Long-eared Bat	0	0	0	0	0	0	0	0
SITE 3	8-Nov	9-Nov	10-Nov	11-Nov	12-Nov	13-Nov	14-Nov	Total calls identified
Files generated	642	352	273	509	702	641	416	3535
Gould's Wattled Bat		x		x	x	x	x	
Chocolate Wattled Bat	x	x	x	x	x	x	x	
Southern Freetail Bat sp 2 30k	x	x			x		x	
Southern Freetail Bat sp 4 28k	x	x	x	x	x	x	x	
Long-eared Bat	x	x	x	x	x	x	x	
Inland Broad-nosed Bat	x	x			x		x	
Yellow-bellied Sheathtail Bat 20k	3	0	4	0	0	0	0	7

White-striped Freetail-bat	x	x	x	x	x	x	x	
Large Forest Bat	x	x	x	x	x	x	x	
Southern Forest Bat	x		x	x				
Little Forest Bat	x	x	x	x	x	x	x	
Corben's Long-eared Bat	1	0	0	0	0	0	0	1
SITE 4	8-Nov	9-Nov	10-Nov	11-Nov	12-Nov	13-Nov	14-Nov	
Files generated	303	441	222	162	225	316	322	1991
Gould's Wattled Bat	x	x	x	x	x	x	x	
Chocolate Wattled Bat	x	x	x	x	x	x	x	
Southern Freetail Bat sp 2 30k		x	x	x	x	x	x	
Southern Freetail Bat sp 4 28k	x	x	x	x	x	x	x	
Long-eared Bat	x	x	x	x	x	x	x	
Inland Broad-nosed Bat	x	x	x	x	x	x	x	
Yellow-bellied Sheath-tail Bat 20k	4	7	4	6	4	7	8	40
White-striped Freetail-bat	x	x	x	x	x	x	x	
Large Forest Bat	x	x	x	x	x	x	x	
Southern Forest Bat		x	x		x	x	x	
Little Forest Bat	x	x	x	x	x	x	x	
Corben's Long-eared Bat	2	1	0	0	0	0	0	3
SITE 5	8-Nov	9-Nov	10-Nov	11-Nov	12-Nov	13-Nov	14-Nov	
Files generated	827	952	996	971	403	495	334	4978
Gould's Wattled Bat	x	x	x	x	x	x	x	
Chocolate Wattled Bat	x	x	x	x	x	x	x	
Southern Freetail Bat sp 2 30k	x	x	x	x	x	x	x	
Southern Freetail Bat sp 4 28k	x	x	x	x	x	x	x	
Long-eared Bat	x	x	x	x	x	x	x	

Inland Broad-nosed Bat	x	x	x	x	x	x	x	
Yellow-bellied Sheathtail Bat 20k	2	0	3	0	4	2	2	13
White-striped Freetail-bat	x	x	x	x	x	x	x	
Large Forest Bat	x	x	x	x	x	x	x	
Southern Forest Bat	x	x	x	x	x	x	x	
Little Forest Bat	x	x	x	x	x	x	x	
Corben’s Long-eared Bat	1	3	1	0	0	2	0	7
SITE 6	15-Nov	16-Nov	17-Nov	18-Nov	19-Nov	20-Nov	21-Nov	
Files generated	504	59	228	423	93	64	66	1437
Gould's Wattled Bat	x	x	x	x	x	x	x	
Chocolate Wattled Bat	x	x	x	x	x	x	x	
Southern Freetail Bat sp 2 30k		x	x	x	x	x	x	
Southern Freetail Bat sp 4 28k	x	x	x	x	x	x	x	
Long-eared Bat	x	x	x	x	x	x	x	
Inland Broad-nosed Bat	x		x		x	x	x	
Yellow-bellied Sheathtail Bat 20k	2	0	0	0	0	0	0	2
White-striped Freetail-bat	x	x	x	x	x	x	x	
Large Forest Bat	x	x	x	x	x	x	x	
Southern Forest Bat								
Little Forest Bat	x	x	x	x	x	x	x	
Corben’s Long-eared Bat	0	0	0	0	0	0	0	0
SITE 7	15-Nov	16-Nov	17-Nov	18-Nov	19-Nov	20-Nov	21-Nov	
Files generated	375	305	773	663	314	298	294	3022
Gould's Wattled Bat	x	x	x	x	x	x	x	
Chocolate Wattled Bat	x	x	x	x	x	x	x	
Southern Freetail Bat sp 2 30k	x	x	x	x	x	x	x	

Southern Freetail Bat sp 4 28k	x	x	x	x	x	x	x	
Long-eared Bat	x	x	x	x	x	x	x	
Inland Broad-nosed Bat	x	x	x	x	x	x	x	
Yellow-bellied Sheathtail Bat 20k	8	3	3	5	3	6	4	32
White-striped Freetail-bat	x	x	x	x	x	x	x	
Large Forest Bat	x	x	x	x	x	x	x	
Southern Forest Bat	x	x	x	x	x	x	x	
Little Forest Bat	x	x	x	x	x	x	x	
Corben’s Long-eared Bat	0	0	0	0	0	0	0	
SITE 8	15-Nov	16-Nov	17-Nov	18-Nov	19-Nov	20-Nov	21-Nov	
Files generated	63	23	28	39	23	52	20	248
Gould's Wattled Bat	x	x	x	x	x	x	x	
Chocolate Wattled Bat	x	x		x	x	x	x	
Southern Freetail Bat sp 2 30k	x	x	x	x	x	x	x	
Southern Freetail Bat sp 4 28k	x			x				
Long-eared Bat	x	x	x	x	x	x	x	
Inland Broad-nosed Bat	x	x	x		x	x	x	
Yellow-bellied Sheathtail Bat 20k	1	0	0	1	1	0	0	3
White-striped Freetail-bat	x	x	x	x	x	x	x	
Large Forest Bat	x	x	x	x	x	x	x	
Southern Forest Bat								
Little Forest Bat	x	x	x	x	x	x	x	
Corben’s Long-eared Bat	0	0	0	0	0	0	0	0
Total files all sites	3630	2951	2964	3305	2333	3305	1807	20295

Appendix 9: Detailed results of the second bat survey

Site 1 (files recorded = 1048)	24-Feb	25-Feb	26-Feb	27-Feb	28-Feb	29-Feb	1-Mar	2-Mar	3-Mar	4-Mar
White-striped Freetail Bat	x				x					
Gould's Wattle Bird	x	x	x	x	x	x		x	x	
Chocolate Wattle Bat			x				x	x		x
Southern Freetail bat (spp. 2)	x	x		x	x		x	x	x	
Southern Freetail bat (spp. 4)	x	x	x	x	x	x	x	x	x	x
Corben's Long-eared Bat	1	0	0	0	0	0	0	0	0	0
Long-eared Bat	x	x			x		x	x		x
Yellow-bellied Sheath-tail Bat	0	0	0	0	0	0	0	0	0	0
Inland Broad-nosed Bat		x	x	x		x	x	x		
Large Forest Bat	x	x	x	x		x	x	x	x	x
Southern Forest Bat				x	x		x			
Little Forest Bat	x	x	x	x	x		x	x	x	
Site 2 - Anabat failed (no calls recorded)										
Site 3 - Anabat failed (no calls recorded)										
Site 4 (files recorded = 8424)	24-Feb	25-Feb	26-Feb	27-Feb	28-Feb	29-Feb	1-Mar	2-Mar	3-Mar	4-Mar
White-striped Freetail Bat	x	x	x	x	x	x	x	x	x	x
Gould's Wattle Bird	x	x	x	x	x	x	x	x	x	x
Chocolate Wattle Bat	x	x	x	x	x	x	x	x	x	x
Southern Freetail bat (spp. 2)	x	x	x	x	x	x	x	x	x	x
Southern Freetail bat (spp. 4)	x	x	x	x	x	x	x	x	x	x
Corben's Long-eared Bat	4	3	6	1	3	0	3	0	0	0

Long-eared Bat	x	x	x	x	x	x	x	x	x	x
Yellow-bellied Sheathtail Bat	4	1	6	2	0	0	0	0	0	0
Inland Broad-nosed Bat	x	x		x		x			x	x
Little Broad-nosed Bat	x	x	x	x	x	x	x	x	x	x
Large Forest Bat	x	x	x	x	x	x	x	x	x	x
Southern Forest Bat	x	x			x		x			x
Little Forest Bat	x	x	x	x	x	x	x	x	x	x
Site 5 (files recorded = 1626)	5-Mar	6-Mar	7-Mar	8-Mar	9-Mar	10-Mar	11-Mar	12-Mar	13-Mar	14-Mar
White-striped Freetail Bat	x	x	x	x	x	x	x	x	x	x
Gould's Wattle Bird			x	x	x			x		
Chocolate Wattle Bat	x	x	x	x	x	x	x	x	x	x
Southern Freetail bat (spp. 2)	x	x	x	x	x	x	x	x	x	x
Southern Freetail bat (spp. 4)	x	x	x	x	x	x	x	x	x	x
Corben's Long-eared Bat	0	3	2	1	0	0	0	0	1	0
Long-eared Bat	x	x	x	x	x	x	x	x	x	x
Yellow-bellied Sheathtail Bat	2	0	0	1	0	0	0	1	0	0
Inland Broad-nosed Bat	x	x	x	x	x	x	x	x	x	x
Little Broad-nosed Bat										
Large Forest Bat	x	x	x	x	x	x	x	x	x	x
Southern Forest Bat		x			x			x	x	x
Little Forest Bat	x	x	x	x	x	x	x	x	x	x
Site 6 (files recorded = 35)	5-Mar	6-Mar	7-Mar	8-Mar	9-Mar	10-Mar	11-Mar	12-Mar	13-Mar	14-Mar
White-striped Freetail Bat		x	x						x	
Gould's Wattle Bird								x		
Chocolate Wattle Bat	x	x	x	x			x			

Southern Freetail bat (spp. 2)									x	
Southern Freetail bat (spp. 4)							x		x	x
Corben's Long-eared Bat										
Long-eared Bat			x				x	x		
Yellow-bellied Sheathtail Bat										
Inland Broad-nosed Bat			x				x			
Little Broad-nosed Bat										
Large Forest Bat	x	x		x	x		x			
Southern Forest Bat								x		
Little Forest Bat										
Site 7 - Anabat failed (no calls recorded)										
Site 8 (files recorded = 107)	5-Mar	6-Mar	7-Mar	8-Mar	9-Mar	10-Mar	11-Mar	12-Mar	13-Mar	14-Mar
White-striped Freetail Bat										
Gould's Wattle Bird	x					x				
Chocolate Wattle Bat	x	x		x		x				
Southern Freetail bat (spp. 2)									x	
Southern Freetail bat (spp. 4)										
Corben's Long-eared Bat	0	0	0	1	0	0	0	0	0	
Long-eared Bat	x					x		x		
Yellow-bellied Sheathtail Bat	0	0	0	0	0	0	0	0	0	
Inland Broad-nosed Bat		x								
Large Forest Bat	x	x	x	x	x	x	x	x	x	x
Southern Forest Bat	x	x	x	x	x					
Little Forest Bat	x	x	x	x	x	x	x	x	x	

Appendix 10: Results of the EPBC Act Protected Matters Search Tool database search



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 about the EPBC Act including significance guidelines, forms and application process details can be found at <http://www.environment.gov.au/epbc/assessmentsapprovals/index.html>

Report created: 14/11/12 16:32:28

[Summary](#)

[Details](#)

[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

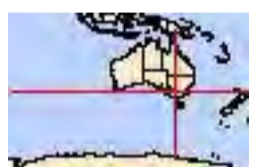
[Acknowledgements](#)



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

[Coordinates](#)

Buffer: 10.0Km



Summary

Matters of National Environment 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 - see <http://www.environment.gov.au/epbc/assessmentsapprovals/guidelines/index.html>

World Heritage Properties:	None
National Heritage Places:	1
Wetlands of International	6
Great Barrier Reef Marine Park:	None
Commonwealth Marine Areas:	None
Threatened Ecological Communities:	4
Threatened Species:	24
Migratory Species:	14

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 and the heritage values of a place on the Register of the National Estate. Information on the new heritage laws can be found at <http://www.environment.gov.au/heritage/index.html>

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.

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. Information on EPBC Act permit requirements and application forms can be found at <http://www.environment.gov>.

Commonwealth Lands:	2
Commonwealth Heritage Places:	None
Listed Marine Species:	11
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves:	None

Extra Information

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

Place on the RNE:	23
State and Territory Reserves:	3
Regional Forest Agreements:	None
Invasive Species:	12
Nationally Important Wetlands:	1

Details

Matters of National Environmental Significance

National Heritage Properties		[Resource Information]
Name	State	Status
Historic		
Echuca Wharf	VIC	Listed place

Wetlands of International Significance (RAMSAR)		[Resource Information]
Name		Proximity
Banrock station wetland complex		Upstream from Ramsar
Barmah forest		Upstream from Ramsar
Coorong and lakes alexandrina and albert		Upstream from Ramsar
Gunbower forest		Upstream from Ramsar
Nsw central murray state forests		Within 10km of Ramsar
Riverland		Upstream from Ramsar

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
Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions	Endangered	Community may occur within area
Grey Box (<i>Eucalyptus microcarpa</i>) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia	Endangered	Community may 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

Threatened Species

[[Resource Information](#)]

Name	Status	Type of Presence
------	--------	------------------

BIRDS

Anthochaera phrygia Regent Honeyeater [82338]	Endangered	Species or species habitat may occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat likely to occur within area
Lathamus discolor Swift Parrot [744]	Endangered	Species or species habitat likely to occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Pedionomus torquatus Plains-wanderer [906]	Vulnerable	Species or species habitat likely to occur within area
Polytelis swainsonii Superb Parrot [738]	Vulnerable	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe [77037]	Vulnerable	Species or species habitat likely to occur within area

FISH

Craterocephalus fluviatilis Murray Hardyhead [56791]	Endangered	Species or species habitat may occur within area
Maccullochella peelii Murray Cod [66633]	Vulnerable	Species or species habitat may occur within area
Macquaria australasica Macquarie Perch [66632]	Endangered	Species or species habitat may occur within area

FROGS

Litoria raniformis Growling Grass Frog, Southern Bell Frog, Green and Golden Frog, Warty Swamp Frog [1828]	Vulnerable	Species or species habitat likely to occur within area
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INSECTS

Synemon plana Golden Sun Moth [25234]	Critically Endangered	Species or species habitat may occur within area
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MAMMALS

Name	Status	Type of Presence
Nyctophilus corbeni South-eastern Long-eared Bat [83395]	Vulnerable	Species or species habitat may occur within area
Petrogale penicillata Brush-tailed Rock-wallaby [225]	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
PLANTS		
Amphibromus fluitans River Swamp Wallaby-grass, Floating Swamp Wallaby-grass [19215]	Vulnerable	Species or species habitat may occur within area
Caladenia tensa Greencomb Spider-orchid, Rigid Spider-orchid [24390]	Endangered	Species or species habitat likely to occur within area
Callitriche cyclocarpa Western Water-starwort [7477]	Vulnerable	Species or species habitat likely to occur within area
Myriophyllum porcatum Ridged Water-milfoil [19919]	Vulnerable	Species or species habitat likely to occur within area
Pimelea spinescens subsp. spinescens Plains Rice-flower, Spiny Rice-flower, Prickly Pimelea [21980]	Critically Endangered	Species or species habitat known to occur within area
Sclerolaena napiformis Turnip Copperbur [11742]	Endangered	Species or species habitat likely to occur within area
Swainsona murrayana Slender Darling-pea, Slender Swainson, Murray Swainson-pea [6765]	Vulnerable	Species or species habitat likely to occur within area
Swainsona plagiotropis Red Darling-pea, Red Swainson-pea [10804]	Vulnerable	Species or species habitat likely to occur within area
REPTILES		
Delma impar Striped Legless Lizard [1649]	Vulnerable	Species or species habitat may occur within area
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
Ardea alba Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Migratory Terrestrial Species		
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat may occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat likely to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Xanthomyza phrygia Regent Honeyeater [430]	Endangered*	Species or species habitat may occur within area
Migratory Wetlands Species		
Ardea alba Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Vulnerable*	Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Lands

[\[Resource Information \]](#)

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 - Australian Telecommunications Corporation Defence - BOBDUBI BARRACKS - ECHUCA

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		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
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 likely to occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat may occur within area
Lathamus discolor Swift Parrot [744]	Endangered	Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat likely to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Vulnerable*	Species or species habitat likely to occur within area

Extra Information

Places on the RNE [\[Resource Information \]](#)

Note that not all Indigenous sites may be listed.

