ASSESSMENT | PLANNING | MANAGEMENT

# Wagga Wagga Planning Study

## Environmental / Biodiversity report for Boorooma East

(Project No. 069-052)

Report prepared for:
Willana Associates
on behalf of Wagga Wagga City Council

March 2008

ABN 87 096 512 088 | address Suite 4 2-4 Merton Street Sutherland NSW 2232
postal PO Box 12 Sutherland NSW 1499 | phone 02 8536 8600 | fax 02 9542 5622
web www.ecoaus.com.au

## Document Tracking

| Item | Detail | Signature |
|---|---|---|
| Project Name | Wagga Wagga Planning Study: Environmental/Biodiversity report for Boorooma East East | |
| Project Number | 069-052 | |
| Prepared by | EL | |
| Prepared by | SL | |
| Approved by | | |
| Status | FINAL | |
| Version Number | V7 | |
| File location | G:\Current_Projects\Private Clients\Willana\Wagga Planning Studies\Reports | |
| Last saved on | 11 March 2008 | |

**Acknowledgements**
This document has been prepared by Eco Logical Australia Pty Ltd with support from Willana Associates.

The study team would like to thank Wagga Wagga Council staff for their assistance in providing relevant information for this report.





**Eco Logical Australia Pty Ltd**
Ecological Assessment, GIS, Environmental Management and Planning
Ph - (02) 8536 8600
Fax - (02) 9542 5622

## Executive Summary

Wagga Wagga City Council (WWCC) is in the process of preparing a draft Local Environment Plan (LEP) for the Wagga Wagga Local Government Area (WWLGA). The draft plan is intended to implement the strategic planning undertaken in the Wagga Wagga Spatial Plan 2007 (WWCC 2006) and will be prepared in accordance with the *Standard Instrument (Local Environmental Plans) Order 2006*.

Eco Logical Australia Pty Ltd was commissioned by Wagga Wagga City Council to prepare a study of the biodiversity values of a site at Boorooma East, Wagga Wagga, along with seven other sites (each subject to an individual report). The biodiversity studies will feed into the broader environmental study for each proposed development site. Each biodiversity report presents the ecological values of the subject lands and whether development of the site will "maintain or improve" biodiversity.

This biodiversity report seeks to present the ecological values of the Boorooma East development site and to discuss the potential impacts on ecological values, including threatened species, endangered populations and endangered ecological communities, arising from development of the site. Moreover the report seeks to provide a framework for maintaining and improving biodiversity at the Boorooma East site.

The specific objectives of the project are to:

- Describe the ecological values of the site
- Describe potential impacts of proposed development
- Recommend ways to minimise impacts on ecological values of the site
- Where impacts are unavoidable, to recommend offsets which ensure larger, viable areas of native vegetation and habitat are retained in such a way as to enhance landscape connectivity.

The report aims to provide a structure plan for the Boorooma East development site which will allow development of the site while avoiding impacts to native vegetation and threatened species habitats

Two vegetation types were identified at the site. Yellow Box Woodland, occupied the ridge and slopes in the south of the site. An area of grassland vegetation running north from the rise at the centre of the site and flanked either side by cropped paddocks was also found to be consistent with this community.

Yellow box woodland forms part of the broader White Box, Yellow Box, Blakely's Red Gum Woodland (Box – Gum Woodland) which is listed as an endangered ecological community under the TSC Act and as a critically endangered ecological community: White Box, Yellow Box, Blakely's Red Gum grassy woodland and derived native grassland, under the Commonwealth EPBC Act. Vegetation within a small area of floodplain in the south of the site was identified as River Redgum Forest. River redgum forest is not currently listed as threatened under state or federal legislation.



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The site contains vegetation of moderate to high value in a regional context owing to the sites location within the Junee Hills and Slopes and Murrumbidgee – Tarcutta Channels and Floodplain Mitchell Landscapes. Both these landscapes have been heavily cleared for agricultural production. The site, while displaying limited connectivity, is a known flyway of the superb parrot.

One threatened fauna species, the superb parrot, is known to utilise the site while another five threatened species are considered likely to occur. In addition, two species listed as migratory under the Commonwealth EPBC Act have the potential to occur at the site.

A structure plan has been produced which outlines the recommended location of potentially developable lands, lands to be retained and areas in which offsets may be located. In general, the location of retained lands and offset areas at the site aim to:

- Elevate patches of native vegetation from moderate to good condition
- Decrease edge effects currently experienced by native vegetation remnants
- Increase connectivity between currently isolated woodland patches within the site
- Increase connectivity of the site to areas of remnant vegetation outside the site boundaries.

The development potential of the Boorooma East site is constrained by the presence of 21.52 ha of 'moderate to good' condition box – gum woodland which is listed as an endangered ecological community and provides potential habitat for a range of threatened species. 'Moderate to good' condition vegetation at the site is not available for development. The site contains 4.78 ha of low condition box – gum woodland and river Redgum forest which, while available for development, is recommended for retention at the site. Approximately 42 ha of non-native vegetation is considered potentially developable land at the site.

The loss of low condition remnant vegetation and remnant trees within potentially developable lands of Boorooma East will require offsetting to a ratio of 1.92 ha and 10:1 respectively. Moreover, remnant trees retained within a residential zoning will also require offsetting. It is likely that such offsets can be accommodated on site within 'moderate to good' condition vegetation. It is recommended that remnant trees within potentially developable lands be retained and incorporated into future Master Planning so as to maximise the retention of biodiversity values within any future urban landscape.



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Ph - (02) 8536 8600
Fax - (02) 9542 5622

# Contents





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Fax - (02) 9542 5622

# 1. Introduction

## 1.1 Project Background

Wagga Wagga City Council (WWCC) is in the process of preparing a draft Local Environment Plan (LEP) for the Wagga Wagga Local Government Area (WWLGA). The draft plan is intended to implement the strategic planning undertaken in the Wagga Wagga Spatial Plan 2007 (WWCC 2006) and will be prepared in accordance with the *Standard Instrument (Local Environmental Plans) Order 2006*.

Preparation of the draft LEP requires that 8 environmental studies be undertaken at sites within the WWLGA that are proposed to be subject to significant zoning changes. These sites are:

- Boorooma East
- Estella West
- Lloyd
- Bomen
- Eastern Industrial – Copland Street South
- Eastern Industrial – Hammond Avenue North
- Edison Road
- Moorong Street

Eco Logical Australia Pty Ltd has been commissioned by Wagga Wagga City Council to prepare a study of the biodiversity values of each of the above sites. The biodiversity studies will feed into the broader environmental study for each proposed development site. Each biodiversity report will present the ecological values of the subject lands and assess whether development of the site will "maintain or improve" biodiversity.

The current document presents the biodiversity report for the proposed development site known as Boorooma East. Biodiversity reports for each of the 7 additional development sites are presented as separate documents.

## 1.2 Project Objectives

This biodiversity report seeks to present the ecological values of the Boorooma East development site and to discuss the potential impacts on ecological values, including threatened species, endangered populations and endangered ecological communities, arising from development of the site. Moreover the report seeks to provide a framework for maintaining and improving biodiversity at the Boorooma East site.

The specific objectives of the project are to:

- Describe the ecological values of the site
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Fax - (02) 9542 5622

The report aims to provide a structure plan for the Boorooma East development site which will allow development of the site while avoiding impacts to native vegetation and threatened species habitats

### 1.3 Study Area

The Boorooma East site occurs to the north of the existing urban area of the city of Wagga Wagga. The site occupies an area of approximately 67.94 ha and is bound by Amundsen Street to the west, Olympic Highway and Cooramin Street to the south, Farrer Road to the north and Coolamon Road to the east (Map 1. Kingsford Smith Road runs through the eastern side of the site in a north to south direction.

Current land use at the site is predominately rural. The majority of the northern section of the site has been cropped while the southern section of the site consists of mixed or improved pasture sparsely grazed by sheep and cattle. The land is owned by WWCC, as well as Gobba Family Investments, Tunstall, Glazier, Morrow and Oke. Four houses and associated residential infrastructure occur at the site.

Land use surrounding the site is also predominately rural, consisting of grazed paddocks, although residential development in private ownership occurs further west of the site. Charles Sturt University is located to the north west of the site and is used for educational and training purposes.

The site can be characterised as undulating land. A ridgeline runs in an east to west direction through the site and two peaks (approximately 212 and 226 metres above sea level, ASL) occur on the site. Elevation across the site ranges from 226 metres ASL on the highest peak to approximately 178 m ASL in the south along the Olympic Highway. Above the ridgeline, in the north of the site, land slopes gently east and west while in the south, land slopes southward toward the Olympic Highway.

Drainage at the site appears to be via overland flows and along shallow, informal drainage lines. The northern section of the site drains east and west from a high point which occupies the centre of the site. South of the ridgeline, drainage is southward and toward a small area of floodplain north of the Olympic Highway.

The East Bomen soils group dominates above the ridgeline in the northern section of the site while along the ridgeline and southern slopes in the south of the site, soils of the Glenmornon soils group are dominant(Chen and McKane 1997). Both the East Bomen and Glenmornon soil groups are prone to erosion (WISDOM 1995). A small area of Kurrajong Floodplain soils group can be found on the floodplain area, immediately north of the Highway (Chen and McKane 1997). The Kurrajong Plain soil group is typically fertile and represents a low erosion hazard (WISDOM 1995).

Native vegetation occurs as a broad (approximately 150 – 200 m wide) band stretching east to west along the ridge and slopes in the south of the site (Map 1). The Amundsen Street and Farrer Street road reserves represent the two other significant areas of native vegetation at the site. Gently sloping land in the north of the site has been extensively cropped and does not support any native vegetation.


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The site is located approximately 35 km north of Livingstone National Park and 30 km north east of the Rock Nature Reserve. Ulandra Nature Reserve is located approximately 40 km north east of the site while Elerslie Nature Reserve is approximately 40 km to the south east. The Murrumbidgee River occurs approximately 1.5 km south of the site.