Name	State	Status
Natural		
Cobb Highway Travelling Stock Route Grasslands	NSW	Indicative Place
Echuca Aerodrome Remnant Grasslands	VIC	Indicative Place
Indigenous		
Scarred Tree and Mileage Tree	NSW	Indicative Place
Historic		
The Mount Alexander - Murray Valley Railway Line	VIC	Indicative Place
Bank of NSW (former)	VIC	Registered
Customs House (former)	VIC	Registered
Echuca Club	VIC	Registered
Echuca Conservation Area	VIC	Registered
Echuca Conservation Area Revised	VIC	Registered
Echuca Courthouse (former)	VIC	Registered
Echuca Flour Mill	VIC	Registered
Echuca Post Office	VIC	Registered
Echuca Road and Rail Bridge	NSW	Registered
Echuca Wharf	VIC	Registered
Hopewood Hotel	VIC	Registered
Library	VIC	Registered
Locomotive Engine Shed	VIC	Registered
Moama Courthouse	NSW	Registered
Permewan Wright Building	VIC	Registered
Perri Place	VIC	Registered
Police Station (former) now Museum	VIC	Registered
Pumping Station	VIC	Registered

Name	State	Status
Shackells Bond Store (former)	VIC	Registered

State and Territory Reserves [\[Resource Information \]](#)

Name	State
Goulburn River	VIC
River Murray Reserve	VIC
River Murray Reserve (non-PV)	VIC

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 Resources Audit,

Name	Status	Type of Presence
Mammals		

[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

[Oryctolagus cuniculus](#)

Rabbit, European Rabbit [128]

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

[Asparagus asparagoides](#)

Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]

Species or species habitat likely to occur within area

[Chrysanthemoides monilifera](#)

Bitou Bush, Boneseed [18983]

Species or species habitat may occur within area

[Lycium ferocissimum](#)

African Boxthorn, Boxthorn [19235]

Species or species habitat may occur within area

[Nassella neesiana](#)

Chilean Needle grass [67699]

Species or species habitat likely to 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

[Ulex europaeus](#)

Gorse, Furze [7693]

Species or species habitat likely to occur within area

Nationally Important Wetlands [\[Resource Information \]](#)

Name	State
Lower Goulburn River Floodplain	VIC

Coordinates

-36.11306 144.74333

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 Heritage and Register of National Estate properties, Wetlands of International 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

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

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.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

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.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

- [-Department of Environment, Climate Change and Water, New South Wales](#)
- [-Department of Sustainability and Environment, Victoria](#)
- [-Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [-Department of Environment and Natural Resources, South Australia](#)
- [-Parks and Wildlife Service NT, NT Dept of Natural Resources, Environment and the Arts](#)
- [-Environmental and Resource Management, Queensland](#)
- [-Department of Environment and Conservation, Western Australia](#)
- [-Department of the Environment, Climate Change, Energy and Water](#)
- [-Birds Australia](#)
- [-Australian Bird and Bat Banding Scheme](#)
- [-Australian National Wildlife Collection](#)
- Natural history museums of Australia
- [-Museum Victoria](#)
- [-Australian Museum](#)
- [-SA 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, Atherton and Canberra](#)
- [-University of New England](#)
- [-Ocean Biogeographic Information System](#)
- [-Australian Government, Department of Defence](#)
- [-State Forests of NSW](#)
- 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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[Department of Sustainability, Environment, Water, Population and Communities](#)

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Appendix 11: Plant species recorded from the FIS search region

Origin	Scientific Name	Common Name	Family Name	EPBC	FFG	DSE	Freq	Number of Sites
	<i>Acacia acinacea s.l.</i>	Gold-dust Wattle	Mimosaceae				0.70%	6
	<i>Acacia acinacea s.s.</i>	Gold-dust Wattle	Mimosaceae				0.10%	1
	<i>Acacia ausfeldii</i>	Ausfeld's Wattle	Mimosaceae			v	0.10%	1
	<i>Acacia dealbata</i>	Silver Wattle	Mimosaceae				0.40%	4
#	<i>Acacia floribunda</i>	White Sallow-wattle	Mimosaceae				0.10%	1
	<i>Acacia implexa</i>	Lightwood	Mimosaceae				0.10%	1
	<i>Acacia mearnsii</i>	Black Wattle	Mimosaceae				0.10%	1
	<i>Acacia melanoxylon</i>	Blackwood	Mimosaceae				0.20%	2
	<i>Acacia omalophylla</i>	Yarran Wattle	Mimosaceae		f	e	0.30%	3
#	<i>Acacia pendula</i>	Weeping Myall	Mimosaceae		f	e	0.40%	4
	<i>Acacia pycnantha</i>	Golden Wattle	Mimosaceae				0.30%	3
	<i>Acacia salicina</i>	Willow Wattle	Mimosaceae				0.30%	3
	<i>Acacia spp.</i>	Wattle	Mimosaceae				0.20%	2
	<i>Acaulon granulatum</i>	Pygmy Moss	Pottiaceae				0.10%	1
	<i>Acaulon mediterraneum</i>	Spiny-spored Pygmy-moss	Pottiaceae				0.10%	1
	<i>Agrostis s.l. spp.</i>	Bent/Blown Grass	Poaceae				0.10%	1
*	<i>Aira cupaniana</i>	Quicksilver Grass	Poaceae				0.30%	3
*	<i>Aira elegantissima</i>	Delicate Hair-grass	Poaceae				0.40%	4
*	<i>Aira spp.</i>	Hair Grass	Poaceae				0.60%	5
*	<i>Alisma lanceolata</i>	Water Plantain	Alismataceae				0.70%	6
	<i>Alisma plantago-aquatica</i>	Water Plantain	Alismataceae				0.70%	6
*	<i>Allium vineale</i>	Crow Garlic	Alliaceae				0.10%	1
	<i>Allocasuarina luehmannii</i>	Buloke	Casuarinaceae		f		1.20%	10
*	<i>Alopecurus spp.</i>	Fox Tail	Poaceae				0.30%	3
	<i>Alternanthera denticulata s.l.</i>	Lesser Joyweed	Amaranthaceae				0.40%	4
	<i>Alternanthera denticulata s.s.</i>	Lesser Joyweed	Amaranthaceae				0.10%	1
*	<i>Alternanthera pungens</i>	Khaki Weed	Amaranthaceae				0.10%	1
	<i>Alternanthera spp.</i>	Joyweed	Amaranthaceae				0.90%	8
	<i>Amaranthus macrocarpus var. macrocarpus</i>	Dwarf Amaranth	Amaranthaceae			v	0.20%	2
	<i>Amphibromus fluitans</i>	River Swamp Wallaby-grass	Poaceae	V			0.20%	2
	<i>Amphibromus nervosus</i>	Common Swamp Wallaby-grass	Poaceae				0.20%	2
	<i>Amphibromus spp.</i>	Swamp Wallaby-grass	Poaceae				0.30%	3
*	<i>Amsinckia intermedia</i>	Common Fiddle-neck	Boraginaceae				0.10%	1
	<i>Amyema linophylla subsp. orientale</i>	Buloke Mistletoe	Loranthaceae			v	0.10%	1
	<i>Amyema miquelii</i>	Box Mistletoe	Loranthaceae				0.10%	1
	<i>Amyema spp.</i>	Mistletoe	Loranthaceae				0.10%	1
*	<i>Anagallis arvensis</i>	Pimpernel	Primulaceae				0.30%	3
*	<i>Aphanes arvensis</i>	Parsley Piert	Rosaceae				0.10%	1
	<i>Aphanes australiana</i>	Australian Piert	Rosaceae				0.10%	1
*	<i>Arctotheca calendula</i>	Cape Weed	Asteraceae				3.40%	28
	<i>Aristida behriana</i>	Brush Wire-grass	Poaceae				0.70%	6
	<i>Arthropodium fimbriatum</i>	Nodding Chocolate-lily	Anthericaceae				0.20%	2
	<i>Arthropodium minus</i>	Small Vanilla-lily	Anthericaceae				1.20%	10
	<i>Arthropodium sp. 3 (aff. strictum)</i>	Small Chocolate-lily	Anthericaceae				0.30%	3
	<i>Arthropodium spp. (s.s.)</i>	Vanilla Lily	Anthericaceae				0.20%	2

Origin	Scientific Name	Common Name	Family Name	EPBC	FFG	DSE	Freq	Number of Sites
	<i>Arthropodium strictum s.l.</i>	Chocolate Lily	Anthericaceae				0.10%	1
*	<i>Asparagus asparagoides</i>	Bridal Creeper	Asparagaceae				0.10%	1
*	<i>Asparagus scandens</i>	Asparagus Fern	Asparagaceae				0.10%	1
	<i>Asperula conferta</i>	Common Woodruff	Rubiaceae				1.20%	10
	<i>Asperula scoparia subsp. scoparia</i>	Prickly Woodruff	Rubiaceae				1.10%	9
*	<i>Asphodelus fistulosus</i>	Onion Weed	Asphodelaceae				0.20%	2
*	<i>Aster subulatus</i>	Aster-weed	Asteraceae				0.60%	5
	<i>Atriplex nummularia subsp. nummularia</i>	Old-man Saltbush	Chenopodiaceae				0.20%	2
	<i>Atriplex semibaccata</i>	Berry Saltbush	Chenopodiaceae				3%	25
	<i>Atriplex spp.</i>	Saltbush	Chenopodiaceae				0.10%	1
	<i>Austrostipa aristiglumis</i>	Plump Spear-grass	Poaceae				0.70%	6
	<i>Austrostipa elegantissima</i>	Feather Spear-grass	Poaceae				0.10%	1
	<i>Austrostipa gibbosa</i>	Spurred Spear-grass	Poaceae				0.70%	6
	<i>Austrostipa nodosa</i>	Knotty Spear-grass	Poaceae				0.90%	8
	<i>Austrostipa pubinodis</i>	Tall Spear-grass	Poaceae				0.10%	1
	<i>Austrostipa scabra</i>	Rough Spear-grass	Poaceae				1.20%	10
	<i>Austrostipa scabra subsp. falcata</i>	Rough Spear-grass	Poaceae				0.30%	3
	<i>Austrostipa scabra subsp. scabra</i>	Rough Spear-grass	Poaceae				0.10%	1
	<i>Austrostipa spp.</i>	Spear Grass	Poaceae				2.50%	21
*	<i>Avena barbata</i>	Bearded Oat	Poaceae				0.10%	1
*	<i>Avena fatua</i>	Wild Oat	Poaceae				1.80%	15
*	<i>Avena spp.</i>	Oat	Poaceae				2.20%	18
*	<i>Axonopus fissifolius</i>	Carpet Grass	Poaceae				0.20%	2
	<i>Azolla filiculoides</i>	Pacific Azolla	Azollaceae				0.60%	5
	<i>Azolla pinnata</i>	Ferny Azolla	Azollaceae				0.10%	1
	<i>Barbula calycina</i>	Common Beard-moss	Pottiaceae				0.10%	1
	<i>Barbula crinita</i>	Dusky Beard-moss	Pottiaceae				0.10%	1
#	<i>Boerhavia dominii</i>	Tah-vine	Nyctaginaceae				0.20%	2
	<i>Bothriochloa macra</i>	Red-leg Grass	Poaceae				0.10%	1
	<i>Brachyscome basaltica var. gracilis</i>	Woodland Swamp-daisy	Asteraceae				0.60%	5
	<i>Brachyscome chrysoglossa</i>	Yellow-tongue Daisy	Asteraceae		f	v	0.30%	3
	<i>Brachyscome ciliaris</i>	Variable Daisy	Asteraceae				0.20%	2
	<i>Brachyscome ciliaris var. subintegrifolia</i>	Variable Daisy	Asteraceae				0.10%	1
	<i>Brachyscome dentata</i>	Lobe-seed Daisy	Asteraceae				0.10%	1
	<i>Brachyscome spp.</i>	Daisy	Asteraceae				0.20%	2
*	<i>Briza maxima</i>	Large Quaking-grass	Poaceae				0.10%	1
*	<i>Briza minor</i>	Lesser Quaking-grass	Poaceae				0.40%	4
	<i>Bromus arenarius</i>	Sand Brome	Poaceae			r	0.10%	1
*	<i>Bromus catharticus</i>	Prairie Grass	Poaceae				0.20%	2
*	<i>Bromus diandrus</i>	Great Brome	Poaceae				0.70%	6
*	<i>Bromus hordeaceus subsp. hordeaceus</i>	Soft Brome	Poaceae				0.80%	7
*	<i>Bromus rubens</i>	Red Brome	Poaceae				0.10%	1
	<i>Bromus spp.</i>	Brome	Poaceae				1.30%	11
*	<i>Bromus sterilis</i>	Sterile Brome	Poaceae				0.10%	1
	<i>Bryum argenteum</i>	Silver Moss	Bryaceae				0.10%	1
	<i>Bulbine bulbosa</i>	Bulbine Lily	Asphodelaceae				1.20%	10

Origin	Scientific Name	Common Name	Family Name	EPBC	FFG	DSE	Freq	Number of Sites
#	<i>Callistemon rugulosus</i>	Scarlet Bottlebrush	Myrtaceae				0.10%	1
	<i>Callistemon sieberi</i>	River Bottlebrush	Myrtaceae				0.20%	2
*	<i>Callitriche brutia</i> var. <i>brutia</i>	Thread Water-starwort	Veronicaceae				0.10%	1
	<i>Callitriche cyclocarpa</i>	Western Water-starwort	Veronicaceae	V	f	v		
	<i>Callitriche sonderi</i>	Matted Water-starwort	Veronicaceae				0.40%	4
*	<i>Callitriche stagnalis</i>	Common Water-starwort	Veronicaceae				0.60%	5
	<i>Calocephalus citreus</i>	Lemon Beauty-heads	Asteraceae				0.80%	7
	<i>Calocephalus sonderi</i>	Pale Beauty-heads	Asteraceae				0.10%	1
	<i>Calotis anthemoides</i>	Cut-leaf Burr-daisy	Asteraceae				1.20%	10
	<i>Calotis cuneifolia</i>	Blue Burr-daisy	Asteraceae			r	0.10%	1
	<i>Calotis scabiosifolia</i>	Rough Burr-daisy	Asteraceae				0.60%	5
	<i>Calotis scabiosifolia</i> var. <i>integrifolia</i>	Rough Burr-daisy	Asteraceae				0.30%	3
	<i>Calotis scapigera</i>	Tufted Burr-daisy	Asteraceae				0.70%	6
	<i>Calotis</i> spp.	Burr Daisy	Asteraceae				0.40%	4
	<i>Calytrix tetragona</i>	Common Fringe-myrtle	Myrtaceae				0.30%	3
	<i>Campylopus introflexus</i>	Heath Star Moss	Leucobryaceae				0.10%	1
	<i>Cardamine moirensis</i>	Riverina Bitter-cress	Brassicaceae			r	0.10%	1
	<i>Cardamine paucijuga</i> s.l.	Annual Bitter-cress	Brassicaceae				0.10%	1
*	<i>Carduus pycnocephalus</i>	Slender Thistle	Asteraceae				0.30%	3
	<i>Carex appressa</i>	Tall Sedge	Cyperaceae				0.10%	1
	<i>Carex bichenoviana</i>	Plains Sedge	Cyperaceae				0.10%	1
	<i>Carex inversa</i>	Knob Sedge	Cyperaceae				1.10%	9
	<i>Carex</i> spp.	Sedge	Cyperaceae				0.80%	7
	<i>Carex tereticaulis</i>	Poong'ort	Cyperaceae				1.10%	9
*	<i>Carthamus lanatus</i>	Saffron Thistle	Asteraceae				0.60%	5
	<i>Cassinia arcuata</i>	Drooping Cassinia	Asteraceae				0.60%	5
*	<i>Casuarina glauca</i>	Swamp Oak	Casuarinaceae				0.20%	2
	<i>Casuarina</i> spp.	Sheoak	Casuarinaceae				0.10%	1
*	<i>Cenchrus longispinus</i>	Spiny Burr-grass	Poaceae				0.20%	2
*	<i>Centaurium tenuiflorum</i>	Slender Centaury	Gentianaceae				0.90%	8
	<i>Centella cordifolia</i>	Centella	Apiaceae				0.10%	1
	<i>Centipeda cunninghamii</i>	Common Sneezeweed	Asteraceae				0.30%	3
	<i>Centipeda minima</i> s.l.	Spreading Sneezeweed	Asteraceae				0.10%	1
	<i>Centipeda minima</i> subsp. <i>minima</i> s.s.	Spreading Sneezeweed	Asteraceae				0.10%	1
	<i>Centipeda</i> spp.	Sneezeweed	Asteraceae				0.10%	1
*	<i>Cerastium glomeratum</i> s.l.	Common Mouse-ear Chickweed	Caryophyllaceae				0.80%	7
*	<i>Cerastium glomeratum</i> s.s.	Sticky Mouse-ear Chickweed	Caryophyllaceae				0.10%	1
*	<i>Cerastium</i> spp.	Mouse-ear Chickweed	Caryophyllaceae				0.10%	1
	<i>Ceratodon purpureus</i> subsp. <i>convolutus</i>	Redshank Moss	Ditrichaceae				0.10%	1
#	<i>Chamaesyce drummondii</i>	Flat Spurge	Euphorbiaceae				2.40%	20
	<i>Cheilanthes austrotenuifolia</i>	Green Rock-fern	Adiantaceae				0.10%	1
*	<i>Chenopodium ambrosioides</i>	Mexican Tea	Chenopodiaceae				0.10%	1
	<i>Chenopodium desertorum</i>	Frosted Goosefoot	Chenopodiaceae				0.10%	1
	<i>Chenopodium desertorum</i> subsp. <i>microphyllum</i>	Small-leaf Goosefoot	Chenopodiaceae				0.40%	4
	<i>Chenopodium desertorum</i> subsp. <i>viosum</i>	Frosted Goosefoot	Chenopodiaceae			k	0.80%	7
*	<i>Chenopodium murale</i>	Sowbane	Chenopodiaceae				0.40%	4

Origin	Scientific Name	Common Name	Family Name	EPBC	FFG	DSE	Freq	Number of Sites
#	<i>Chenopodium pumilio</i>	Clammy Goosefoot	Chenopodiaceae				0.60%	5
	<i>Chenopodium spp.</i>	Goosefoot	Chenopodiaceae				0.20%	2
	<i>Chloris spp.</i>	Windmill Grass	Poaceae				0.10%	1
	<i>Chloris truncata</i>	Windmill Grass	Poaceae				2.50%	21
*	<i>Chondrilla juncea</i>	Skeleton Weed	Asteraceae				0.30%	3
	<i>Chrysocephalum apiculatum s.l.</i>	Common Everlasting	Asteraceae				1.50%	13
	<i>Chrysocephalum apiculatum s.s.</i>	Common Everlasting	Asteraceae				0.10%	1
	<i>Chrysocephalum sp. 1</i>	Plains Everlasting	Asteraceae				0.10%	1
	<i>Chrysocephalum spp.</i>	Everlasting	Asteraceae				0.10%	1
*	<i>Cicendia quadrangularis</i>	Square Cicendia	Gentianaceae				0.70%	6
*	<i>Cichorium intybus</i>	Chicory	Asteraceae				0.60%	5
*	<i>Cirsium vulgare</i>	Spear Thistle	Asteraceae				2.40%	20
*	<i>Citrullus lanatus</i>	Camel Melon	Cucurbitaceae				0.10%	1
	<i>Convolvulus erubescens spp. agg.</i>	Pink Bindweed	Convolvulaceae				1.50%	13
	<i>Convolvulus remotus</i>	Grass Bindweed	Convolvulaceae				0.60%	5
	<i>Convolvulus spp.</i>	Bindweed	Convolvulaceae				0.10%	1
*	<i>Conyza spp.</i>	Fleabane	Asteraceae				0.20%	2
*	<i>Conyza sumatrensis</i>	Tall Fleabane	Asteraceae				0.60%	5
*	<i>Cortaderia spp.</i>	Pampas Grass	Poaceae				0.10%	1
	<i>Cotula australis</i>	Common Cotula	Asteraceae				1.10%	9
*	<i>Cotula bipinnata</i>	Ferny Cotula	Asteraceae				1.30%	11
*	<i>Cotula coronopifolia</i>	Water Buttons	Asteraceae				0.40%	4
	<i>Craspedia glauca spp. agg.</i>	Common Billy-buttons	Asteraceae				0.10%	1
	<i>Craspedia spp.</i>	Billy Buttons	Asteraceae				0.10%	1
	<i>Crassula decumbens var. decumbens</i>	Spreading Crassula	Crassulaceae				1.30%	11
	<i>Crassula helmsii</i>	Swamp Crassula	Crassulaceae				0.10%	1
	<i>Crassula peduncularis</i>	Purple Crassula	Crassulaceae				0.30%	3
	<i>Crassula sieberiana s.l.</i>	Sieber Crassula	Crassulaceae				0.60%	5
	<i>Crassula spp.</i>	Crassula	Crassulaceae				0.40%	4
*	<i>Crataegus monogyna</i>	Hawthorn	Rosaceae				0.10%	1
*	<i>Cucumis myriocarpus subsp. leptodermis</i>	Paddy Melon	Cucurbitaceae				0.70%	6
	<i>Cullen parvum</i>	Small Scurf-pea	Fabaceae		f	e	0.30%	3
*	<i>Cupressus spp.</i>	Cypress	Cupressaceae				0.20%	2
*	<i>Cynara cardunculus</i>	Artichoke Thistle	Asteraceae				0.60%	5
	<i>Cynodon dactylon</i>	Couch	Poaceae				0.40%	4
*	<i>Cynodon dactylon var. dactylon</i>	Couch	Poaceae				0.60%	5
	<i>Cynoglossum suaveolens</i>	Sweet Hound's-tongue	Boraginaceae				0.30%	3
#	<i>Cyperus difformis</i>	Variable Flat-sedge	Cyperaceae				0.60%	5
*	<i>Cyperus eragrostis</i>	Drain Flat-sedge	Cyperaceae				1.80%	15
	<i>Cyperus exaltatus</i>	Tall Flat-sedge	Cyperaceae				0.20%	2
	<i>Cyperus gunnii subsp. gunnii</i>	Flecked Flat-sedge	Cyperaceae				0.20%	2
	<i>Damasonium minus</i>	Star Fruit	Alismataceae				0.20%	2
*	<i>Datura stramonium</i>	Common Thorn-apple	Solanaceae				0.10%	1
	<i>Daucus glochidiatus</i>	Australian Carrot	Apiaceae				0.10%	1
	<i>Deyeuxia quadriseta</i>	Reed Bent-grass	Poaceae				0.20%	2
	<i>Dianella admixta</i>	Black-anther Flax-lily	Hemerocallidaceae				0.10%	1