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Fax - (02) 9542 5622


**Map 1: Site location**.



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Fax - (02) 9542 5622

## 1.4 Legislative Summary

The following provides a brief summary of the main pieces of legislation relevant to biodiversity conservation within the study area.

**NSW Native Vegetation Act, 2003 (NV Act)**
The objects of the *Native Vegetation Act, 2003* (NV Act) are to manage native vegetation on a regional basis through bringing an end to broadscale clearing and seeking to protect and improve areas of existing native vegetation, particularly those areas of high conservation value. The NV Act also seeks to encourage the revegetation and rehabilitation of land in accordance with the principles of ecologically sustainable development.

Under the NV Act, clearing of native vegetation is not permitted unless the clearing is in accordance with a development consent granted in accordance with the NV Act or unless the clearing is in accordance with a property vegetation plan (PVP). Clearing of unprotected regrowth, of certain groundcover and clearing associated with routine agricultural management activities (RAMAs) does not constitute clearing of native vegetation under the Act and therefore does not require a consent approval or PVP.

Under the NV Act, clearing of native vegetation cannot be undertaken unless it **improves or maintains environment outcomes**. Mitigating actions or offsets which provide gains equal to, or exceeding, losses from clearing, may be required in order for clearing of native vegetation to improve or maintain biodiversity values under the Act. Under the Act, native vegetation which is in '**moderate to good' condition** and is of a type, or within a landscape that is highly cleared (>70%), can not be offset and is not permitted to be cleared.

**Environmental Planning and Assessment Act 1979 (EP&A Act)**
The NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) is the principal planning legislation for the state, providing a framework for the overall environmental planning and assessment of development proposals. Various legislation and instruments, such as the NSW *Threatened Species Conservation Act 1995* (TSC Act), are integrated with the EP&A Act.

The LES is being prepared in accordance with section 57 of the EP&A Act. Issues to be addressed in the LES were raised during consultation with agencies (conducted in accordance with sections 34A and 62 of the EP&A Act).

**NSW Threatened Species Conservation Act, 1995 (TSC Act)**
The TSC Act aims to protect and encourage the recovery of threatened species, populations and ecological communities listed under the Act. The integration of the TSC Act with the NSW Environmental Planning and Assessment Act (EP&A Act) requires consideration of the likelihood of a development (Part 4 of the EP&A Act) or an activity (Part 5 of the EP&A Act) significantly affecting threatened species, populations and ecological communities or their habitat. This is undertaken through the preparation of a '7-part test' (Section 5A).


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Schedule 1 of the TSC Act lists threatened species, populations and ecological communities and species that are endangered or presumed extinct. Schedule 2 lists vulnerable species and Schedule 3 lists key threatening processes.

The TSC Act defines 'endangered' as a species, population or ecological community that is likely to become extinct or is in immediate danger of extinction. A species that is 'presumed extinct' has not been located in nature during the preceding fifty years despite the searching of known and likely habitats. A 'vulnerable' species is likely to become endangered unless the circumstances and factors threatening its survival or evolutionary development cease to operate.

The site is known or potential habitat for a number of threatened species, ecological communities and/or migratory species listed under the Act.

The TSC Act provides for the preparation of recovery plans and threat abatement plans, some of which apply to the site. Biodiversity certification of Local Environment Plans (LEPs) is also facilitated through this Act.

**Commonwealth Environment Protection & Biodiversity Conservation Act, 1999 (EPBC Act)**

Approval from the Commonwealth Environment Minister is required under the EPBC Act if an action (can include a project, development, undertaking or activity) will, or is likely to, have a significant impact on matters considered to be of national environmental significance (NES matters). NES matters relevant to this study include threatened species, ecological communities and migratory (JAMBA/CAMBA) species that are listed under the Act.

The EPBC Act does not define significant impact but identifies matters that are necessary to take into consideration. If the matter is referred to the Minister a decision is generally required within 20 days in relation to whether an action requires Commonwealth approval.

The site is known or potential habitat for a number of threatened species, ecological communities and/or migratory species listed under the Act.

**NSW Noxious Weeds Act, 1993 (NW Act)**

The objectives of the Noxious Weeds Act are to identify which noxious weeds require control measures, identify control measures suitable to those species and to specify the responsibilities of both public and private landholders for noxious weed control.

The Noxious Weeds Act allows for the declaration of weeds as noxious within a Local Control Area (LCA) and assigns a weed control class to each declared noxious weeds. The Boorooma East site is located within the Wagga Wagga City Council LCA. Currently 106 species or groups of species are listed as noxious weeds within the Wagga Wagga City Council LCA. 3 noxious weeds are known to occur on the site.


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**Water Management Act 2000 (WM Act)**

The Water Management *Act 2000* and *Water Act 1912* control the extraction of water, the use of water, the construction of works such as dams and weirs and the carrying out of activities in or near water sources in New South Wales. 'Water sources' include any river, lake, estuary, place where water occurs naturally on or below the surface of the ground and New South Wales coastal waters.