Origin	Scientific Name	Common Name	Family Name	EPBC	FFG	DSE	Freq	Number of Sites
	<i>Dianella longifolia</i> s.l.	Pale Flax-lily	Hemerocallidaceae				0.10%	1
	<i>Dianella longifolia</i> var. <i>longifolia</i> s.l.	Pale Flax-lily	Hemerocallidaceae				0.10%	1
	<i>Dianella</i> sp. aff. <i>longifolia</i> (Riverina)	Pale Flax-lily	Hemerocallidaceae			v	0.10%	1
	<i>Dianella</i> spp.	Flax Lily	Hemerocallidaceae				0.10%	1
#	<i>Dichanthium sericeum</i> subsp. <i>sericeum</i>	Silky Blue-grass	Poaceae				0.10%	1
	<i>Dichondra repens</i>	Kidney-weed	Convolvulaceae				0.20%	2
	<i>Dichopogon</i> spp.	Chocolate Lily	Anthericaceae				0.30%	3
	<i>Didymodon torquatus</i>	Beard Moss	Pottiaceae				0.10%	1
	<i>Dillwynia cinerascens</i> s.l.	Grey Parrot-pea	Fabaceae				0.30%	3
	<i>Dillwynia cinerascens</i> s.s.	Grey Parrot-pea	Fabaceae				0.40%	4
*	<i>Dittrichia graveolens</i>	Stinkwort	Asteraceae				0.20%	2
	<i>Dysphania glomulifera</i> subsp. <i>glomulifera</i>	Globular Pigweed	Chenopodiaceae				0.10%	1
*	<i>Echium plantagineum</i>	Paterson's Curse	Boraginaceae				7.90%	65
#	<i>Eclipta platyglossa</i>	Yellow Twin-heads	Asteraceae				1.10%	9
*	<i>Ehrharta longiflora</i>	Annual Veldt-grass	Poaceae				0.60%	5
	<i>Einadia nutans</i> subsp. <i>nutans</i>	Nodding Saltbush	Chenopodiaceae				1.50%	13
	<i>Elatine gratioloides</i>	Waterwort	Elatinaceae				0.30%	3
	<i>Eleocharis acuta</i>	Common Spike-sedge	Cyperaceae				0.80%	7
	<i>Eleocharis pusilla</i>	Small Spike-sedge	Cyperaceae				1.10%	9
	<i>Eleocharis</i> spp.	Spike Sedge	Cyperaceae				0.40%	4
	<i>Elymus scaber</i> var. <i>scaber</i>	Common Wheat-grass	Poaceae				1.10%	9
	<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	Ruby Saltbush	Chenopodiaceae				0.40%	4
	<i>Enteropogon acicularis</i>	Spider Grass	Poaceae				2.20%	18
	<i>Epilobium billardierianum</i>	Variable Willow-herb	Onagraceae				0.10%	1
	<i>Epilobium billardierianum</i> subsp. <i>cinereum</i>	Grey Willow-herb	Onagraceae				0.30%	3
	<i>Epilobium hirtigerum</i>	Hairy Willow-herb	Onagraceae				0.70%	6
	<i>Epilobium</i> spp.	Willow Herb	Onagraceae				0.20%	2
	<i>Eragrostis brownii</i>	Common Love-grass	Poaceae				0.10%	1
	<i>Eragrostis diandra</i>	Close-headed Love-grass	Poaceae				0.20%	2
	<i>Eragrostis infecunda</i>	Southern Cane-grass	Poaceae				0.30%	3
*	<i>Eragrostis pilosa</i>	Soft Love-grass	Poaceae				0.10%	1
	<i>Eragrostis</i> spp.	Love Grass	Poaceae				0.20%	2
	<i>Eremophila longifolia</i>	Berrigan	Scrophulariaceae				0.10%	1
	<i>Eriochlamys squamata</i>	Scaly Mantle	Asteraceae			v	0.20%	2
#	<i>Eriochloa pseudoacrotricha</i>	Early Spring-grass	Poaceae				0.20%	2
*	<i>Erodium botrys</i>	Big Heron's-bill	Geraniaceae				1.80%	15
*	<i>Erodium cicutarium</i>	Common Heron's-bill	Geraniaceae				0.30%	3
	<i>Erodium crinitum</i>	Blue Heron's-bill	Geraniaceae				0.10%	1
	<i>Erodium</i> spp.	Heron's Bill	Geraniaceae				0.20%	2
	<i>Eryngium ovinum</i>	Blue Devil	Apiaceae				1.20%	10
	<i>Eryngium paludosum</i>	Long Eryngium	Apiaceae			v	0.30%	3
	<i>Eucalyptus camaldulensis</i>	River Red-gum	Myrtaceae				2.30%	19
*	<i>Eucalyptus cladocalyx</i>	Sugar Gum	Myrtaceae				0.90%	8
	<i>Eucalyptus largiflorens</i>	Black Box	Myrtaceae				3%	25
	<i>Eucalyptus melliodora</i>	Yellow Box	Myrtaceae				0.60%	5
	<i>Eucalyptus microcarpa</i>	Grey Box	Myrtaceae				0.80%	7

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*	<i>Eucalyptus occidentalis</i> var. <i>occidentalis</i>	Swamp Yate	Myrtaceae				0.10%	1
	<i>Eucalyptus</i> spp.	Eucalypt	Myrtaceae				0.60%	5
	<i>Eucalyptus tricarpa</i>	Red Ironbark	Myrtaceae				0.10%	1
	<i>Euchiton collinus</i> s.s.	Creeping Cudweed	Asteraceae				0.10%	1
	<i>Euchiton involucratus</i> s.l.	Common Cudweed	Asteraceae				0.10%	1
	<i>Euchiton involucratus</i> s.s.	Star Cudweed	Asteraceae				0.10%	1
	<i>Euchiton sphaericus</i>	Annual Cudweed	Asteraceae				0.70%	6
	<i>Eulalia aurea</i>	Silky Browntop	Poaceae				0.30%	3
	<i>Euphorbia</i> spp.	Spurge	Euphorbiaceae				0.20%	2
	<i>Exocarpos strictus</i>	Pale-fruit Ballart	Santalaceae				0.90%	8
*	<i>Festuca arundinacea</i>	Tall Fescue	Poaceae				0.10%	1
	<i>Fissidens megalotis</i>	Curly Pocket-moss	Fissidentaceae				0.10%	1
*	<i>Foeniculum vulgare</i>	Fennel	Apiaceae				0.10%	1
*	<i>Fumaria capreolata</i>	White Fumitory	Fumariaceae				0.40%	4
*	<i>Gamochaeta americana</i>	Spiked Cudweed	Asteraceae				0.10%	1
*	<i>Gamochaeta purpurea</i> s.l.	Purple Cudweed	Asteraceae				0.10%	1
*	<i>Gazania linearis</i>	Gazania	Asteraceae				0.30%	3
	<i>Gemmabryum pachythemum</i>	Acorn-fruited Thread-moss	Bryaceae				0.10%	1
*	<i>Genista monspessulana</i>	Montpellier Broom	Fabaceae				0.10%	1
	<i>Geranium retrorsum</i> s.l.	Grassland Crane's-bill	Geraniaceae				0.10%	1
	<i>Geranium</i> spp.	Crane's Bill	Geraniaceae				0.10%	1
	<i>Gigaspermum repens</i>	Pineapple Moss	Gigaspermaceae				0.10%	1
	<i>Glycine</i> spp.	Glycine	Fabaceae				0.30%	3
	<i>Glycine tabacina</i> s.l.	Variable Glycine	Fabaceae				0.10%	1
	<i>Gnaphalium polycaulon</i>	Indian Cudweed	Asteraceae				0.30%	3
	<i>Goodenia blackiana</i>	Black's Goodenia	Goodeniaceae				0.10%	1
	<i>Goodenia fascicularis</i>	Silky Goodenia	Goodeniaceae				0.10%	1
	<i>Goodenia gracilis</i>	Slender Goodenia	Goodeniaceae				0.40%	4
	<i>Goodenia pinnatifida</i>	Cut-leaf Goodenia	Goodeniaceae				1.20%	10
	<i>Goodenia pusilliflora</i>	Small-flower Goodenia	Goodeniaceae				1.20%	10
	<i>Goodenia</i> spp.	Goodenia	Goodeniaceae				1.50%	13
	<i>Haloragis aspera</i>	Rough Raspwort	Haloragaceae				0.30%	3
	<i>Haloragis glauca</i> f. <i>glauca</i>	Bluish Raspwort	Haloragaceae			k	0.20%	2
	<i>Haloragis heterophylla</i>	Varied Raspwort	Haloragaceae				0.30%	3
	<i>Haloragis</i> spp.	Raspwort	Haloragaceae				0.70%	6
	<i>Hardenbergia violacea</i>	Purple Coral-pea	Fabaceae				0.10%	1
*	<i>Hedypnois rhagadioloides</i>	Hedypnois	Asteraceae				0.80%	7
*	<i>Heliotropium europaeum</i>	Common Heliotrope	Boraginaceae				0.30%	3
	<i>Heliotropium</i> spp.	Heliotrope	Boraginaceae				0.20%	2
*	<i>Helminthotheca echioides</i>	Ox-tongue	Asteraceae				3%	25
	<i>Hemarthria uncinata</i> var. <i>uncinata</i>	Mat Grass	Poaceae				0.10%	1
*	<i>Hibiscus trionum</i> var. <i>trionum</i>	Bladder Ketmia	Malvaceae				0.10%	1
*	<i>Holcus lanatus</i>	Yorkshire Fog	Poaceae				0.70%	6
*	<i>Hordeum hystrix</i>	Mediterranean Barley-grass	Poaceae				0.10%	1
*	<i>Hordeum marinum</i>	Sea Barley-grass	Poaceae				1.30%	11
*	<i>Hordeum murinum</i> s.l.	Barley-grass	Poaceae				0.10%	1

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*	<i>Hordeum vulgare s.l.</i>	Barley	Poaceae				0.10%	1
	<i>Hyalosperma praecox</i>	Mayweed Sunray	Asteraceae				0.40%	4
	<i>Hyalosperma semisterile</i>	Orange Sunray	Asteraceae				0.30%	3
	<i>Hyalosperma spp.</i>	Sunray	Asteraceae				0.30%	3
	<i>Hydrocotyle foveolata</i>	Yellow Pennywort	Araliaceae				0.10%	1
	<i>Hydrocotyle sibthorpioides</i>	Shining Pennywort	Araliaceae				0.10%	1
	<i>Hypericum gramineum</i>	Small St John's Wort	Hypericaceae				0.20%	2
*	<i>Hypericum perforatum subsp. veronense</i>	St John's Wort	Hypericaceae				0.10%	1
*	<i>Hypochaeris glabra</i>	Smooth Cat's-ear	Asteraceae				1.10%	9
*	<i>Hypochaeris radicata</i>	Flatweed	Asteraceae				0.90%	8
*	<i>Hypochaeris spp.</i>	Cat's Ear	Asteraceae				0.70%	6
	<i>Hypoxis glabella var. glabella</i>	Tiny Star	Hypoxidaceae				0.40%	4
	<i>Isoetopsis graminifolia</i>	Grass Cushion	Asteraceae				0.60%	5
	<i>Isolepis hookeriana</i>	Grassy Club-sedge	Cyperaceae				0.20%	2
*	<i>Isolepis hystrix</i>	Awned Club-sedge	Cyperaceae				0.20%	2
	<i>Isolepis spp.</i>	Club Sedge	Cyperaceae				0.20%	2
	<i>Isotoma fluviatilis subsp. australis</i>	Swamp Isotome	Campanulaceae				0.10%	1
	<i>Juncus amabilis</i>	Hollow Rush	Juncaceae				1.30%	11
	<i>Juncus aridicola</i>	Tussock Rush	Juncaceae				1.10%	9
*	<i>Juncus articulatus</i>	Jointed Rush	Juncaceae				0.40%	4
	<i>Juncus bufonius</i>	Toad Rush	Juncaceae				0.30%	3
	<i>Juncus flavidus</i>	Gold Rush	Juncaceae				0.80%	7
	<i>Juncus holoschoenus</i>	Joint-leaf Rush	Juncaceae				0.10%	1
	<i>Juncus radula</i>	Hoary Rush	Juncaceae				0.20%	2
	<i>Juncus sp. (sect genuini)</i>	Rush	Juncaceae				0.10%	1
	<i>Juncus spp.</i>	Rush	Juncaceae				2.80%	23
	<i>Juncus subsecundus</i>	Finger Rush	Juncaceae				1.10%	9
	<i>Juncus usitatus</i>	Billabong Rush	Juncaceae				0.30%	3
	<i>Lachnagrostis filiformis s.l.</i>	Common Blown-grass	Poaceae				0.60%	5
	<i>Lachnagrostis filiformis s.s.</i>	Common Blown-grass	Poaceae				0.10%	1
*	<i>Lactuca saligna</i>	Willow-leaf Lettuce	Asteraceae				0.20%	2
*	<i>Lactuca serriola</i>	Prickly Lettuce	Asteraceae				1.40%	12
*	<i>Lactuca spp.</i>	Lettuce	Asteraceae				0.30%	3
*	<i>Lamium amplexicaule</i>	Dead Nettle	Lamiaceae				0.10%	1
	<i>Landoltia punctata</i>	Thin Duckweed	Araceae				0.20%	2
	<i>Leiocarpa panaetioides</i>	Woolly Buttons	Asteraceae				0.80%	7
	<i>Leiocarpa spp.</i>	Plover Daisy	Asteraceae				0.20%	2
	<i>Leiocarpa websteri</i>	Stalked Plover-daisy	Asteraceae				0.10%	1
*	<i>Leontodon taraxacoides subsp. taraxacoides</i>	Hairy Hawkbit	Asteraceae				0.60%	5
*	<i>Lepidium africanum</i>	Common Peppergrass	Brassicaceae				1.40%	12
*	<i>Lepidium bonariense</i>	Argentine Cress	Brassicaceae				0.20%	2
*	<i>Lepidium didymum</i>	Lesser Swine-cress	Brassicaceae				0.10%	1
*	<i>Lepidium draba</i>	Hoary Cress	Brassicaceae				0.10%	1
	<i>Lepidium spp.</i>	Peppergrass	Brassicaceae				0.10%	1
	<i>Leptorhynchus spp.</i>	Buttons	Asteraceae				0.30%	3
	<i>Leptorhynchus squamatus</i>	Scaly Buttons	Asteraceae				1.70%	14

Origin	Scientific Name	Common Name	Family Name	EPBC	FFG	DSE	Freq	Number of Sites
	<i>Levenhookia dubia</i>	Hairy Stylewort	Stylidiaceae				0.10%	1
	<i>Limosella australis</i>	Austral Mudwort	Scrophulariaceae				0.10%	1
	<i>Limosella curdieana</i>	Large Mudwort	Scrophulariaceae				0.10%	1
	<i>Linum marginale</i>	Native Flax	Linaceae				0.40%	4
	<i>Lobelia concolor</i>	Poison Pratia	Campanulaceae				0.90%	8
	<i>Lobelia pedunculata s.l.</i>	Matted Pratia	Campanulaceae				0.10%	1
	<i>Lobelia pratioides</i>	Poison Lobelia	Campanulaceae				0.30%	3
*	<i>Lolium loliaceum</i>	Stiff Rye-grass	Poaceae				0.10%	1
*	<i>Lolium multiflorum</i>	Italian Rye-grass	Poaceae				0.20%	2
*	<i>Lolium perenne</i>	Perennial Rye-grass	Poaceae				1.70%	14
*	<i>Lolium rigidum</i>	Wimmera Rye-grass	Poaceae				2.30%	19
*	<i>Lolium spp.</i>	Rye Grass	Poaceae				1.40%	12
	<i>Lomandra effusa</i>	Scented Mat-rush	Xanthorrhoeaceae				0.10%	1
	<i>Lomandra filiformis</i>	Wattle Mat-rush	Xanthorrhoeaceae				0.10%	1
	<i>Lotus australis var. australis</i>	Austral Trefoil	Fabaceae			k	0.20%	2
	<i>Ludwigia peploides subsp. montevidensis</i>	Clove-strip	Onagraceae				0.20%	2
*	<i>Lycium ferocissimum</i>	African Box-thorn	Solanaceae				0.80%	7
	<i>Lythrum hyssopifolia</i>	Small Loosestrife	Lythraceae				0.80%	7
	<i>Maireana brevifolia</i>	Short-leaf Bluebush	Chenopodiaceae				0.20%	2
	<i>Maireana decalvans</i>	Black Cotton-bush	Chenopodiaceae				1.70%	14
	<i>Maireana enchylaenoides</i>	Wingless Bluebush	Chenopodiaceae				2.20%	18
	<i>Maireana excavata</i>	Bottle Bluebush	Chenopodiaceae				1.30%	11
	<i>Maireana humillima</i>	Dwarf Bluebush	Chenopodiaceae				1.90%	16
	<i>Maireana microphylla</i>	Small-leaf Bluebush	Chenopodiaceae			e	0.40%	4
	<i>Maireana pentagona</i>	Hairy Bluebush	Chenopodiaceae				2%	17
	<i>Maireana rohrlachii</i>	Rohrlach's Bluebush	Chenopodiaceae				0.10%	1
	<i>Maireana spp.</i>	Bluebush	Chenopodiaceae				0.40%	4
*	<i>Malva nicaeensis</i>	Mallow of Nice	Malvaceae				0.60%	5
*	<i>Malva parviflora</i>	Small-flower Mallow	Malvaceae				0.90%	8
	<i>Malva spp.</i>	Mallow	Malvaceae				0.10%	1
*	<i>Malvella leprosa</i>	Alkali Sida	Malvaceae				0.20%	2
*	<i>Marrubium vulgare</i>	Horehound	Lamiaceae				1.20%	10
	<i>Marsilea costulifera</i>	Narrow-leaf Nardoo	Marsileaceae				0.30%	3
	<i>Marsilea drummondii</i>	Common Nardoo	Marsileaceae				1.90%	16
	<i>Marsilea spp.</i>	Nardoo	Marsileaceae				0.30%	3
*	<i>Medicago arabica</i>	Spotted Medic	Fabaceae				0.10%	1
*	<i>Medicago minima</i>	Little Medic	Fabaceae				0.10%	1
*	<i>Medicago polymorpha</i>	Burr Medic	Fabaceae				0.30%	3
*	<i>Medicago sativa subsp. sativa</i>	Lucerne	Fabaceae				0.20%	2
*	<i>Medicago spp.</i>	Medic	Fabaceae				0.70%	6
#	<i>Melaleuca decussata</i>	Totem-poles	Myrtaceae				0.10%	1
	<i>Melaleuca spp.</i>	Honey-myrtle	Myrtaceae				0.30%	3
	<i>Mentha australis</i>	River Mint	Lamiaceae				0.20%	2
	<i>Mentha diemenica</i>	Slender Mint	Lamiaceae				0.30%	3
	<i>Mentha laxiflora</i>	Forest Mint	Lamiaceae				0.40%	4
	<i>Mentha satuireioides</i>	Creeping mint	Lamiaceae				0.20%	2