Approval is required under the *Water Management Act* for carrying out of a 'controlled activity' on 'waterfront land' (s91). Controlled activities' include:

- the construction of buildings or carrying out of works;
- the removal of material or vegetation from land by excavation or any other means;
- the deposition of material on land by landfill or otherwise; or
- any activity that affects the quantity or flow of water in a water source.

'Waterfront land' is defined as the bed of any river or lake, and any land lying between any permanent or intermittent waterbody or lake and a line drawn parallel to and forty metres inland from either the highest bank or shore (in relation to non-tidal waters) or the mean high water mark (in relation to tidal waters). The distance of forty metres can be reduced by the regulations. Depending upon the regulations, land adjoining coastal waters may also be waterfront land.

It is an offence to carry out a controlled activity on waterfront land except in accordance with an approval.

The removal of vegetation or material from within 40 m of waterbodies within the site would require approval under the Act.



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Ph - (02) 8536 8600
Fax - (02) 9542 5622

# 2. Description of Methods

## 2.1 Review of existing information

The Vision 21 Land Use Strategy for Wagga Wagga (PB 2006) was reviewed to obtain information on the natural environment of Wagga Wagga. Information from the Structure Plan for Boorooma Estate (GMP and N&P 1995), Structure Plan Development Strategy for Boorooma Estate (UDAS 2000) and the Wagga Wagga Development Control Plan for Boorooma (WWCC 2001) were also reviewed to obtain information on the development and management of open space and natural areas in Boorooma.

A description of each report and their major findings is provided below:

- **Parsons Brinckerhoff (2006).** ***Vision 21 Land Use Strategy for Wagga Wagga - Framework for developing a New City Development Plan and Local Environmental Plan*****. Unpublished report to Wagga Wagga City Council**

  This document established a framework for examining social, cultural, environmental, and economic issues equally in land use decision making in the Wagga Wagga LGA. As such, it outlined some significant natural resources present in the Wagga Wagga LGA. The document provided information on the amount of vegetation remaining in Wagga Wagga after vegetation clearing, and briefly outlined the condition of the remaining vegetation communities. It highlighted that of the 18 vegetation communities identified in the Wagga Wagga LGA, 7 are considered to be endangered and 7 are considered to be vulnerable, with only 2 adequately reserved (the two most threatened vegetation communities are grassy box and box/cypress woodlands). In addition, it noted that 37 species of flora and fauna were listed as threatened in the Wagga Wagga LGA.

- **Graham Moseley Planning and R. J. Nairne and Partners (1995).** ***City of Wagga Wagga, Boorooma-Estella Structure Plan Review*****. Unpublished report to Wagga Wagga City Council**

  This document outlined the current land use in the Boorooma area as of 1995 and highlighted the opportunities for developing the area for urban use. In addition, it outlined the constraints to development and thus provided recommendations for the placement of housing, roads and other infrastructure, schools, community centres, open space and natural areas within the Boorooma area.

- **Urban Design Advisory Service (2000).** ***Boorooma Estate Structure Plan Development Strategy*****. Unpublished report to Wagga Wagga City Council.**

  This document provided guidelines for the development of Boorooma Estate. In relation to the development of natural areas, it outlined flora species that would be appropriate for planting in different areas (on hill tops, higher slopes, middle slopes, lower slopes, and near drainage lines and wetlands), with lists provided for trees, shrubs and ground cover.



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- **Wagga Wagga City Council (2001).** ***Draft Wagga Wagga Development Control Plan No 17 - Boorooma.***

  This report followed on from the Boorooma Estate Structure Plan Development Strategy and took up the recommendations outlined in the review if development of the Boorooma area proceeded further. The report outlined the principles that needed to be incorporated into the development of Boorooma, and included principles that take natural qualities of the area into consideration (the natural topography, susceptibility to erosion, soil stability, existing vegetation, local species, and water courses in the area).

## 2.2 Desktop Assessment

The NSW National Parks and Wildlife Atlas of NSW Wildlife and Commonwealth Environmental Protection and Biodiversity Conservation Act (1999) Protected Matters Search Tool were used to supplement surveys undertaken in this site in order to compile a comprehensive list of flora and fauna likely or with the potential to occur at the site. The searches were performed on 4/09/2007 for the Wagga Wagga LGA. Likelihood of occurrences for threatened species, populations and communities for the Boorooma East site were then made based on the habitat characteristics of the site, results of the field survey and professional judgement (Appendix 1). Five terms for the likelihood of occurrence of species were used and are defined below:

- "yes" = the species was or has been observed on the site
- "likely" = a medium to high probability that a species uses the site
- "potential" = suitable habitat for a species occurs on the site, but there is insufficient information to categorise the species as likely to occur, or unlikely to occur
- "unlikely" = a very low to low probability that a species uses the site
- "no" = habitat on site and in the vicinity is unsuitable for the species.

Aerial photographs of the site and surrounding area were provided by the Wagga Wagga City Council and were used to investigate the extent of vegetation cover, landscape features and land use in the area.

## 2.3 Field Survey

Survey of the site was conducted during the period between the 15th and 24th of August, 2007. Weather conditions ranged from fine and sunny to cold and rainy during the survey period. Weather conditions for the period are summarised in (Table 1).

Prior to field survey, aerial photography of the site was assessed and vegetation zones requiring survey mapped. Vegetation Zones were mapped according to the methods described in the *BioMetric Tool* v1.8 (Ayers *et al.* 2005).



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**Table 1: Weather conditions for the survey period 15th – 24th August, 2007.**

| Date | Day | Temps (°C) | | Rain (mm) |
|---|---|---|---|---|
| | | Min | Max | |
| 15 | We | 1.5 | 16 | 0 |
| 16 | Th | 2.3 | 16.6 | 0 |
| 17 | Fr | 5 | 12.2 | 14.2 |
| 18 | Sa | 5.5 | 14.4 | 1.8 |
| 19 | Su | 3.2 | 15.8 | 0.2 |
| 20 | Mo | 4.1 | 17.7 | 0.2 |
| 21 | Tu | 1.4 | 16.8 | 0 |
| 22 | We | 3.4 | 15.2 | 0 |
| 23 | Th | 2.8 | 16.6 | 0 |
| 24 | Fr | 7.3 | 17.2 | 0 |

The aim of the field survey was to accurately and quantitatively record the type, condition and extent of vegetation at the site. Field survey also aimed to record the various types of fauna habitat present within the site and the types and degree of disturbance acting on ecological values at the site.

Targeted fauna surveys were not conducted in the current study, rather incidental fauna sightings were recorded.

Vegetation within the study area was assessed using three methods:

- Systematic Vegetation Survey (vegetation plots)
- Vegetation Traverses
- Tree Counts

Systematic vegetation surveys were conducted using the methods described in Appendix 3 of the BioMetric Tool v1.8 Operation Manual (Ayers *et al.* 2005). The location of vegetation plots was biased towards vegetation zones containing woodland vegetation or mixed native/exotic grasslands (Map 2).

Vegetated areas that were not assessed through vegetation plots, including areas of paddock trees and exotic pasture were surveyed using the random traverse method. The traverse extended for more that 100 m and all visible vascular flora were recorded. Incidental sightings of fauna were also noted.

All large trees at the site (i.e. > 40 cm diameter at breast height (DBH)) were identified and their location recorded either via a handheld GPS unit or by marking their location on a high resolution aerial photograph. Large trees were assigned to a size class (Large - > 40 cm, < 80 cm DBH and Very Large - > 80 cm DBH).

Following completion of the field survey, data collected was used to run the BioMetric Tool v1.8 (NSW DEC 2005). BioMetric is a tool for assessing terrestrial biodiversity at the scale of patch, paddock or property (Ayers *et al.* 2005). Readers should consult the BioMetric Tool Operational Manual (Ayers *et al.* 2005) for a detailed discussion of the assessment process under the BioMetric Tool v1.8.


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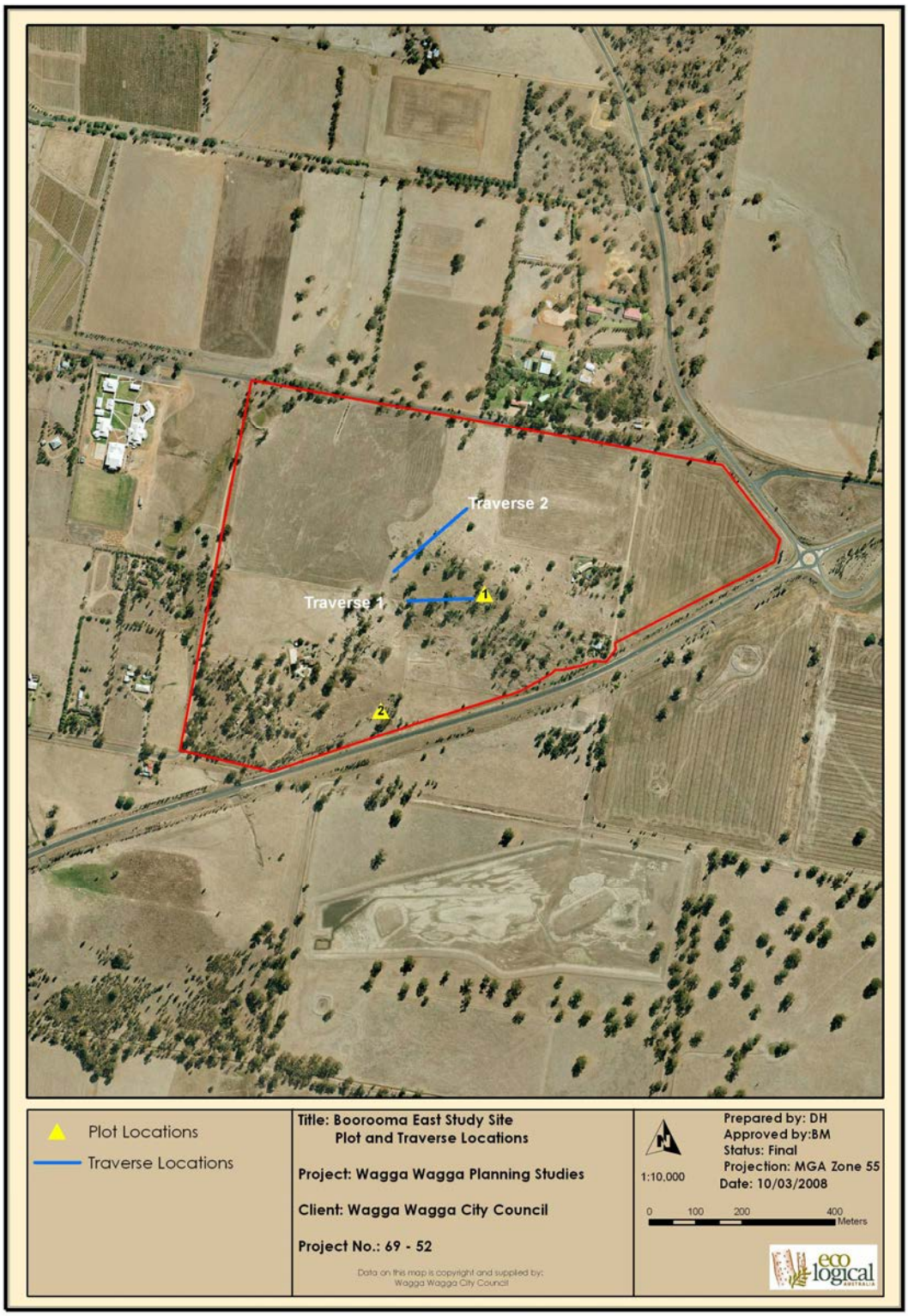
Fax - (02) 9542 5622