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	<i>Microseris scapigera s.l.</i>	Yam Daisy	Asteraceae				0.60%	5
	<i>Microseris sp. 3</i>	Yam Daisy	Asteraceae				0.30%	3
	<i>Microseris spp.</i>	Yam Daisy	Asteraceae				0.10%	1
	<i>Mimulus gracilis</i>	Slender Monkey-flower	Phrymaceae				0.20%	2
	<i>Minuria integerrima</i>	Smooth Minuria	Asteraceae			r	0.10%	1
	<i>Minuria leptophylla</i>	Minnie Daisy	Asteraceae				0.20%	2
*	<i>Moraea flaccida</i>	One-leaf Cape-tulip	Iridaceae				0.10%	1
*	<i>Moraea setifolia</i>	Thread Iris	Iridaceae				1.30%	11
	<i>Muehlenbeckia florulenta</i>	Tangled Lignum	Polygonaceae				1.40%	12
	<i>Muellerina eucalyptoides</i>	Creeping Mistletoe	Loranthaceae				0.20%	2
	<i>Myriocephalus rhizocephalus</i>	Woolly-heads	Asteraceae				0.10%	1
	<i>Myriophyllum crispatum</i>	Upright Water-milfoil	Haloragaceae				0.40%	4
	<i>Myriophyllum porcatum</i>	Ridged Water-milfoil	Haloragaceae	V	f	v		
	<i>Myriophyllum spp.</i>	Water Milfoil	Haloragaceae				0.10%	1
*	<i>Onopordum acaulon</i>	Stemless Thistle	Asteraceae				0.10%	1
	<i>Ophioglossum lusitanicum</i>	Austral Adder's-tongue	Ophioglossaceae				0.10%	1
	<i>Ophioglossum spp.</i>	Adder's-tongue	Ophioglossaceae				0.10%	1
*	<i>Opuntia spp.</i>	Prickly Pear	Cactaceae				0.10%	1
*	<i>Opuntia stricta</i>	Common Prickly-pear	Cactaceae				0.10%	1
	<i>Oxalis corniculata s.l.</i>	Yellow Wood-sorrel	Oxalidaceae				0.20%	2
	<i>Oxalis exilis</i>	Shady Wood-sorrel	Oxalidaceae				0.10%	1
	<i>Oxalis perennans</i>	Grassland Wood-sorrel	Oxalidaceae				3.30%	27
*	<i>Oxalis pes-caprae</i>	Soursob	Oxalidaceae				0.30%	3
	<i>Oxalis spp.</i>	Wood Sorrel	Oxalidaceae				0.30%	3
	<i>Ozothamnus obcordatus</i>	Grey Everlasting	Asteraceae				0.10%	1
*	<i>Panicum coloratum</i>	Coolah Grass	Poaceae				0.10%	1
	<i>Panicum decompositum var. decompositum</i>	Native Millet	Poaceae				0.30%	3
	<i>Panicum laevinode</i>	Pepper Grass	Poaceae			v	0.10%	1
	<i>Panicum spp.</i>	Panic	Poaceae				0.40%	4
*	<i>Parentucellia latifolia</i>	Red Bartsia	Orobanchaceae				0.30%	3
#	<i>Paspalidium jubiflorum</i>	Warrego Summer-grass	Poaceae				0.70%	6
*	<i>Paspalum dilatatum</i>	Paspalum	Poaceae				0.90%	8
*	<i>Paspalum distichum</i>	Water Couch	Poaceae				0.90%	8
*	<i>Paspalum spp.</i>	Paspalum	Poaceae				0.20%	2
*	<i>Pennisetum clandestinum</i>	Kikuyu	Poaceae				0.10%	1
	<i>Persicaria decipiens</i>	Slender Knotweed	Polygonaceae				0.40%	4
	<i>Persicaria hydropiper</i>	Water Pepper	Polygonaceae				0.60%	5
	<i>Persicaria lapathifolia</i>	Pale Knotweed	Polygonaceae				0.30%	3
	<i>Persicaria prostrata</i>	Creeping Knotweed	Polygonaceae				0.40%	4
*	<i>Petrorhagia dubia</i>	Velvety Pink	Caryophyllaceae				0.10%	1
*	<i>Phalaris aquatica</i>	Toowoomba Canary-grass	Poaceae				0.90%	8
*	<i>Phalaris minor</i>	Lesser Canary-grass	Poaceae				0.10%	1
*	<i>Phalaris paradoxa</i>	Paradoxical Canary-grass	Poaceae				0.30%	3
*	<i>Phalaris spp.</i>	Canary Grass	Poaceae				0.20%	2
	<i>Phragmites australis</i>	Common Reed	Poaceae				0.30%	3
*	<i>Phyla canescens</i>	Fog-fruit	Verbenaceae				0.60%	5

Origin	Scientific Name	Common Name	Family Name	EPBC	FFG	DSE	Freq	Number of Sites
	<i>Pimelea curviflora</i> s.s.	Curved Rice-flower	Thymelaeaceae				0.10%	1
	<i>Pimelea humilis</i>	Common Rice-flower	Thymelaeaceae				0.20%	2
	<i>Pimelea linifolia</i> subsp. <i>linifolia</i>	Slender Rice-flower	Thymelaeaceae				0.10%	1
	<i>Pimelea micrantha</i>	Silky Rice-flower	Thymelaeaceae				0.10%	1
	<i>Pimelea spinescens</i>	Spiny Rice-flower	Thymelaeaceae		f	e	0.10%	1
	<i>Pimelea spinescens</i> subsp. <i>spinescens</i>	Spiny Rice-flower	Thymelaeaceae	C	f	e	0.70%	6
	<i>Pimelea</i> spp.	Rice Flower	Thymelaeaceae				0.10%	1
*	<i>Pinus</i> spp.	Pine	Pinaceae				0.10%	1
*	<i>Plantago coronopus</i>	Buck's-horn Plantain	Veronicaceae				0.10%	1
	<i>Plantago cunninghamii</i>	Clay Plantain	Veronicaceae				0.10%	1
	<i>Plantago gaudichaudii</i>	Narrow Plantain	Veronicaceae				0.70%	6
*	<i>Plantago lanceolata</i>	Ribwort	Veronicaceae				1.10%	9
	<i>Plantago</i> spp.	Plantain	Veronicaceae				0.60%	5
*	<i>Poa annua</i>	Annual Meadow-grass	Poaceae				0.60%	5
	<i>Poa australis</i> spp. agg.	Tussock Grass	Poaceae				0.10%	1
*	<i>Poa bulbosa</i>	Bulbous Meadow-grass	Poaceae				0.40%	4
	<i>Poa fordeana</i>	Forde Poa	Poaceae				0.10%	1
	<i>Poa labillardierei</i>	Common Tussock-grass	Poaceae				0.40%	4
	<i>Poa labillardierei</i> var. <i>labillardierei</i>	Common Tussock-grass	Poaceae				0.20%	2
	<i>Poa sieberiana</i>	Grey Tussock-grass	Poaceae				0.40%	4
	<i>Poa</i> spp.	Tussock Grass	Poaceae				0.80%	7
	<i>Podolepis</i> sp. 1	Basalt Podolepis	Asteraceae			e	0.10%	1
	<i>Pohlia</i> spp.	Thread Moss	Mniaceae				0.10%	1
*	<i>Polygonum aviculare</i> s.l.	Prostrate Knotweed	Polygonaceae				1.40%	12
	<i>Polygonum plebeium</i>	Small Knotweed	Polygonaceae				0.20%	2
	<i>Polygonum</i> spp.	Hogweed	Polygonaceae				0.30%	3
*	<i>Polypogon monspeliensis</i>	Annual Beard-grass	Poaceae				0.40%	4
	<i>Potamogeton tricarinatus</i> s.l.	Floating Pondweed	Potamogetonaceae				0.20%	2
*	<i>Proboscidea lutea</i>	Yellow-flower Devil's-claw	Pedaliaceae				0.10%	1
	<i>Pseudognaphalium luteoalbum</i>	Jersey Cudweed	Asteraceae				0.10%	1
	<i>Pseudoraphis spinescens</i>	Spiny Mud-grass	Poaceae				0.10%	1
	<i>Ptilotus erubescens</i>	Hairy Tails	Amaranthaceae		f		0.60%	5
	<i>Ptilotus exaltatus</i>	Mulla Mulla	Amaranthaceae				0.30%	3
	<i>Ptilotus exaltatus</i> var. <i>exaltatus</i>	Pink Mulla-mulla	Amaranthaceae				0.20%	2
	<i>Ptilotus macrocephalus</i>	Feather Heads	Amaranthaceae				0.10%	1
	<i>Ptilotus spathulatus</i> f. <i>spathulatus</i>	Pussy Tails	Amaranthaceae				0.20%	2
#	<i>Pycnosorus globosus</i>	Drumsticks	Asteraceae				1.80%	15
	<i>Pycnosorus</i> spp	Billy Buttons	Asteraceae				0.20%	2
	<i>Ranunculus inundatus</i>	River Buttercup	Ranunculaceae				0.60%	5
	<i>Ranunculus lappaceus</i>	Australian Buttercup	Ranunculaceae				0.40%	4
*	<i>Ranunculus muricatus</i>	Sharp Buttercup	Ranunculaceae				0.10%	1
	<i>Ranunculus pumilio</i>	Ferny Small-flower Buttercup	Ranunculaceae				0.20%	2
*	<i>Ranunculus sceleratus</i> subsp. <i>sceleratus</i>	Celery Buttercup	Ranunculaceae				0.60%	5
	<i>Ranunculus sessiliflorus</i>	Annual Buttercup	Ranunculaceae				0.10%	1
*	<i>Ranunculus trilobus</i>	Large Annual Buttercup	Ranunculaceae				0.10%	1
*	<i>Raphanus raphanistrum</i>	Wild Radish	Brassicaceae				0.10%	1

Origin	Scientific Name	Common Name	Family Name	EPBC	FFG	DSE	Freq	Number of Sites
	<i>Rhagodia</i> spp.	Saltbush	Chenopodiaceae				0.20%	2
*	<i>Rhaponticum repens</i>	Creeping Knapweed	Asteraceae				0.10%	1
	<i>Rhodanthe corymbiflora</i>	Paper Sunray	Asteraceae				1.40%	12
	<i>Rhodanthe pygmaea</i>	Pygmy Sunray	Asteraceae				0.30%	3
*	<i>Romulea minutiflora</i>	Small-flower Onion-grass	Iridaceae				2%	17
*	<i>Romulea rosea</i>	Onion Grass	Iridaceae				1.50%	13
*	<i>Romulea rosea</i> var. <i>australis</i> s.s.	Common Onion-grass	Iridaceae				0.60%	5
	<i>Rorippa eustylis</i>	Dwarf Bitter-cress	Brassicaceae			r	0.20%	2
	<i>Rorippa laciniata</i>	Jagged Bitter-cress	Brassicaceae				0.20%	2
*	<i>Rorippa palustris</i>	Marsh Yellow-cress	Brassicaceae				0.10%	1
*	<i>Rosa rubiginosa</i>	Sweet Briar	Rosaceae				0.30%	3
*	<i>Rosa</i> spp.	Rose	Rosaceae				0.10%	1
*	<i>Rostraria cristata</i>	Annual Cat's-tail	Poaceae				0.20%	2
	<i>Rosulabryum campylothecium</i>	Sand Thread-moss	Bryaceae				0.10%	1
*	<i>Rubus fruticosus</i> spp. <i>agg.</i>	Blackberry	Rosaceae				5.50%	45
*	<i>Rubus ulmifolius</i>	Elm-leaf Blackberry	Rosaceae				0.30%	3
	<i>Rumex brownii</i>	Slender Dock	Polygonaceae				1.30%	11
*	<i>Rumex conglomeratus</i>	Clustered Dock	Polygonaceae				0.20%	2
*	<i>Rumex crispus</i>	Curled Dock	Polygonaceae				1.20%	10
	<i>Rumex dumosus</i>	Wiry Dock	Polygonaceae				0.30%	3
*	<i>Rumex obtusifolius</i> subsp. <i>obtusifolius</i>	Broad-leaf Dock	Polygonaceae				0.70%	6
	<i>Rumex</i> spp.	Dock	Polygonaceae				0.60%	5
	<i>Rumex tenax</i>	Narrow-leaf Dock	Polygonaceae				0.40%	4
	<i>Rytidosperma auriculatum</i>	Lobed Wallaby-grass	Poaceae				0.20%	2
	<i>Rytidosperma caespitosum</i>	Common Wallaby-grass	Poaceae				2%	17
	<i>Rytidosperma carphoides</i>	Short Wallaby-grass	Poaceae				0.70%	6
	<i>Rytidosperma duttonianum</i>	Brown-back Wallaby-grass	Poaceae				1.80%	15
	<i>Rytidosperma erianthum</i>	Hill Wallaby-grass	Poaceae				0.40%	4
	<i>Rytidosperma fulvum</i>	Copper-awned Wallaby-grass	Poaceae				0.30%	3
	<i>Rytidosperma racemosum</i> var. <i>racemosum</i>	Slender Wallaby-grass	Poaceae				0.10%	1
	<i>Rytidosperma setaceum</i>	Bristly Wallaby-grass	Poaceae				3.40%	28
	<i>Rytidosperma setaceum</i> var. <i>setaceum</i>	Bristly Wallaby-grass	Poaceae				0.30%	3
	<i>Rytidosperma</i> spp.	Wallaby Grass	Poaceae				3.10%	26
*	<i>Sagina apetala</i>	Common Pearlwort	Caryophyllaceae				0.10%	1
*	<i>Sagittaria platyphylla</i>	Sagittaria	Alismataceae				41%	335
*	<i>Sagittaria</i> spp.	Sagittaria	Alismataceae				0.10%	1
*	<i>Salix alba</i>	White Willow	Salicaceae				0.10%	1
*	<i>Salix babylonica</i> s.l.	Weeping Willow	Salicaceae				0.70%	6
*	<i>Salix fragilis</i>	Crack Willow	Salicaceae				0.20%	2
*	<i>Salix</i> spp.	Willow	Salicaceae				0.10%	1
	<i>Salsola tragus</i> subsp. <i>tragus</i>	Prickly Saltwort	Chenopodiaceae				0.20%	2
*	<i>Salvia verbenaca</i>	Wild Sage	Lamiaceae				0.10%	1
*	<i>Schinus molle</i>	Pepper Tree	Anacardiaceae				0.60%	5
*	<i>Schismus barbatus</i>	Arabian Grass	Poaceae				0.10%	1
	<i>Schoenoplectus pungens</i>	Sharp Club-sedge	Cyperaceae				0.10%	1
	<i>Sclerolaena birchii</i>	Galvanized Burr	Chenopodiaceae			k	0.10%	1

Origin	Scientific Name	Common Name	Family Name	EPBC	FFG	DSE	Freq	Number of Sites
	<i>Sclerolaena diacantha</i>	Grey Copperburr	Chenopodiaceae				0.20%	2
	<i>Sclerolaena muricata</i>	Black Roly-poly	Chenopodiaceae				1.40%	12
	<i>Sclerolaena muricata var. semiglabra</i>	Dark Roly-poly	Chenopodiaceae			k	0.20%	2
	<i>Sclerolaena muricata var. villosa</i>	Grey Roly-poly	Chenopodiaceae				0.20%	2
	<i>Sclerolaena napiformis</i>	Turnip Copperburr	Chenopodiaceae	E	f	e	1.30%	11
*	<i>Scorzonera laciniata</i>	Scorzonera	Asteraceae				0.30%	3
*	<i>Scorzonera spp.</i>	Scorzonera	Asteraceae				0.10%	1
	<i>Senecio phelleus</i>	Stony Fireweed	Asteraceae				0.20%	2
	<i>Senecio quadridentatus</i>	Cotton Fireweed	Asteraceae				0.70%	6
	<i>Senecio runcinifolius</i>	Tall Fireweed	Asteraceae				0.70%	6
	<i>Senecio tenuiflorus spp. agg.</i>	Slender Fireweed	Asteraceae				0.10%	1
*	<i>Setaria verticillata</i>	Whorled Pigeon-grass	Poaceae				0.10%	1
	<i>Sida corrugata</i>	Variable Sida	Malvaceae				2.80%	23
	<i>Sida spp.</i>	Sida	Malvaceae				0.90%	8
*	<i>Silene vulgaris subsp. vulgaris</i>	Bladder Champion	Caryophyllaceae				0.10%	1
*	<i>Silybum marianum</i>	Variegated Thistle	Asteraceae				0.70%	6
*	<i>Sisymbrium orientale</i>	Indian Hedge-mustard	Brassicaceae				0.20%	2
*	<i>Sisymbrium spp.</i>	Mustard	Brassicaceae				0.10%	1
*	<i>Solanum elaeagnifolium</i>	Silver-leaf Nightshade	Solanaceae				0.10%	1
	<i>Solanum esuriale</i>	Quena	Solanaceae				0.80%	7
*	<i>Solanum nigrum sensu Willis (1972)</i>	Black Nightshade	Solanaceae				0.60%	5
*	<i>Solanum rostratum</i>	Buffalo Burr	Solanaceae				0.10%	1
	<i>Solenogyne dominii</i>	Smooth Solenogyne	Asteraceae				0.10%	1
*	<i>Solidago sempervirens</i>	Goldenrod	Asteraceae				0.10%	1
*	<i>Sonchus asper s.l.</i>	Rough Sow-thistle	Asteraceae				1.10%	9
*	<i>Sonchus oleraceus</i>	Common Sow-thistle	Asteraceae				1.40%	12
	<i>Sonchus spp.</i>	Sow Thistle	Asteraceae				0.70%	6
	<i>Spergularia media s.l.</i>	Coast Sand-spurrey	Caryophyllaceae				0.20%	2
*	<i>Spergularia rubra s.l.</i>	Red Sand-spurrey	Caryophyllaceae				0.80%	7
	<i>Spergularia spp.</i>	Sand Spurrey	Caryophyllaceae				0.30%	3
	<i>Sporobolus caroli</i>	Yakka Grass	Poaceae			r	0.10%	1
	<i>Stackhousia monogyne s.l.</i>	Creamy Stackhousia	Stackhousiaceae				0.30%	3
	<i>Stellaria angustifolia</i>	Swamp Starwort	Caryophyllaceae				0.20%	2
	<i>Stellaria caespitosa</i>	Matted Starwort	Caryophyllaceae				0.10%	1
*	<i>Stellaria media</i>	Chickweed	Caryophyllaceae				0.30%	3
*	<i>Stellaria pallida</i>	Lesser Chickweed	Caryophyllaceae				0.10%	1
	<i>Stellaria spp.</i>	Starwort	Caryophyllaceae				0.20%	2
	<i>Swainsona behriana</i>	Southern Swainson-pea	Fabaceae			r	0.10%	1
	<i>Swainsona microphylla</i>	Small-leaf Swainson-pea	Fabaceae			r	0.10%	1
	<i>Swainsona murrayana</i>	Slender Darling-pea	Fabaceae	V	f	e	0.10%	1
	<i>Swainsona oroboides s.l.</i>	Variable Swainson-pea	Fabaceae				0.40%	4
	<i>Swainsona plagiotropis</i>	Red Swainson-pea	Fabaceae	V	f	e	2.20%	18
	<i>Swainsona procumbens</i>	Broughton Pea	Fabaceae				0.70%	6
	<i>Swainsona sericea</i>	Silky Swainson-pea	Fabaceae		f	v	0.90%	8
*	<i>Taraxacum officinale spp. agg.</i>	Garden Dandelion	Asteraceae				0.20%	2
	<i>Taraxacum spp.</i>	Dandelion	Asteraceae				0.10%	1