**Map 2: Location of vegetation plots and traverses.**



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## 2.4 Desktop review results

The species, populations and communities considered to have the potential to occur on the site based on the habitat present are outlined in Table 2 below.

**Table 2: Species, populations and communities listed under the TSC Act and EPBC Act for which the site represents habitat.**

| Scientific Name | Common Name | Status | | Habitat |
|---|---|---|---|---|
| | | TSC Act | EPBC Act | |
| **Threatened species** | | | | |
| *Ardea ibis* | Cattle Egret | | M | Stock paddocks, pastures, croplands, garbage tips, wetlands, tidal mudflats |
| *Hirundapus caudacutus* | White-throated Needletail | | M | Open space above canopy. Forages over large areas |
| *Lathamus discolor* | Swift Parrot | E | E, M | Forests, woodlands, plantations, banksias, street trees and gardens on the mainland |
| *Polytelis swainsonii* | Superb Parrot | V | V | Breeds along inland rivers in river red gum, feeding in box woodland with 10km of nest tree. West of dividing range. |
| *Pomatostomus temporalis temporalis* | Grey-crowned Babbler (eastern subspecies) | V | | Inhabits open Box-gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains |
| *Stagonopleura guttata* | Diamond Firetail | V | | Open eucalypt forests, woodlands. |
| *Saccolaimus flaviventris* | Yellow-bellied Sheathtail Bat | V | - | Forages in most habitats across its very wide range, with and without trees. Roosts and breeds in living or dead hollow bearing trees. |
| *Chalinolobus picatus* | Little Pied bat | V | - | Dry open forest, open woodland, mulga woodlands, chenopod shrublands, cypress pine forest, malle and bramble box. Roosts and breeds in tree hollows, fissures or cracks, buildings, power poles, fence posts, caves, cliff crevices, mineshafts and tunnels. |
| **Threatened Ecological** | | | | |



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| Scientific Name | Common Name | Status | | Habitat |
|---|---|---|---|---|
| | | TSC Act | EPBC Act | |
| **Communities** | | | | |
| | White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland | E | CE | Western slopes and plains |

## 2.5 Field Survey Results

*2.5.1 Flora*

A total of 55 flora species were recorded during the current study when both systematic survey and random traverse data are combined. A list of flora species recorded during the survey is presented in Appendix 1.

Of the species recorded at the site, 18 were found to be exotic species. Common weeds included onion grass (*Romulea rosea*), clover (*Trifolium* spp.) and Patterson's curse (*Echium plantagineum*). Three weed species recorded at the site; African boxthorn (*Lyceum ferocissimum*), Patterson's curse and St John's wort (*Hypericum perforatum*), are Class 4 declared noxious weeds within the Wagga Wagga LGA. According to NSW DPI (2007), the ""growth and spread of the [Class 4 Noxious Weed] must be controlled according to measures specified in a management plan published by the local control authority".

Eighty-eight remnant trees were recorded on the site. These trees were scattered in the southern sections of the site. The majority of trees were in the large size class, but trees in the very large size class were also present. These trees were likely to contain some hollows. Table 3 provides a summary of the trees within the study site.