Origin	Scientific Name	Common Name	Family Name	EPBC	FFG	DSE	Freq	Number of Sites
	<i>Teucrium racemosum s.l.</i>	Grey Germander	Lamiaceae				0.20%	2
	<i>Teucrium racemosum s.s.</i>	Grey Germander	Lamiaceae				0.10%	1
	<i>Teucrium spp.</i>	Germander	Lamiaceae				0.20%	2
	<i>Themeda triandra</i>	Kangaroo Grass	Poaceae				0.70%	6
	<i>Thysanotus patersonii</i>	Twining Fringe-lily	Anthericaceae				0.10%	1
	<i>Thysanotus tuberosus subsp. tuberosus</i>	Common Fringe-lily	Anthericaceae				0.10%	1
	<i>Tortula atrovirens</i>	Flamingo Moss	Pottiaceae				0.10%	1
*	<i>Tribolium acutiflorum s.l.</i>	Desmazeria	Poaceae				0.10%	1
#	<i>Tribulus terrestris</i>	Caltrop	Zygophyllaceae				0.10%	1
*	<i>Trifolium angustifolium var. angustifolium</i>	Narrow-leaf Clover	Fabaceae				0.30%	3
*	<i>Trifolium arvense var. arvense</i>	Hare's-foot Clover	Fabaceae				0.60%	5
*	<i>Trifolium campestre var. campestre</i>	Hop Clover	Fabaceae				0.30%	3
*	<i>Trifolium cernuum</i>	Drooping-flower Clover	Fabaceae				0.10%	1
*	<i>Trifolium dubium</i>	Suckling Clover	Fabaceae				0.10%	1
*	<i>Trifolium fragiferum var. fragiferum</i>	Strawberry Clover	Fabaceae				0.20%	2
*	<i>Trifolium glomeratum</i>	Cluster Clover	Fabaceae				0.70%	6
*	<i>Trifolium repens var. repens</i>	White Clover	Fabaceae				0.90%	8
*	<i>Trifolium spp.</i>	Clover	Fabaceae				1.20%	10
*	<i>Trifolium striatum</i>	Knotted Clover	Fabaceae				0.70%	6
*	<i>Trifolium subterraneum</i>	Subterranean Clover	Fabaceae				0.80%	7
*	<i>Trifolium tomentosum var. tomentosum</i>	Woolly Clover	Fabaceae				0.30%	3
	<i>Triglochin procera s.l.</i>	Water Ribbons	Juncaginaceae				0.20%	2
	<i>Triglochin spp.</i>	Water Ribbons	Juncaginaceae				0.10%	1
	<i>Triptilodiscus pygmaeus</i>	Common Sunray	Asteraceae				0.20%	2
	<i>Triquetrella papillata</i>	Common Twine-moss	Pottiaceae				0.10%	1
*	<i>Triticum aestivum</i>	Wheat	Poaceae				0.10%	1
	<i>Typha domingensis</i>	Narrow-leaf Cumbungi	Typhaceae				0.70%	6
*	<i>Typha latifolia</i>	Lesser Reed-mace	Typhaceae				0.60%	5
	<i>Typha orientalis</i>	Broad-leaf Cumbungi	Typhaceae				0.70%	6
	<i>Typha spp.</i>	Bulrush	Typhaceae				0.10%	1
*	<i>Ulex europaeus</i>	Gorse	Fabaceae				0.40%	4
*	<i>Urtica urens</i>	Small Nettle	Urticaceae				0.30%	3
	<i>Utricularia australis</i>	Yellow Bladderwort	Lentibulariaceae				0.10%	1
	<i>Velleia paradoxa</i>	Spur Velleia	Goodeniaceae				0.60%	5
*	<i>Verbascum virgatum</i>	Twiggy Mullein	Scrophulariaceae				0.20%	2
*	<i>Verbena bonariensis s.l.</i>	Purple-top Verbena	Verbenaceae				0.10%	1
*	<i>Verbena bonariensis var. bonariensis s.s.</i>	Purple-top Verbena	Verbenaceae				0.10%	1
#	<i>Verbena officinalis s.l.</i>	Common Verbena	Verbenaceae				0.30%	3
	<i>Verbena officinalis var. gaudichaudii</i>	Native Verbena	Verbenaceae			k	0.20%	2
	<i>Verbena spp.</i>	Verbena	Verbenaceae				0.20%	2
*	<i>Veronica peregrina</i>	Wandering Speedwell	Veronicaceae				0.20%	2
*	<i>Vicia sativa</i>	Common Vetch	Fabaceae				0.20%	2
*	<i>Vicia sativa subsp. nigra</i>	Narrow-leaf Vetch	Fabaceae				0.20%	2
	<i>Viola betonicifolia</i>	Showy Violet	Violaceae				0.10%	1
	<i>Vittadinia cervicalis</i>	Annual New Holland Daisy	Asteraceae				0.10%	1
	<i>Vittadinia cuneata</i>	Fuzzy New Holland Daisy	Asteraceae				0.30%	3

Origin	Scientific Name	Common Name	Family Name	EPBC	FFG	DSE	Freq	Number of Sites
	<i>Vittadinia gracilis</i>	Woolly New Holland Daisy	Asteraceae				0.80%	7
	<i>Vittadinia spp.</i>	New Holland Daisy	Asteraceae				0.60%	5
*	<i>Vulpia bromoides</i>	Squirrel-tail Fescue	Poaceae				1.50%	13
*	<i>Vulpia muralis</i>	Wall Fescue	Poaceae				0.10%	1
*	<i>Vulpia myuros</i>	Rat's-tail Fescue	Poaceae				0.10%	1
*	<i>Vulpia myuros f. myuros</i>	Rat's-tail Fescue	Poaceae				0.20%	2
*	<i>Vulpia spp.</i>	Fescue	Poaceae				1.90%	16
	<i>Wahlenbergia fluminalis</i>	River Bluebell	Campanulaceae				0.90%	8
	<i>Wahlenbergia gracilentia s.l.</i>	Annual Bluebell	Campanulaceae				0.10%	1
	<i>Wahlenbergia gracilis</i>	Sprawling Bluebell	Campanulaceae				0.20%	2
	<i>Wahlenbergia spp.</i>	Bluebell	Campanulaceae				1.30%	11
	<i>Walwhalleya proluta</i>	Rigid Panic	Poaceae				1.20%	10
	<i>Weissia controversa</i>	Green-tufted Stubble-moss	Pottiaceae				0.10%	1
	<i>Wurmbea dioica</i>	Common Early Nancy	Colchicaceae				0.40%	4
	<i>Wurmbea dioica subsp. dioica</i>	Common Early Nancy	Colchicaceae				0.10%	1
	<i>Wurmbea latifolia subsp. vanessae</i>	Broad-leaf Early Nancy	Colchicaceae				0.20%	2
*	<i>Xanthium spinosum</i>	Bathurst Burr	Asteraceae				1.50%	13
*	<i>Xanthium spp.</i>	Cockleburr	Asteraceae				0.10%	1
*	<i>Xanthium strumarium spp. agg.</i>	Noogoora Burr species aggregate	Asteraceae				0.20%	2

* = introduced species; # = native species occurring outside of natural range; L = listed as threatened; EPBC = status under EPBC Act; FFG = status under FFG Act; DSE = status under DSE's Advisory List; C = critically endangered; E, e = endangered; V, v = vulnerable; R, r = rare; k = insufficiently known

Appendix 12: Flora Species Recorded from the Atlas of NSW Wildlife search region

SCIENTIFIC NAME	COMMON NAME	EXOTIC	LEGAL STATUS	FIRSTDATE	LASTDATE	LATITUDE	LONGITUDE
<i>Amaranthus albus</i>	Tumbleweed	*		10/03/1977	10/03/1977	-36.1167	144.767
<i>Ptilotus erubescens</i>				01/04/1770	4/03/2008	-36.1167	144.767
<i>Ptilotus exaltatus</i> var. <i>exaltatus</i>	Tall Mulla Mulla			30/11/1891	30/11/1891	-36.1167	144.767
<i>Dichopogon fimbriatus</i>	Nodding Chocolate Lily			30/11/1891	30/11/1891	-36.1167	144.767
<i>Asparagus asparagoides</i>	Bridal Creeper	*		26/06/1969	26/06/1969	-36.1167	144.767
<i>Asparagus asparagoides</i>	Bridal Creeper	*		5/09/2001	5/09/2001	-36.1119	144.753
<i>Calotis cuneifolia</i>	Purple Burr-Daisy			12/10/1992	12/10/1992	-36.0764	144.782
<i>Calotis scabiosifolia</i>	Rough Burr-daisy			01/10/1891	31/10/1891	-36.1167	144.767
<i>Centaurea melitensis</i>	Maltese Cockspur	*		07/11/1894	07/11/1894	-36.1167	144.767
<i>Chrysocephalum semipapposum</i>	Clustered Everlasting			18/11/1978	18/11/1978	-36.0333	144.783
<i>Chrysocephalum semipapposum</i>	Clustered Everlasting			01/10/1891	31/10/1891	-36.1167	144.767
<i>Hypochaeris radicata</i>	Catsear	*		07/11/1894	07/11/1894	-36.1167	144.767
<i>Leontodon taraxacoides</i> subsp. <i>taraxacoides</i>	Lesser Hawkbit	*		18/11/1978	18/11/1978	-36.1167	144.767
<i>Leptorhynchos squamatus</i>	Scaly Buttons			7/10/1999	7/10/1999	-36.0542	144.755
<i>Olearia pimeleoides</i>				01/10/1891	31/10/1891	-36.1167	144.767
<i>Rhodanthe corymbiflora</i>	Small White Sunray			01/10/1891	31/10/1891	-36.1167	144.767
<i>Cynoglossum suaveolens</i>	Sweet Hound's-tongue			1/05/1936	31/05/1936	-36.1167	144.767
<i>Echium plantagineum</i>	Patterson's Curse	*		01/10/1891	31/10/1891	-36.1167	144.767
<i>Allocasuarina luehmannii</i>	Bulloak			1/06/1904	30/06/1904	-36.1167	144.767
<i>Allocasuarina luehmannii</i>	Bulloak			7/07/1958	7/07/1958	-36.1167	144.767
<i>Allocasuarina verticillata</i>	Drooping Sheoak			1/07/1913	31/07/1913	-36.1167	144.767
<i>Casuarina pauper</i>	Black Oak			1/06/1904	30/06/1904	-36.1167	144.767
<i>Chenopodium desertorum</i> subsp. <i>microphyllum</i>				18/11/1978	18/11/1978	-36.0833	144.767
<i>Chenopodium multifidum</i>	Scented Goosefoot	*		1/03/1979	31/03/1979	-36.1167	144.767
<i>Sclerolaena napiformis</i>	Turnip Copperburr		E1	1/11/1991	30/11/1991	-36.047	144.758
<i>Sclerolaena napiformis</i>	Turnip Copperburr		E1	3/11/2009	3/11/2009	-36.073	144.75
<i>Sclerolaena napiformis</i>	Turnip Copperburr		E1	3/11/2009	3/11/2009	-36.0734	144.75
<i>Sclerolaena napiformis</i>	Turnip Copperburr		E1	3/11/2009	3/11/2009	-36.0743	144.751
<i>Sclerolaena napiformis</i>	Turnip Copperburr		E1	3/11/2009	3/11/2009	-36.0743	144.751
<i>Sclerolaena napiformis</i>	Turnip Copperburr		E1	3/11/2009	3/11/2009	-36.0744	144.751
<i>Sclerolaena napiformis</i>	Turnip Copperburr		E1	3/11/2009	3/11/2009	-36.0743	144.751
<i>Sclerolaena napiformis</i>	Turnip Copperburr		E1	3/11/2009	3/11/2009	-36.0744	144.751
<i>Sclerolaena napiformis</i>	Turnip Copperburr		E1	3/11/2009	3/11/2009	-36.0746	144.751
<i>Sclerolaena napiformis</i>	Turnip Copperburr		E1	3/11/2009	3/11/2009	-36.0746	144.751
<i>Sclerolaena napiformis</i>	Turnip Copperburr		E1	3/11/2009	3/11/2009	-36.0751	144.751
<i>Sclerolaena napiformis</i>	Turnip Copperburr		E1	3/11/2009	3/11/2009	-36.0756	144.751
<i>Sclerolaena napiformis</i>	Turnip Copperburr		E1	3/11/2009	3/11/2009	-36.0759	144.751
<i>Sclerolaena napiformis</i>	Turnip Copperburr		E1	3/11/2009	3/11/2009	-36.0761	144.751
<i>Sclerolaena napiformis</i>	Turnip Copperburr		E1	3/11/2009	3/11/2009	-36.0761	144.751
<i>Sclerolaena napiformis</i>	Turnip Copperburr		E1	3/11/2009	3/11/2009	-36.0747	144.751
<i>Sclerolaena napiformis</i>	Turnip Copperburr		E1	3/11/2009	3/11/2009	-36.072	144.751
<i>Sclerolaena napiformis</i>	Turnip Copperburr		E1	3/11/2009	3/11/2009	-36.0721	144.751
<i>Sclerolaena napiformis</i>	Turnip Copperburr		E1	3/11/2009	3/11/2009	-36.0719	144.751
<i>Sclerolaena napiformis</i>	Turnip Copperburr		E1	3/11/2009	3/11/2009	-36.0695	144.752
<i>Sclerolaena napiformis</i>	Turnip Copperburr		E1	3/11/2009	3/11/2009	-36.0675	144.752

SCIENTIFIC NAME	COMMON NAME	EXOTIC	LEGAL STATUS	FIRSTDATE	LASTDATE	LATITUDE	LONGITUDE
Sclerolaena napiformis	Turnip Copperburr		E1	3/11/2009	3/11/2009	-36.067	144.752
Sclerolaena napiformis	Turnip Copperburr		E1	3/11/2009	3/11/2009	-36.0623	144.753
Sclerolaena napiformis	Turnip Copperburr		E1	3/11/2009	3/11/2009	-36.062	144.753
Sclerolaena napiformis	Turnip Copperburr		E1	3/11/2009	3/11/2009	-36.0619	144.753
Sclerolaena napiformis	Turnip Copperburr		E1	4/11/2009	4/11/2009	-36.0618	144.753
Sclerolaena napiformis	Turnip Copperburr		E1	4/11/2009	4/11/2009	-36.0613	144.753
Sclerolaena napiformis	Turnip Copperburr		E1	4/11/2009	4/11/2009	-36.0609	144.753
Sclerolaena napiformis	Turnip Copperburr		E1	4/11/2009	4/11/2009	-36.0607	144.753
Sclerolaena napiformis	Turnip Copperburr		E1	4/11/2009	4/11/2009	-36.0605	144.753
Sclerolaena napiformis	Turnip Copperburr		E1	4/11/2009	4/11/2009	-36.0577	144.754
Sclerolaena napiformis	Turnip Copperburr		E1	4/11/2009	4/11/2009	-36.0574	144.754
Sclerolaena napiformis	Turnip Copperburr		E1	4/11/2009	4/11/2009	-36.0572	144.754
Sclerolaena napiformis	Turnip Copperburr		E1	4/11/2009	4/11/2009	-36.056	144.754
Sclerolaena napiformis	Turnip Copperburr		E1	4/11/2009	4/11/2009	-36.0552	144.754
Sclerolaena napiformis	Turnip Copperburr		E1	4/11/2009	4/11/2009	-36.0542	144.754
Sclerolaena napiformis	Turnip Copperburr		E1	4/11/2009	4/11/2009	-36.0532	144.754
Sclerolaena napiformis	Turnip Copperburr		E1	4/11/2009	4/11/2009	-36.0514	144.755
Sclerolaena napiformis	Turnip Copperburr		E1	4/11/2009	4/11/2009	-36.0505	144.755
Sclerolaena napiformis	Turnip Copperburr		E1	4/11/2009	4/11/2009	-36.0493	144.757
Sclerolaena napiformis	Turnip Copperburr		E1	4/11/2009	4/11/2009	-36.0484	144.758
Sclerolaena napiformis	Turnip Copperburr		E1	4/11/2009	4/11/2009	-36.0479	144.758
Sclerolaena napiformis	Turnip Copperburr		E1	4/11/2009	4/11/2009	-36.0478	144.759
Sclerolaena napiformis	Turnip Copperburr		E1	4/11/2009	4/11/2009	-36.0473	144.76
Sclerolaena napiformis	Turnip Copperburr		E1	4/11/2009	4/11/2009	-36.0462	144.762
Sclerolaena napiformis	Turnip Copperburr		E1	4/11/2009	4/11/2009	-36.0456	144.763
Sclerolaena napiformis	Turnip Copperburr		E1	4/11/2009	4/11/2009	-36.0452	144.764
Sclerolaena napiformis	Turnip Copperburr		E1	4/11/2009	4/11/2009	-36.0443	144.766
Sclerolaena napiformis	Turnip Copperburr		E1	4/11/2009	4/11/2009	-36.0438	144.766
Sclerolaena napiformis	Turnip Copperburr		E1	4/11/2009	4/11/2009	-36.0433	144.767
Sclerolaena napiformis	Turnip Copperburr		E1	4/11/2009	4/11/2009	-36.0429	144.768
Sclerolaena napiformis	Turnip Copperburr		E1	4/11/2009	4/11/2009	-36.0423	144.769
Sclerolaena napiformis	Turnip Copperburr		E1	4/11/2009	4/11/2009	-36.0417	144.77
Sclerolaena napiformis	Turnip Copperburr		E1	4/11/2009	4/11/2009	-36.0401	144.773
Sclerolaena napiformis	Turnip Copperburr		E1	4/11/2009	4/11/2009	-36.0394	144.774
Sclerolaena napiformis	Turnip Copperburr		E1	4/11/2009	4/11/2009	-36.0353	144.782
Sclerolaena napiformis	Turnip Copperburr		E1	4/11/2009	4/11/2009	-36.034	144.784
Sclerolaena napiformis	Turnip Copperburr		E1	4/11/2009	4/11/2009	-36.0333	144.786
Sclerolaena napiformis	Turnip Copperburr		E1	4/11/2009	4/11/2009	-36.0329	144.786
Sclerolaena napiformis	Turnip Copperburr		E1	5/11/2009	5/11/2009	-36.0328	144.787
Sclerolaena napiformis	Turnip Copperburr		E1	5/11/2009	5/11/2009	-36.0324	144.788
Sclerolaena napiformis	Turnip Copperburr		E1	5/11/2009	5/11/2009	-36.0324	144.788
Sclerolaena napiformis	Turnip Copperburr		E1	5/11/2009	5/11/2009	-36.0322	144.788
Sclerolaena napiformis	Turnip Copperburr		E1	5/11/2009	5/11/2009	-36.0325	144.788
Sclerolaena napiformis	Turnip Copperburr		E1	5/11/2009	5/11/2009	-36.0315	144.79
Sclerolaena napiformis	Turnip Copperburr		E1	5/11/2009	5/11/2009	-36.0288	144.79
Sclerolaena napiformis	Turnip Copperburr		E1	5/11/2009	5/11/2009	-36.0287	144.79