**Table 3: Size classes of trees located on the Boorooma East site.**

| Species | Large size class (> 40 cm, < 80 cm DBH) | Very large size class (> 80 cm DBH) |
|---|---|---|
| Yellow Box *Eucalyptus melliodora* | 24 | 7 |
| Blakely's Red Gum *Eucalyptus blakelyi* | 45 | 6 |
| River Red Gum *Eucalyptus camaldulensis* | 1 | 1 |
| Kurrajong *Brachychiton populneus* | 4 | 0 |

No threatened flora were recorded during the surveys nor are they considered likely to occur on site. A review of the NSW Wildlife Atlas (TSC Act) and Protected Matters Search Tool (EPBC Act) found a total of 10 threatened flora species that have been


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Fax - (02) 9542 5622

recorded within the Wagga Wagga LGA. The site is considered unlikely to provide habitat for any of the 10 species.

### *2.5.2 Fauna*

A total of 9 species of fauna were observed during the field survey period at the site, with birds the most common fauna group recorded (Table 4). Galah (*Eolophus roseicapillus*), noisy miner (*Manorina melanocephala*) and Australian raven (*Corvus coronoides*) were commonly observed bird species during the survey. One reptile, the robust ctenotus (*Ctenotus robustus*) was observed at the site sheltering beneath a piece of scrap metal while one amphibian, the eastern sign-bearing froglet (*Crinia parinsignifera*) was heard calling at the site.

No threatened fauna species were encountered at the site. A review of the NSW Wildlife Atlas and EPBC Act Protected Matters Search Tool indicated a total of 54 threatened or migratory species, one endangered population and one endangered ecological community have been previously recorded within the Wagga Wagga LGA (Appendix 2).

**Table 4: Fauna species recorded at the site.**

| Species name | Common name |
|---|---|
| **Birds** | |
| *Acanthiza chrysorrhoa* | Yellow-rumped Thornbill |
| *Corvus coronoides* | Australian raven |
| *Eolophus roseicapillus* | Galah |
| *Gymnorhina tibicen* | Australian Magpie |
| *Hieraaetus morphnoides* | Little Eagle |
| *Manorina melanocephala* | Noisy Miner |
| *Platycercus elegans flaveolus* | Yellow Rosella |
| **Reptiles** | |
| *Ctenotus robustus* | Robust Ctenotus |
| **Amphibians** | |
| *Crinia parinsignifera* | Eastern Sign-bearing Froglet |

The site contained habitat for a range of fauna species. Habitat varied in condition from moderate quality woodland containing large, hollow bearing trees, to exotic grassland and cropped paddocks offering limited foraging habitat for common species such as Australian raven and galah. Surface rock and massive granite outcrops occurred at high points along the ridgeline in the south of the site and may provide habitat for a number of reptiles. A small area of floodplain occurs in the extreme south of the site, adjacent to the Olympic Highway. During times of heavy rain and flood, this low lying area may provide habitat for a number of wading birds.

Fauna habitat observed at the site included:

- Woodland vegetation
- Mixed native/exotic grassland
- Large hollow bearing trees
- Large paddock trees



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- Surface rock
- Woody debris
- Floodplain

## 2.6 Special Considerations

Vegetation surveys were undertaken during late winter and are therefore likely to underestimate native groundcover due to the many non-native annuals that grow in the region at that time. The region is currently experiencing average rainfall after an extended period of drought which may also favour the dominance of exotic species during the time of survey.

## 2.7 Consultation

Consultation was held with Mark Sheahan (NSW Department of Environment and Climate Change) on the 16th August, 2007. The consultation process included discussion of the assessment methodology at the site and included an onsite meeting to discuss practical application of the agreed methodology.


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# 3. Assessment of Vegetation

## 3.1 Areas of Native Vegetation

Native vegetation at the Boorooma site was restricted to the ridgeline and slopes in the south of the site and to the road reserves of Farrer Street and Amundsen Street (Map 3). The north east and north west corners of the site, excepting the road reserves, were devoid of native vegetation having been routinely cropped in the past.

## 3.2 Regional Scale Assessment

### *3.2.1 Mitchell Landscapes*

A review of the Mitchell Landscapes mapping within the Wagga Wagga area found that the site occurs within the Junee Hills and Slopes and Murrumbidgee – Tarcutta Channels and Floodplain landscapes (Map 4). The boundary of Junee Hills and Slopes and Murrumbidgee – Tarcutta Channels and Floodplain landscapes occurs in the south of the site.

The degree of clearance for the Mitchell Landscapes and the amount and percentage of Mitchell Landscape present within the study site is shown in Table 5. Both landscapes have been extensively cleared in the past for agricultural production.

**Table 5: Mitchell landscapes within the study area.**

| Mitchell Landscape | Degree of Clearance | Area within Study Area | Proportion of Study Area |
|---|---|---|---|
| Junee Hills and Slopes | 98 % | 51.19 ha | 75.6 % |
| Murrumbidgee – Tarcutta Channels and Floodplain | 91 % | 16.48 ha | 24.4 % |



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**Map 3: Areas of native vegetation at the site.**



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**Map 4: Mitchell landscapes at the site**



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**Vegetation Types**

Two vegetation types were identified at the site. Yellow Box Woodland, as described by Priday and Mulvaney (1995), was found to occupy the ridge and slopes in the south of the site. The entire band of vegetation running east to west through the site was found to be consistent with this community (Map 5). An area of grassland vegetation running north from the rise at the centre of the site and flanked either side by cropped paddocks was also found to be consistent with this community (Map 5).