SCIENTIFIC NAME	COMMON NAME	EXOTIC	LEGAL STATUS	FIRSTDATE	LASTDATE	LATITUDE	LONGITUDE
<i>Sclerolaena napiformis</i>	Turnip Copperburr		E1	5/11/2009	5/11/2009	-36.0286	144.791
<i>Sclerolaena napiformis</i>	Turnip Copperburr		E1	5/11/2009	5/11/2009	-36.0394	144.773
<i>Sclerolaena napiformis</i>	Turnip Copperburr		E1	5/11/2009	5/11/2009	-36.0413	144.769
<i>Sclerolaena napiformis</i>	Turnip Copperburr		E1	5/11/2009	5/11/2009	-36.0445	144.764
<i>Sclerolaena napiformis</i>	Turnip Copperburr		E1	5/11/2009	5/11/2009	-36.0478	144.758
<i>Sclerolaena napiformis</i>	Turnip Copperburr		E1	5/11/2009	5/11/2009	-36.0519	144.754
<i>Sclerolaena napiformis</i>	Turnip Copperburr		E1	5/11/2009	5/11/2009	-36.0555	144.753
<i>Sclerolaena napiformis</i>	Turnip Copperburr		E1	5/11/2009	5/11/2009	-36.0596	144.752
<i>Sclerolaena napiformis</i>	Turnip Copperburr		E1	4/03/2008	4/03/2008	-36.0638	144.753
<i>Sclerolaena napiformis</i>	Turnip Copperburr		E1	4/03/2008	4/03/2008	-36.0337	144.782
<i>Sclerolaena napiformis</i>	Turnip Copperburr		E1	7/10/1999	7/10/1999	-36.0542	144.755
<i>Sclerolaena napiformis</i>	Turnip Copperburr		E1	7/10/1999	7/10/1999	-36.0542	144.755
<i>Callitris gracilis</i> subsp. <i>murrayensis</i>	Murray Pine			19/07/1906	19/07/1906	-36.1167	144.767
<i>Cyperus brevifolius</i>		*		1/04/1984	30/04/1984	-36.1167	144.767
<i>Cyperus eragrostis</i>	Umbrella Sedge	*		8/02/1977	8/02/1977	-36.1167	144.767
<i>Cyperus eragrostis</i>	Umbrella Sedge	*		10/03/1977	10/03/1977	-36.1231	144.753
<i>Eleocharis pallens</i>	Pale Spike Sedge			01/02/1894	28/02/1894	-36.1167	144.767
<i>Eleocharis pallens</i>	Pale Spike Sedge			06/02/1894	06/02/1894	-36.1167	144.767
<i>Fimbristylis aestivalis</i>				1/01/1980	31/01/1980	-36.1167	144.767
<i>Fimbristylis aestivalis</i>				1/04/1984	30/04/1984	-36.1167	144.767
<i>Chamaesyce drummondii</i>	Caustic Weed			24/02/1903	24/02/1903	-36.1167	144.767
<i>Dillwynia cinerascens</i>				3/09/1982	3/09/1982	-36.1167	144.767
<i>Dillwynia cinerascens</i>				1/10/1983	31/10/1983	-36.1167	144.767
<i>Dillwynia cinerascens</i>				4/09/1982	4/09/1982	-36.1167	144.767
<i>Dillwynia cinerascens</i>				1/10/1981	31/10/1981	-36.1167	144.767
<i>Eutaxia microphylla</i>				12/10/1992	12/10/1992	-36.0764	144.782
<i>Lotus corniculatus</i>	Birds-foot Trefoil	*		01/10/1891	31/10/1891	-36.1167	144.767
<i>Acacia acinacea</i>	Gold-dust Wattle			8/02/1977	8/02/1977	-36.1167	144.767
<i>Acacia acinacea</i>	Gold-dust Wattle			5/09/2001	5/09/2001	-36.1186	144.754
<i>Acacia dealbata</i> subsp. <i>dealbata</i>	Silver Wattle			10/03/1977	10/03/1977	-36.1167	144.767
<i>Acacia dealbata</i> subsp. <i>dealbata</i>	Silver Wattle			8/02/1977	8/02/1977	-36.1167	144.767
<i>Acacia dealbata</i> subsp. <i>dealbata</i>	Silver Wattle			5/09/2001	5/09/2001	-36.1119	144.753
<i>Acacia hakeoides</i>	Hakea Wattle			1/07/1906	31/07/1906	-36.1167	144.767
<i>Acacia montana</i>	Mallee Wattle			10/03/1977	10/03/1977	-36.1	144.733
<i>Acacia oswaldii</i>	Miljee			1/06/1905	30/06/1905	-36.1167	144.767
<i>Erodium crinitum</i>	Blue Crowfoot			01/10/1891	31/10/1891	-36.1167	144.767
<i>Goodenia gracilis</i>				01/04/1770	4/03/2008	-36.1167	144.767
<i>Myriophyllum crispatum</i>				30/11/1891	30/11/1891	-36.1167	144.767
<i>Hypoxis glabella</i> var. <i>glabella</i>	Tiny Star			28/09/1983	28/09/1983	-36.1167	144.767
<i>Juncus amabilis</i>				10/07/2003	10/07/2003	-36.063	144.679
<i>Juncus flavidus</i>				21/04/1973	21/04/1973	-36.1333	144.75
<i>Amyema linophyllum</i> subsp. <i>orientale</i>				1/12/1904	31/12/1904	-36.1167	144.767
<i>Eremophila deserti</i>	Turkeybush			12/10/1992	12/10/1992	-36.0764	144.782
<i>Eucalyptus camaldulensis</i>	River Red Gum			01/04/1770	4/03/2008	-36.1167	144.767
<i>Eucalyptus camaldulensis</i>	River Red Gum			1/01/1906	31/01/1906	-36.1167	144.767
<i>Eucalyptus largiflorens</i>	Black Box			01/08/1894	31/08/1894	-36.1167	144.767

SCIENTIFIC NAME	COMMON NAME	EXOTIC	LEGAL STATUS	FIRSTDATE	LASTDATE	LATITUDE	LONGITUDE
<i>Eucalyptus largiflorens</i>	Black Box			01/04/1770	4/03/2008	-36.1167	144.767
<i>Eucalyptus melliodora</i>	Yellow Box			19/07/1906	19/07/1906	-36.1167	144.767
<i>Eucalyptus melliodora</i>	Yellow Box			01/04/1770	4/03/2008	-36.1167	144.767
<i>Eucalyptus melliodora</i>	Yellow Box			1/10/1906	31/10/1906	-36.1167	144.767
<i>Eucalyptus melliodora</i>	Yellow Box			7/11/1913	7/11/1913	-36.1167	144.767
<i>Melaleuca lanceolata</i>	Moonah			1/10/1904	31/10/1904	-36.1167	144.767
<i>Fraxinus angustifolia</i> subsp. <i>angustifolia</i>	Desert Ash	*		5/09/2001	5/09/2001	-36.1111	144.753
<i>Thelymitra megcalyptra</i>	Scented Sun Orchid			01/10/1891	31/10/1891	-36.1167	144.767
<i>Amphibromus fluitans</i>	Floating Swamp Wallaby-grass			20/03/1979	20/03/1979	-36.1167	144.75
<i>Cynodon transvaalensis</i>	South African Couch	*		3/03/1987	3/03/1987	-36.1167	144.75
<i>Panicum decompositum</i> var. <i>tenuius</i>				3/03/1987	3/03/1987	-36.1333	144.733
<i>Poa fordeana</i>	Sweet Swamp-grass			18/11/1978	18/11/1978	-36.0667	144.767
<i>Persicaria lapathifolia</i>	Pale Knotweed			1/02/1974	28/02/1974	-36.0833	144.683
<i>Rumex tenax</i>	Shiny Dock			01/11/1894	30/11/1894	-36.1167	144.767
<i>Hakea tephrosperma</i>	Hooked Needlewood			1/10/1906	31/10/1906	-36.1167	144.767
<i>Ranunculus sceleratus</i>	Celery Buttercup	*		10/03/1977	10/03/1977	-36.1167	144.767
<i>Exocarpos strictus</i>	Dwarf Cherry			5/09/2001	5/09/2001	-36.1119	144.753
<i>Exocarpos strictus</i>	Dwarf Cherry			10/03/1977	10/03/1977	-36.1167	144.767
<i>Euphrasia collina</i>				2/10/2003	2/10/2003	-36.0542	144.755
<i>Glossostigma elatinoides</i>				1/01/1980	31/01/1980	-36.1167	144.767
<i>Mimulus gracilis</i>	Slender Monkey-flower			01/04/1770	4/03/2008	-36.1167	144.767
<i>Stemodia florulenta</i>	Bluerod			01/04/1770	4/03/2008	-36.1167	144.767
<i>Cestrum parqui</i>	Green Cestrum	*		1/06/1984	30/06/1984	-36.1167	144.767

* = introduced species; **E1** = Endangered Species.

Appendix 13: Fauna Species Recorded From the AWW search region

Common Name	Scientific Name	EPBC	FFG	DSE	Year Last Recorded	Number of Records
Birds						
Australasian Grebe	<i>Tachybaptus novaehollandiae</i>				1994	6
Australasian Pipit	<i>Anthus novaeseelandiae</i>				1994	4
Australasian Shoveler	<i>Anas rhynchos</i>			VU	1953	1
Australian Hobby	<i>Falco longipennis</i>				2001	2
Australian Magpie	<i>Gymnorhina tibicen</i>				2005	32
Australian Pelican	<i>Pelecanus conspicillatus</i>				1994	6
Australian Raven	<i>Corvus coronoides</i>				2001	25
Australian Shelduck	<i>Tadorna tadornoides</i>				2005	30
Australian Spotted Crake	<i>Porzana fluminea</i>				1994	1
Australian White Ibis	<i>Threskiornis molucca</i>				2000	14
Australian Wood Duck	<i>Chenonetta jubata</i>				2005	32
Azure Kingfisher	<i>Alcedo azurea</i>			NT	2001	3
Banded Lapwing	<i>Vanellus tricolor</i>				1973	2
Black Falcon	<i>Falco subniger</i>			VU	1994	1
Black Kite	<i>Milvus migrans</i>				2005	8
Black Swan	<i>Cygnus atratus</i>				1991	23
Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>				2005	27
Black-fronted Dotterel	<i>Euseyornis melanops</i>				2001	6
Black-shouldered Kite	<i>Elanus axillaris</i>				2005	7
Black-tailed Native-hen	<i>Gallinula ventralis</i>				1994	2
Black-winged Stilt	<i>Himantopus himantopus</i>				1982	1
Blue-billed Duck	<i>Oxyura australis</i>		L	EN	1989	2
Blue-faced Honeyeater	<i>Entomyzon cyanotis</i>				2005	6
Brown Falcon	<i>Falco berigora</i>				2005	5
Brown Quail	<i>Coturnix ypsilophora</i>			NT	2001	2
Brown Songlark	<i>Cincloramphus cruralis</i>				1994	2
Brown Thornbill	<i>Acanthiza pusilla</i>				1985	1
Brown Treecreeper (south-eastern ssp.)	<i>Climacteris picumnus victoriae</i>			NT	2001	17
Brown-headed Honeyeater	<i>Melithreptus brevirostris</i>				2001	6
Brush Cuckoo	<i>Cacomantis variolosus</i>				1987	1
Buff-rumped Thornbill	<i>Acanthiza reguloides</i>				2001	11
Bush Stone-curlew	<i>Burhinus grallarius</i>		L	EN	2006	5
Cattle Egret	<i>Ardea ibis</i>				1989	1
Chestnut Teal	<i>Anas castanea</i>				1999	7
Chestnut-rumped Thornbill	<i>Acanthiza uropygialis</i>				2005	1
Clamorous Reed Warbler	<i>Acrocephalus stentoreus</i>				1982	1
Cockatiel	<i>Nymphicus hollandicus</i>				1985	1
Collared Sparrowhawk	<i>Accipiter cirrhocephalus</i>				1999	3
Common Blackbird	<i>Turdus merula</i>			*	2001	9
Common Bronzewing	<i>Phaps chalcoptera</i>				2001	9
Common Myna	<i>Acridotheres tristis</i>			*	1993	1
Common Starling	<i>Sturnus vulgaris</i>			*	2005	20
Crested Pigeon	<i>Ocyphaps lophotes</i>				2005	15
Crested Shrike-tit	<i>Falcunculus frontatus</i>				2001	6
Crimson Rosella	<i>Platycercus elegans elegans</i>				2001	12
Darter	<i>Anhinga novaehollandiae</i>				2000	2
Diamond Dove	<i>Geopelia cuneata</i>		L	NT	2001	1
Diamond Firetail	<i>Stagonopleura guttata</i>		L	VU	1984	1
Dollarbird	<i>Eurystomus orientalis</i>				2001	6
Dusky Moorhen	<i>Gallinula tenebrosa</i>				2001	15
Dusky Woodswallow	<i>Artamus cyanopterus</i>				2000	11
Eastern Great Egret	<i>Ardea modesta</i>		L	VU	2001	8
Eastern Rosella	<i>Platycercus eximius</i>				2005	16
Eurasian Coot	<i>Fulica atra</i>				2000	6
Eurasian Tree Sparrow	<i>Passer montanus</i>			*	2000	1
European Goldfinch	<i>Carduelis carduelis</i>			*	1994	1
Fan-tailed Cuckoo	<i>Cacomantis flabelliformis</i>				1984	2
Flame Robin	<i>Petroica phoenicea</i>				2005	4
Galah	<i>Eolophus roseicapilla</i>				2005	45
Golden Whistler	<i>Pachycephala pectoralis</i>				2000	2
Golden-headed Cisticola	<i>Cisticola exilis</i>				2001	2
Great Cormorant	<i>Phalacrocorax carbo</i>				1994	4
Great Crested Grebe	<i>Podiceps cristatus</i>				1989	1
Grey Fantail	<i>Rhipidura albiscarpa</i>				2001	24

Common Name	Scientific Name	EPBC	FFG	DSE	Year Last Recorded	Number of Records
Grey Goshawk	<i>Accipiter novaehollandiae</i>		L	VU	1999	1
Grey Shrike-thrush	<i>Colluricincla harmonica</i>				2001	16
Grey Teal	<i>Anas gracilis</i>				2005	29
Gull-billed Tern	<i>Gelochelidon nilotica</i>		L	EN	2006	1
Hardhead	<i>Aythya australis</i>			VU	1994	5
Hoary-headed Grebe	<i>Poliiocephalus poliocephalus</i>				1991	2
Horsfield's Bronze-Cuckoo	<i>Chrysococcyx basalis</i>				2000	2
House Sparrow	<i>Passer domesticus</i>			*	2005	11
Intermediate Egret	<i>Ardea intermedia</i>		L	CE	2001	5
Jacky Winter	<i>Microeca fascinans</i>				1999	3
Laughing Kookaburra	<i>Dacelo novaeguineae</i>				2001	26
Leaden Flycatcher	<i>Myiagra rubecula</i>				1985	1
Letter-winged Kite	<i>Elanus scriptus</i>				2005	1
Little Black Cormorant	<i>Phalacrocorax sulcirostris</i>				2001	6
Little Corella	<i>Cacatua sanguinea</i>				2001	6
Little Eagle	<i>Hieraaetus morphnoides</i>				2006	8
Little Friarbird	<i>Philemon citreogularis</i>				2000	12
Little Grassbird	<i>Megalurus gramineus</i>				2000	1
Little Pied Cormorant	<i>Microcarbo melanoleucos</i>				2001	12
Little Raven	<i>Corvus mellori</i>				2005	22
Little Wattlebird	<i>Anthochaera chrysoptera</i>				1994	1
Long-billed Corella	<i>Cacatua tenuirostris</i>				2005	22
Magpie-lark	<i>Grallina cyanoleuca</i>				2005	30
Masked Lapwing	<i>Vanellus miles</i>				2005	23
Masked Woodswallow	<i>Artamus personatus</i>				1985	3
Mistletoebird	<i>Dicaeum hirundinaceum</i>				2000	4
Musk Duck	<i>Biziura lobata</i>			VU	1991	7
Musk Lorikeet	<i>Glossopsitta concinna</i>				2001	2
Nankeen Kestrel	<i>Falco cenchroides</i>				2005	6
Nankeen Night Heron	<i>Nycticorax caledonicus</i>			NT	1984	1
Noisy Friarbird	<i>Philemon corniculatus</i>				2001	10
Noisy Miner	<i>Manorina melanocephala</i>				2005	14
Northern Mallard	<i>Anas platyrhynchos</i>			*	2000	1
Olive-backed Oriole	<i>Oriolus sagittatus</i>				1985	4
Pacific Barn Owl	<i>Tyto javanica</i>				2005	2
Pacific Black Duck	<i>Anas superciliosa</i>				2005	53
Painted Button-quail	<i>Turnix varia</i>				1985	6
Pallid Cuckoo	<i>Cuculus pallidus</i>				1999	5
Peaceful Dove	<i>Geopelia striata</i>				2001	11
Pied Butcherbird	<i>Cracticus nigrogularis</i>				2005	2
Pied Currawong	<i>Strepera graculina</i>				2001	5
Pink-eared Duck	<i>Malacorhynchus membranaceus</i>				1991	5
Plains-wanderer	<i>Pedionomus torquatus</i>	VU	L	CE	1954	2
Plumed Whistling-Duck	<i>Dendrocygna eytoni</i>				1994	2
Purple Swamphen	<i>Porphyrio porphyrio</i>				2000	8
Rainbow Bee-eater	<i>Merops ornatus</i>				2001	14
Red Wattlebird	<i>Anthochaera carunculata</i>				2005	7
Red-browed Finch	<i>Neochmia temporalis</i>				2001	4
Red-capped Robin	<i>Petroica goodenovii</i>				2001	6
Red-rumped Parrot	<i>Psephotus haematonotus</i>				2005	19
Restless Flycatcher	<i>Myiagra inquieta</i>				2001	7
Rock Dove	<i>Columba livia</i>			*	2001	8
Royal Spoonbill	<i>Platalea regia</i>			VU	1994	3
Rufous Songlark	<i>Cincloramphus mathewsi</i>				1985	7
Rufous Whistler	<i>Pachycephala rufiventris</i>				2001	17
Sacred Kingfisher	<i>Todiramphus sanctus</i>				2001	12
Shining Bronze-Cuckoo	<i>Chrysococcyx lucidus</i>				1985	1
Silver Gull	<i>Chroicocephalus novaehollandiae</i>				1994	2
Silvereye	<i>Zosterops lateralis</i>				2001	10
Southern Boobook	<i>Ninox novaeseelandiae</i>				1985	5
Spotted Pardalote	<i>Pardalotus punctatus</i>				2001	10
Spotted Turtle-Dove	<i>Streptopelia chinensis</i>			*	2001	1
Straw-necked Ibis	<i>Threskiornis spinicollis</i>				2005	16
Striated Pardalote	<i>Pardalotus striatus</i>				2005	33
Striated Thornbill	<i>Acanthiza lineata</i>				2000	10
Stubble Quail	<i>Coturnix pectoralis</i>				1994	1

Common Name	Scientific Name	EPBC	FFG	DSE	Year Last Recorded	Number of Records
Sulphur-crested Cockatoo	<i>Cacatua galerita</i>				2001	23
Superb Fairy-wren	<i>Malurus cyaneus</i>				2001	24
Tawny Frogmouth	<i>Podargus strigoides</i>				1999	4
Tree Martin	<i>Hirundo nigricans</i>				2000	3
Turquoise Parrot	<i>Neophema pulchella</i>		L	NT	1986	3
Varied Sittella	<i>Daphoenositta chrysoptera</i>				2001	4
Weebill	<i>Smicrornis brevirostris</i>				2001	13
Welcome Swallow	<i>Hirundo neoxena</i>				2005	19
Western Gerygone	<i>Gerygone fusca</i>				1984	3
Whiskered Tern	<i>Chlidonias hybridus</i>			NT	1994	2
Whistling Kite	<i>Haliastur sphenurus</i>				2005	13
White-bellied Cuckoo-shrike	<i>Coracina papuensis</i>				1985	2
White-bellied Sea-Eagle	<i>Haliaeetus leucogaster</i>		L	VU	1999	1
White-breasted Woodswallow	<i>Artamus leucorhynchus</i>				2001	1
White-browed Babbler	<i>Pomatostomus superciliosus</i>				1998	2
White-browed Woodswallow	<i>Artamus superciliosus</i>				1984	2
White-faced Heron	<i>Egretta novaehollandiae</i>				2005	20
White-fronted Chat	<i>Epthianura albifrons</i>				1994	1
White-necked Heron	<i>Ardea pacifica</i>				2001	5
White-plumed Honeyeater	<i>Lichenostomus penicillatus</i>				2005	34
White-throated Needletail	<i>Hirundapus caudacutus</i>				2001	1
White-throated Treecreeper	<i>Cormobates leucophaeus</i>				2001	18
White-winged Chough	<i>Corcorax melanorhamphos</i>				2001	16
White-winged Triller	<i>Lalage sueurii</i>				1998	1
Willie Wagtail	<i>Rhipidura leucophrys</i>				2005	28
Yellow Rosella	<i>Platycercus elegans flaveolus</i>				1994	8
Yellow Thornbill	<i>Acanthiza nana</i>				2001	12
Yellow-billed Spoonbill	<i>Platalea flavipes</i>				2000	9
Yellow-plumed Honeyeater	<i>Lichenostomus ornatus</i>				1999	1
Yellow-rumped Thornbill	<i>Acanthiza chrysorrhoa</i>				2005	14
Zebra Finch	<i>Taeniopygia guttata</i>				1994	4
Mammals						
Chocolate Wattled Bat	<i>Chalinolobus morio</i>				2000	4
Common Brushtail Possum	<i>Trichosurus vulpecula</i>				1994	29
Common Ringtail Possum	<i>Pseudocheirus peregrinus</i>				1994	2
Eastern Grey Kangaroo	<i>Macropus giganteus</i>				1985	1
European Hare	<i>Lepus europeaus</i>			*	2005	6
European Rabbit	<i>Oryctolagus cuniculus</i>			*	2005	1
Gould's Wattled Bat	<i>Chalinolobus gouldii</i>				2000	4
House Mouse	<i>Mus musculus</i>			*	1994	1
Inland Broad-nosed Bat	<i>Scotorepens balstoni</i>				2000	4
Large Forest Bat	<i>Vespadelus darlingtoni</i>				2000	2
Lesser Long-eared Bat	<i>Nyctophilus geoffroyi</i>				2000	4
Little Forest Bat	<i>Vespadelus vulturinus</i>				2000	4
Platypus	<i>Ornithorhynchus anatinus</i>				2003	4
Red Fox	<i>Vulpes vulpes</i>			*	1994	3
Southern Forest Bat	<i>Vespadelus regulus</i>				2000	2
Southern Freetail Bat (long penis)	<i>Mormopterus sp. 1</i>				2000	4
Squirrel Glider	<i>Petaurus norfolcensis</i>		L	EN	2000	28
Sugar Glider	<i>Petaurus breviceps</i>				1985	12
Water Rat	<i>Hydromys chrysogaster</i>				1994	1
Yellow-footed Antechinus	<i>Antechinus flavipes</i>				1997	8
Reptiles						
Bandy Bandy	<i>Vermicella annulata</i>		L	NT	1951	2
Eastern Brown Snake	<i>Pseudonaja textilis</i>				1994	2
Garden Skink	<i>Lampropholis guichenoti</i>				1994	1
Marbled Gecko	<i>Christinus marmoratus</i>				1982	37
Murray River Turtle	<i>Emydura macquarii</i>			DD	1982	2
Tiger Snake	<i>Notechis scutatus</i>				1994	3
Frogs						
Common Froglet	<i>Crinia signifera</i>				2005	56
Peron's Tree Frog	<i>Litoria peronii</i>				1964	4
Plains Froglet	<i>Crinia parinsignifera</i>				2005	18
Spotted Marsh Frog	<i>Limnodynastes tasmaniensis</i>				1989	3
Fish						
Australian Smelt	<i>Retropinna semoni</i>				1913	1

Common Name	Scientific Name	EPBC	FFG	DSE	Year Last Recorded	Number of Records
Bony Herring	<i>Nematalosa erebi</i>				1912	4
Common Carp	<i>Cyprinus carpio</i>			*	1913	13
Eastern Gambusia	<i>Gambusia holbrooki</i>			*	1913	1
Flat-headed Gudgeon	<i>Philypnodon grandiceps</i>				1913	6
Golden Perch	<i>Macquaria ambigua</i>			VU	1995	6
Goldfish	<i>Carassius auratus</i>			*	1913	8
Redfin Perch	<i>Perca fluviatilis</i>			*	1913	11
Short-headed Lamprey	<i>Mordacia mordax</i>				1905	2
Silver Perch	<i>Bidyanus bidyanus</i>		L	CE	1995	4

* = introduced species; L = listed as threatened; EPBC = status under EPBC Act; FFG = status under FFG Act; DSE = status under DSE's Advisory List; CE = critically endangered; EN = endangered; VU = vulnerable; DD = data deficient.

Appendix 14: Fauna Species Recorded from the Atlas of NSW Wildlife search region

Scientific Name	Common Name	Legal Status	Count
Birds			
<i>Platycercus elegans flaveolus</i>	[Yellow Rosella]	P	5
<i>Cracticus tibicen</i>	Australian Magpie	P	5
<i>Aegotheles cristatus</i>	Australian Owlet-nightjar	P	1
<i>Corvus coronoides</i>	Australian Raven	P	5
<i>Acrocephalus australis</i>	Australian Reed-Warbler	P	2
<i>Threskiornis molucca</i>	Australian White Ibis	P	2
<i>Chenonetta jubata</i>	Australian Wood Duck	P	3
<i>Cygnus atratus</i>	Black Swan	P	1
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike	P	3
<i>Entomyzon cyanotis</i>	Blue-faced Honeyeater	P	2
<i>Coturnix ypsilophora</i>	Brown Quail	P	1
<i>Melithreptus brevirostris</i>	Brown-headed Honeyeater	P	2
<i>Phaps chalcoptera</i>	Common Bronzewing	P	3
<i>Ocyphaps lophotes</i>	Crested Pigeon	P	4
<i>Gallinula tenebrosa</i>	Dusky Moorhen	P	2
<i>Artamus cyanopterus</i>	Dusky Woodswallow	P	1
<i>Platycercus eximius</i>	Eastern Rosella	P	4
<i>Falcunculus frontatus frontatus</i>	Eastern Shrike-tit	P	2
<i>Fulica atra</i>	Eurasian Coot	P	1
<i>Eolophus roseicapillus</i>	Galah	P	7
<i>Rhipidura albiscapa</i>	Grey Fantail	P	2
<i>Colluricincla harmonica</i>	Grey Shrike-thrush	P	6
<i>Anas gracilis</i>	Grey Teal	P	2
<i>Ardea intermedia</i>	Intermediate Egret	P	1
<i>Microeca fascinans</i>	Jacky Winter	P	2
<i>Dacelo novaeguineae</i>	Laughing Kookaburra	P	3
<i>Phalacrocorax sulcirostris</i>	Little Black Cormorant	P	2
<i>Cacatua sanguinea</i>	Little Corella	P	3
<i>Philemon citreogularis</i>	Little Friarbird	P	3
<i>Microcarbo melanoleucos</i>	Little Pied Cormorant	P	1
<i>Cacatua tenuirostris</i>	Long-billed Corella	P	1
<i>Grallina cyanoleuca</i>	Magpie-lark	P	5
<i>Dicaeum hirundinaceum</i>	Mistletoebird	P	1
<i>Philemon corniculatus</i>	Noisy Friarbird	P	1
<i>Manorina melanocephala</i>	Noisy Miner	P	3
<i>Oriolus sagittatus</i>	Olive-backed Oriole	P	1
<i>Anas superciliosa</i>	Pacific Black Duck	P	4
<i>Merops ornatus</i>	Rainbow Bee-eater	P	1
<i>Anthochaera carunculata</i>	Red Wattlebird	P	1
<i>Neochmia temporalis</i>	Red-browed Finch	P	2
<i>Psephotus haematonotus</i>	Red-rumped Parrot	P	1

Scientific Name	Common Name	Legal Status	Count
<i>Pachycephala rufiventris</i>	Rufous Whistler	P	2
<i>Todiramphus sanctus</i>	Sacred Kingfisher	P	2
<i>Zosterops lateralis</i>	Silvereye	P	1
<i>Ninox novaeseelandiae</i>	Southern Boobook	P	6
<i>Pardalotus punctatus</i>	Spotted Pardalote	P	2
<i>Threskiornis spinicollis</i>	Straw-necked Ibis	P	1
<i>Pardalotus striatus</i>	Striated Pardalote	P	4
<i>Cacatua galerita</i>	Sulphur-crested Cockatoo	P	6
<i>Malurus cyaneus</i>	Superb Fairy-wren	P	3
<i>Aquila audax</i>	Wedge-tailed Eagle	P	1
<i>Hirundo neoxena</i>	Welcome Swallow	P	3
<i>Gerygone fusca</i>	Western Gerygone	P	1
<i>Haliastur sphenurus</i>	Whistling Kite	P	2
<i>Egretta novaehollandiae</i>	White-faced Heron	P	2
<i>Lichenostomus penicillatus</i>	White-plumed Honeyeater	P	6
<i>Cormobates leucophaea</i>	White-throated Treecreeper	P	1
<i>Corcorax melanorhamphos</i>	White-winged Cough	P	4
<i>Rhipidura leucophrys</i>	Willie Wagtail	P	4
<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill	P	1
<i>Sturnus vulgaris</i> *	Common Starling		2
<i>Turdus merula</i> *	Eurasian Blackbird		2
<i>Columba livia</i> *	Rock Dove		1
<i>Melithreptus gularis gularis</i>	Black-chinned Honeyeater (eastern subspecies)	V	1
<i>Climacteris picumnus</i>	Brown Treecreeper	V	4
<i>Stagonopleura guttata</i>	Diamond Firetail	V	1
<i>Pomatostomus temporalis temporalis</i>	Grey-crowned Babbler (eastern subspecies)	V	1
<i>Melanodryas cucullata</i>	Hooded Robin	V	1
<i>Pyrrholaemus saggitatus</i>	Speckled Warbler	V	1
Mammals			
<i>Rattus rattus</i> *	Black Rat		4
<i>Chalinolobus morio</i>	Chocolate Wattled Bat	P	1
<i>Trichosurus vulpecula</i>	Common Brushtail Possum	P	2
<i>Pseudocheirus peregrinus</i>	Common Ringtail Possum	P	3
<i>Macropus giganteus</i>	Eastern Grey Kangaroo	P	2
<i>Vulpes vulpes</i> *	Fox		2
<i>Nyctophilus gouldi</i>	Gould's Long-eared Bat	P	1
<i>Chalinolobus gouldii</i>	Gould's Wattled Bat	P	1
<i>Vespadelus darlingtoni</i>	Large Forest Bat	P	1
<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat	P	1
<i>Vespadelus vulturinus</i>	Little Forest Bat	P	1
<i>Mormopterus planiceps</i>	Little Mastiff-bat	P	1
<i>Vespadelus regulus</i>	Southern Forest Bat	P	1

Scientific Name	Common Name	Legal Status	Count
<i>Petaurus breviceps</i>	Sugar Glider	P	1
<i>Tadarida australis</i>	White-striped Freetail-bat	P	6
<i>Antechinus flavipes</i>	Yellow-footed Antechinus	P	8
Reptiles			
<i>Pseudechis porphyriacus</i>	Red-bellied Black Snake	P	1
<i>Christinus marmoratus</i>	Marbled Gecko	P	1
<i>Ramphotyphlops bituberculatus</i>	Prong-snouted Blind Snake	P	1
Frogs			
<i>Limnodynastes tasmaniensis</i>	Spotted Grass Frog	P	2

* = introduced species; **P** = listed as protected under the *National Parks and Wildlife Act 1974*;
V = listed as vulnerable under the TSC Act.

Appendix 15: Records of bird species compiled by Birds Australia for the search region

Common Name	Scientific Name	Common Name	Scientific Name
Australasian Darter	<i>Anhinga novaehollandiae</i>	Long-billed Corella	<i>Cacatua tenuirostris</i>
Australasian Grebe	<i>Tachybaptus novaehollandiae</i>	Magpie-lark	<i>Grallina cyanoleuca</i>
Australasian Pipit	<i>Anthus novaeseelandiae</i>	Masked Lapwing	<i>Vanellus miles</i>
Australian Hobby	<i>Falco longipennis</i>	Mistletoebird	<i>Dicaeum hirundinaceum</i>
Australian Magpie	<i>Cracticus tibicen</i>	Musk Lorikeet	<i>Glossopsitta concinna</i>
Australian Pelican	<i>Pelecanus conspicillatus</i>	Nankeen Kestrel	<i>Falco cenchroides</i>
Australian Raven	<i>Corvus coronoides</i>	Nankeen Night-Heron	<i>Nycticorax caledonicus</i>
Australian Reed-Warbler	<i>Acrocephalus australis</i>	Noisy Friarbird	<i>Philemon corniculatus</i>
Australian Shelduck	<i>Tadorna tadornoides</i>	Noisy Miner	<i>Manorina melanocephala</i>
Australian White Ibis	<i>Threskiornis molucca</i>	Northern Mallard	<i>Anas platyrhynchos</i>
Australian Wood Duck	<i>Chenonetta jubata</i>	Olive-backed Oriole	<i>Oriolus sagittatus</i>
Azure Kingfisher	<i>Ceyx azureus</i>	Pacific Black Duck	<i>Anas superciliosa</i>
Banded Lapwing	<i>Vanellus tricolor</i>	Painted Button-quail	<i>Turnix varius</i>
Barking Owl	<i>Ninox connivens</i>	Pallid Cuckoo	<i>Cacomantis pallidus</i>
Black Kite	<i>Milvus migrans</i>	Peaceful Dove	<i>Geopelia striata</i>
Black Swan	<i>Cygnus atratus</i>	Peregrine Falcon	<i>Falco peregrinus</i>
Black-chinned Honeyeater	<i>Melithreptus gularis</i>	Pied Butcherbird	<i>Cracticus nigrogularis</i>
Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>	Pied Cormorant	<i>Phalacrocorax varius</i>
Black-fronted Dotterel	<i>Euseyornis melanops</i>	Pied Currawong	<i>Strepera graculina</i>
Black-shouldered Kite	<i>Elanus axillaris</i>	Pink Robin	<i>Petroica rodinogaster</i>
Black-tailed Native-hen	<i>Tribonyx ventralis</i>	Purple Swamphen	<i>Porphyrio porphyrio</i>
Blue-faced Honeyeater	<i>Entomyzon cyanotis</i>	Rainbow Bee-eater	<i>Merops ornatus</i>
Brown Falcon	<i>Falco berigora</i>	Red Wattlebird	<i>Anthochaera carunculata</i>
Brown Goshawk	<i>Accipiter fasciatus</i>	Red-browed Finch	<i>Neochmia temporalis</i>
Brown Quail	<i>Coturnix ypsilophora</i>	Red-capped Robin	<i>Petroica goodenovii</i>
Brown Thornbill	<i>Acanthiza pusilla</i>	Red-rumped Parrot	<i>Psephotus haematonotus</i>
Brown Treecreeper	<i>Climacteris picumnus</i>	Restless Flycatcher	<i>Myiagra inquieta</i>
Brown-headed Honeyeater	<i>Melithreptus brevirostris</i>	Rock Dove	<i>Columba livia</i>
Buff-rumped Thornbill	<i>Acanthiza reguloides</i>	Royal Spoonbill	<i>Platalea regia</i>
Chestnut Teal	<i>Anas castanea</i>	Rufous Fantail	<i>Rhipidura rufifrons</i>
Chestnut-crowned Babbler	<i>Pomatostomus ruficeps</i>	Rufous Songlark	<i>Cincloramphus mathewsi</i>
Collared Sparrowhawk	<i>Accipiter cirrocephalus</i>	Rufous Whistler	<i>Pachycephala rufiventris</i>
Common Blackbird	<i>Turdus merula</i>	Sacred Kingfisher	<i>Todiramphus sanctus</i>
Common Bronzewing	<i>Phaps chalcoptera</i>	Scarlet Robin	<i>Petroica boodang</i>
Common Myna	<i>Sturnus tristis</i>	Shining Bronze-Cuckoo	<i>Chalcites lucidus</i>
Common Starling	<i>Sturnus vulgaris</i>	Silver Gull	<i>Chroicocephalus novaehollandiae</i>
Crested Pigeon	<i>Ocyphaps lophotes</i>	Silvereye	<i>Zosterops lateralis</i>
Crested Shrike-tit	<i>Falcunculus frontatus</i>	Singing Honeyeater	<i>Lichenostomus virescens</i>

Common Name	Scientific Name	Common Name	Scientific Name
Crimson Rosella	<i>Platycercus elegans</i>	Southern Boobook	<i>Ninox novaeseelandiae</i>
Diamond Dove	<i>Geopelia cuneata</i>	Southern Whiteface	<i>Aphelocephala leucopsis</i>
Diamond Firetail	<i>Stagonopleura guttata</i>	Spiny-cheeked Honeyeater	<i>Acanthagenys rufogularis</i>
Dollarbird	<i>Eurystomus orientalis</i>	Spotted Dove	<i>Streptopelia chinensis</i>
Dusky Moorhen	<i>Gallinula tenebrosa</i>	Spotted Pardalote	<i>Pardalotus punctatus</i>
Dusky Woodswallow	<i>Artamus cyanopterus</i>	Straw-necked Ibis	<i>Threskiornis spinicollis</i>
Eastern Great Egret	<i>Ardea modesta</i>	Striated Pardalote	<i>Pardalotus striatus</i>
Eastern Rosella	<i>Platycercus eximius</i>	Striated Thornbill	<i>Acanthiza lineata</i>
Eastern Yellow Robin	<i>Eopsaltria australis</i>	Sulphur-crested Cockatoo	<i>Cacatua galerita</i>
Eurasian Coot	<i>Fulica atra</i>	Superb Fairy-wren	<i>Malurus cyaneus</i>
Eurasian Tree Sparrow	<i>Passer montanus</i>	Superb Parrot	<i>Polytelis swainsonii</i>
European Goldfinch	<i>Carduelis carduelis</i>	Tawny Frogmouth	<i>Podargus strigoides</i>
Fan-tailed Cuckoo	<i>Cacomantis flabelliformis</i>	Tree Martin	<i>Petrochelidon nigricans</i>
Flame Robin	<i>Petroica phoenicea</i>	Varied Sittella	<i>Daphoenositta chrysoptera</i>
Galah	<i>Eolophus roseicapillus</i>	Wedge-tailed Eagle	<i>Aquila audax</i>
Golden Whistler	<i>Pachycephala pectoralis</i>	Weebill	<i>Smicromis brevirostris</i>
Great Cormorant	<i>Phalacrocorax carbo</i>	Welcome Swallow	<i>Hirundo neoxena</i>
Grey Currawong	<i>Strepera versicolor</i>	Western Gerygone	<i>Gerygone fusca</i>
Grey Fantail	<i>Rhipidura albiscapa</i>	Whiskered Tern	<i>Chlidonias hybrida</i>
Grey Goshawk	<i>Accipiter novaehollandiae</i>	Whistling Kite	<i>Haliastur sphenurus</i>
Grey Shrike-thrush	<i>Colluricincla harmonica</i>	White-backed Swallow	<i>Cheramoeca leucosterna</i>
Grey Teal	<i>Anas gracilis</i>	White-breasted Woodswallow	<i>Artamus leucorhynchus</i>
Grey-crowned Babbler	<i>Pomatostomus temporalis</i>	White-browed Babbler	<i>Pomatostomus superciliosus</i>
Hardhead	<i>Aythya australis</i>	White-eared Honeyeater	<i>Lichenostomus leucotis</i>
Horsfield's Bronze-Cuckoo	<i>Chalcites basalis</i>	White-faced Heron	<i>Egretta novaehollandiae</i>
House Sparrow	<i>Passer domesticus</i>	White-necked Heron	<i>Ardea pacifica</i>
Intermediate Egret	<i>Ardea intermedia</i>	White-plumed Honeyeater	<i>Lichenostomus penicillatus</i>
Jacky Winter	<i>Microeca fascinans</i>	White-throated Needletail	<i>Hirundapus caudacutus</i>
Laughing Kookaburra	<i>Dacelo novaeguineae</i>	White-throated Treecreeper	<i>Cormobates leucophaea</i>
Little Black Cormorant	<i>Phalacrocorax sulcirostris</i>	White-winged Chough	<i>Corcorax melanorhamphos</i>
Little Corella	<i>Cacatua sanguinea</i>	White-winged Triller	<i>Lalage sueurii</i>
Little Eagle	<i>Hieraaetus morphnoides</i>	Willie Wagtail	<i>Rhipidura leucophrys</i>
Little Friarbird	<i>Philemon citreogularis</i>	Yellow Thornbill	<i>Acanthiza nana</i>
Little Grassbird	<i>Megalurus gramineus</i>	Yellow-billed Spoonbill	<i>Platalea flavipes</i>
Little Pied Cormorant	<i>Microcarbo melanoleucos</i>	Yellow-plumed Honeyeater	<i>Lichenostomus ornatus</i>
Little Raven	<i>Corvus mellori</i>	Yellow-rumped Thornbill	<i>Acanthiza chrysorrhoa</i>
Little Wattlebird	<i>Anthochaera chrysoptera</i>		

Appendix 16: Comprehensive list of assemblages of native animal species included in the Aquatic Ecological Community in the Natural Drainage System of the Lower Murray River Catchment (Murray River EEC).

CRUSTACEANS	
<i>Austrochiltonia australis</i> (water scud)	<i>Paratya australiensis</i> (freshwater shrimp)
<i>Austrochiltonia subtenuis</i> (water scud)	<i>Macrobrachium australiense</i> (freshwater prawn)
<i>Bosmina meridionalis</i> (water flea)	<i>Cherax destructor</i> (Yabbie)
<i>Daphnia lumholtzi</i> (water flea)	<i>Euastacus armatus</i> (Murray cray)
<i>Boeckella fluvialis</i> (copepod)	<i>Tachea picta</i> (shrimp lice)
<i>Caridina mccullochi</i> (fresh water shrimp)	<i>Heterias pusilla</i> (freshwater slater)
FISHES	
<i>Mordacia mordax</i> (Shortheaded lamprey)	<i>Nematalosa erebi</i> (Bony bream)
<i>Galaxias olidus</i> (Mountain galaxias)	<i>Galaxias rostratus</i> (Murray jollytail)
<i>Retropinna semoni</i> (Southern smelt)	<i>Tandanus tandanus</i> (Freshwater catfish)
* <i>Craterocephalus fluviatilis</i> (Murray hardyhead)	<i>Craterocephalus stercusmuscarum fulvus</i> (Nonspecked hardyhead)
<i>Melanotaenia fluviatilis</i> (Crimsonspotted rainbowfish)	* <i>Ambassis agassizi</i> (Olive perchlet)
* <i>Maccullochella macquariensis</i> (Trout cod)	<i>Maccullochella peeli peeli</i> (Murray cod)
<i>Macquaria ambigua</i> (Golden perch)	* <i>Macquaria australasica</i> (Macquarie perch)
* <i>Nannoperca australis</i> (Southern pygmy perch)	<i>Gadopsis marmoratus</i> (River blackfish)
* <i>Bidyanus bidyanus</i> (Silver perch)	<i>Hypseleotris klunzingeri</i> (Western carp gudgeon)
<i>Hypseleotris</i> sp. 4 (Midgleys carp gudgeon)	<i>Hypseleotris</i> sp. 5 (Lakes carp gudgeon)
* <i>Mogurnda adspersa</i> (Purplespotted gudgeon)	<i>Philypnodon grandiceps</i> (Flathead gudgeon)
<i>Philypnodon</i> sp. (Dwarf flathead gudgeon)	
INSECTS	
<i>Antiporus femoralis</i> (water beetle)	<i>Micronecta gracilis</i> (water bug)
<i>Antiporus gilberti</i> (water beetle)	<i>Microvelia paramoena</i> (water bug)
<i>Chironomus cloacalis</i> (midge)	<i>Xanthagrion erythroneurum</i> (dragonfly)
<i>Coelopynia pruinosa</i> (midge)	<i>Hemicordulia tau</i> (dragonfly)
<i>Cryptochironomus grisiedorsum</i> (midge)	<i>Austrogomphus cornutus</i> (dragonfly)
<i>Kiefferulus martini</i> (midge)	<i>Notostricta solida</i> (dragonfly)
<i>Procladius paludicola</i> (midge)	<i>Anisocentropus latifascia</i> (caddis fly)
<i>Tanytarsus fuscithorax</i> (midge)	<i>Ecnomus pansus</i> (caddis fly)
<i>Micronecta annae annae</i> (water bug)	<i>Hellyethira eskensis</i> (caddis fly)
MOLLUSCS	
<i>Alathyria condola</i> (bivalve)	<i>Austropeplea lessoni</i> (snail)
<i>Alathyria jacksoni</i> (bivalve)	<i>Glyptophysa gibbosa</i> (snail)
<i>Corbiculina australis</i> (bivalve)	* <i>Notopala sublineata hanleyi</i> (snail)
<i>Sphaerium problematicum</i> (bivalve)	<i>Thiara balonnensis</i> (snail)
<i>Sphaerium tasmanicum</i> (bivalve)	<i>Velesunio ambiguus</i> (bivalve)
OTHER	
<i>Ephydatia ramsayi</i> (freshwater sponge)	<i>Brachionus falcatus</i> (rotifer)
<i>Eunapius fragilis</i> (freshwater sponge)	<i>Brachionus novaezealandia</i> (rotifer)
<i>Heterorotula contraversa</i> (sponge)	<i>Microscoclex dubius</i> (oligochaete worm)
	<i>Temnocephala chaeropsis</i> (flatworm)

An * beside the species denotes a proposed or listed threatened species in the FM Act.

The total species list of the EEC is much larger than that given above. Only fishes, most macro-molluscs and most macro-crustaceans have been listed comprehensively. With more than 400 aquatic invertebrate species recorded from the Murray, only representative species of each of the major invertebrate groups are included here. At any particular site, not all of the assemblage listed above may be present at any one time. The species composition of a site will be influenced by the size and ecological characteristics of the area and the level of threatening processes present.

Appendix 17: NSW Noxious Weeds list for Murray local Council area

Common Name	Scientific Name	Class
African boxthorn	<i>Lycium ferocissimum</i>	4
African feathergrass	<i>Pennisetum macrourum</i>	5
African turnip weed	<i>Sisymbrium runcinatum</i>	5
African turnip weed	<i>Sisymbrium thellungii</i>	5
Alligator weed	<i>Alternanthera philoxeroides</i>	2
Anchored water hyacinth	<i>Eichhornia azurea</i>	1
Annual ragweed	<i>Ambrosia artemisiifolia</i>	5
Arrowhead	<i>Sagittaria montevidensis</i>	4
Artichoke thistle	<i>Cynara cardunculus</i>	5
Athel pine	<i>Tamarix aphylla</i>	5
Bathurst Burr and other burrs	<i>Xanthium species</i>	4
Bear-skin fescue	<i>Festuca gautieri</i>	5
Black knapweed	<i>Centaurea nigra</i>	1
Black willow	<i>Salix nigra</i>	2
Blackberry	<i>Rubus fruticosus aggregate species</i>	4
Boneseed	<i>Chrysanthemoides monilifera subspecies monilifera</i>	2
Bridal creeper	<i>Asparagus asparagoides</i>	4
Broomrapes	<i>Orobanche species</i>	1
Buffalo burr	<i>Solanum rostratum</i>	4
Burr ragweed	<i>Ambrosia confertiflora</i>	5
Cabomba	<i>Cabomba species</i>	5
Cape broom	<i>Genista monspessulana</i>	2
Cape tulip	<i>Moraea species</i>	4
Cayenne snakeweed	<i>Stachytarpheta cayennensis</i>	5
Chilean needle grass	<i>Nassella neesiana</i>	3
Chinese violet	<i>Asystasia gangetica subspecies micrantha</i>	1
Clockweed	<i>Gaura parviflora</i>	5
Columbus grass	<i>Sorghum x almum</i>	4
Coolatai grass	<i>Hyparrhenia hirta</i>	3
Corn sowthistle	<i>Sonchus arvensis</i>	5
Creeping knapweed	<i>Rhaponticum repens</i>	4
Devil's claw (purple-flowered)	<i>Proboscidea louisianica</i>	4
Devil's claw (yellow-flowered)	<i>Ibicella lutea</i>	4
Dodder	<i>Cuscuta species</i>	5
East Indian hygrophila	<i>Hygrophila polysperma</i>	4
Espartillo	<i>Amelichloa brachychaeta, Amelichloa caudata</i>	5
Eurasian water milfoil	<i>Myriophyllum spicatum</i>	1

Common Name	Scientific Name	Class
Fine-bristled burr grass	<i>Cenchrus brownii</i>	5
Fountain grass	<i>Pennisetum setaceum</i>	5
Gallon's curse	<i>Cenchrus biflorus</i>	5
Glaucous starthistle	<i>Carthamus glaucus</i>	5
Golden dodder	<i>Cuscuta campestris</i>	4
Golden thistle	<i>Scolymus hispanicus</i>	5
Harrisia cactus	<i>Harrisia species</i>	4
Hawkweed	<i>Hieracium species</i>	1
Heteranthera	<i>Heteranthera reniformis</i>	1
Horehound	<i>Marrubium vulgare</i>	4
Horsetail	<i>Equisetum species</i>	1
Hydrocotyl	<i>Hydrocotyl ranunculoides</i>	1
Hymenachne	<i>Hymenachne amplexicaulis and hybrids</i>	1
Johnson grass	<i>Sorghum halepense</i>	4
Karoo thorn	<i>Acacia karroo</i>	1
Kochia	<i>Bassia scoparia</i>	1
Kosters curse	<i>Clidemia hirta</i>	1
Lagarosiphon	<i>Lagarosiphon major</i>	1
Lantana	<i>Lantana species</i>	4
Leafy elodea	<i>Egeria densa</i>	4
Lippia	<i>Phyla canescens</i>	4
Long-leaf willow primrose	<i>Ludwigia longifolia</i>	4
Mesquite	<i>Prosopis species</i>	2
Mexican feather grass	<i>Nassella tenuissima</i>	1
Mexican poppy	<i>Argemone mexicana</i>	5
Miconia	<i>Miconia species</i>	1
Mikania	<i>Mikania micrantha</i>	1
Mimosa	<i>Mimosa pigra</i>	1
Mossman River grass	<i>Cenchrus echinatus</i>	5
Onion weed	<i>Asphodelus fistulosus</i>	4
Parkinsonia	<i>Parkinsonia aculeata</i>	2
Parthenium weed	<i>Parthenium hysterophorus</i>	1
Paterson's curse and other echium	<i>Echium species</i>	4
Perennial ground cherry	<i>Physalis virginiana</i>	4
Pond apple	<i>Annona glabra</i>	1
Prairie ground cherry	<i>Physalis hederifolia</i>	4
Prickly acacia	<i>Acacia nilotica</i>	1
Prickly pear	<i>Cylindropuntia species</i>	4
Prickly pear	<i>Opuntia species</i>	4
Red rice	<i>Oryza rufipogon</i>	5

Common Name	Scientific Name	Class
Rhus tree	<i>Toxicodendron succedaneum</i>	4
Rubber vine	<i>Cryptostegia grandiflora</i>	1
Sagittaria	<i>Sagittaria platyphylla</i>	4
Salvinia	<i>Salvinia molesta</i>	2
Scotch Thistle and other thistles	<i>Onopordum species</i>	4
Senegal tea plant	<i>Gymnocoronis spilanthoides</i>	1
Serrated tussock	<i>Nassella trichotoma</i>	3
Siam weed	<i>Chromolaena odorata</i>	1
Silk forage sorghum	<i>Sorghum species hybrid cultivar</i>	4
Silverleaf nightshade	<i>Solanum elaeagnifolium</i>	4
Smooth-stemmed turnip	<i>Brassica barrelieri subspecies oxyrrhina</i>	5
Soldier thistle	<i>Picnomon acarna</i>	5
Spiny burrgrass	<i>Cenchrus incertus</i>	4
Spiny burrgrass	<i>Cenchrus longispinus</i>	4
Spiny emex	<i>Emex australis</i>	4
Spotted knapweed	<i>Centaurea stoebe subspecies micranthos</i>	1
St. John's wort	<i>Hypericum perforatum</i>	3
Texas blueweed	<i>Helianthus ciliaris</i>	5
Tree-of-heaven	<i>Ailanthus altissima</i>	4
Tropical soda apple	<i>Solanum viarum</i>	2
Water caltrop	<i>Trapa species</i>	1
Water hyacinth	<i>Eichhornia crassipes</i>	2
Water lettuce	<i>Pistia stratiotes</i>	1
Water soldier	<i>Stratiotes aloides</i>	1
Willows	<i>Salix species</i>	5
Witchweed	<i>Striga species</i>	1
Yellow burrhead	<i>Limnocharis flava</i>	1
Yellow nutgrass	<i>Cyperus esculentus</i>	5

KEY TO CONTROL CLASS:

Control Class	Weed type	Example control requirements
Class 1	Plants that pose a potentially serious threat to primary production or the environment and are not present in the State or are present only to a limited extent.	<p>The plant must be eradicated from the land and the land must be kept free of the plant.</p> <p>The weeds are also "notifiable" and a range of restrictions on their sale and movement exist.</p>

Class 2	Plants that pose a potentially serious threat to primary production or the environment of a region to which the order applies and are not present in the region or are present only to a limited extent.	The plant must be eradicated from the land and the land must be kept free of the plant.
		The weeds are also "notifiable" and a range of restrictions on their sale and movement exist.
Class 3	Plants that pose a potentially serious threat to primary production or the environment of a region to which the order applies, are not widely distributed in the area and are likely to spread in the area or to another area.	The plant must be fully and continuously suppressed and destroyed.*
Class 4	Plants that pose a potentially serious threat to primary production, the environment or human health, are widely distributed in an area to which the order applies and are likely to spread in the area or to another area.	The growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its reproduction*
Class 5	Plants that are likely, by their sale or the sale of their seeds or movement within the State or an area of the State, to spread in the State or outside the State.	There are no requirements to control existing plants of Class 5 weeds.
		However, the weeds are "notifiable" and a range of restrictions on their sale and movement exists.