The yellow box woodland community described by Priday and Mulvaney (1995) forms part of the broader ecological community known as White Box, Yellow Box, Blakely's Red Gum Woodland which is listed as an endangered ecological community under the TSC Act and as a critically endangered ecological community: White Box, Yellow Box, Blakely's Red Gum grassy woodland and derived native grassland, under the Commonwealth EPBC Act. Each community is widely referred to as Box-gum Woodland. According to DECC identification guidelines for the Box-Gum EEC (DECC 2005c) secondary or derived grasslands where the tree overstorey has been removed and only the Box-Gum Woodland understorey is present is considered part of the endangered ecological community within NSW. Therefore, grassland vegetation running north from the rise at the centre of the site and flanked either side by cropped paddocks is consistent with the Box – Gum EEC as defined under the TSC Act. DECC has indicated that all remnants of the Box-gum woodland ecological community are of conservation value (Priday and Mulvaney 2005). This includes remnants ranging in condition from highly modified to near natural. Grassland vegetation running north from the rise at the centre of the site and flanked either side by cropped paddocks does not contain the appropriate native herbaceous diversity required to be considered consistent with box- gum woodland under the EPBC Act (DEH 2006).

As described earlier in Section 1.3, a small area of floodplain occurs in the south of the site adjacent to the Olympic Highway (Map 5). Vegetation in this area included one, very large river redgum as well as numerous juvenile river redgums and native groundcover species common to periodically inundated areas. Vegetation in this area was thus identified as River Redgum Forest as described in Priday and Mulvaney (1995).

River redgum forest is not currently listed as threatened under state or federal legislation however Priday and Mulvaney (1995) list the conservation status of the community as vulnerable within the Wagga Wagga LGA. The vulnerable listing reflects the high degree of clearing suffered by this community and the ongoing threats such as weed invasion and grazing which continue to degrade existing remnants (Priday and Mulvaney 1995).

Non-native vegetation associated with cropped paddocks occurred in the north east and north west (Map 5). The vegetation types on the site, their degree of clearance, and amount and percentage of vegetation types present on the site are shown in Table 6.



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**Table 6: Vegetation types on the Boorooma East site, their area within the site and the degree to which this landscape type has been cleared from its previous extent.**

| Vegetation Type | Degree of Clearance | Area within Study Area | Proportion of Study Area |
|---|---|---|---|
| Box – Gum Woodland | 95 % | 25.5 ha | 37.5 % |
| River Redgum Forest | 91 % | 0.8 ha | 1.2 % |
| Non-native vegetation | N/A | 41.6 ha | 61.3 % |



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**Map 5: Vegetation types on site.**



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## 3.3 Landscape Scale Assessment

*3.3.1 Landscape Value*

The landscape value of the site is defined by the extent of vegetation cover, the connectivity of vegetation within the site to patches of native vegetation outside the site and the overall size of remnant vegetation patches connected to the site (Ayers *et al.* 2005).

Little to no connectivity exists between native vegetation within and outside the site boundaries except in the north where vegetation within the Farrer Street road reserve is linked to vegetation within properties bordering Coolamon Road. This vegetation is not currently linked to box – gum woodland in the south of the site. A drainage line occurs to the west of the site and drains north from the south west corner to north west corner of the site. Scattered trees along this watercourse provide a tentative link between vegetation in the north and south.

The study site is located within a rural environment, with some residential development, within the suburb of Estella occurring to the west. The Murrumbidgee River lies approximately 1.5 km to the south of the site and provides a major east – west corridor for fauna movement (e.g. superb parrot, swift parrot). No connectivity exists between vegetation on site and vegetation along the river.

A summary of the outcomes of the landscape scale assessment as described in Ayers *et al.* (2005) is provided in Table 7. Overall the site was found to have a low landscape value.

**Table 7: Landscape Value of Vegetation on the Boorooma East site.**

| Landscape Attribute | Current Score |
|---|---|
| % Cover within 1.75 km radius (1000 ha) | <10 % |
| % Cover within 0.55 km radius (100 ha) | <10 % |
| % Cover within 0.2 km radius (10 ha) | <10 % |
| Connectivity value | Nil |
| Total adjacent remnant area | Small |
| **Calculated Landscape Value** | **0** |

## 3.4 Site Scale Assessment

*3.4.1 Assessment Zone Delineation*

Vegetation within the Boorooma East site was broken up into 3 discrete assessment zones based on extant native vegetation at the site following examination of recent aerial photography of the site.

Vegetation Zones determined from aerial photography were:

- Zone 1 – River redgum forest - low condition
- Zone 2 – Yellow Box Woodland – 'moderate to good' condition
- Zone 3 – Yellow Box Woodland – low condition

The resulting assessment zones are presented in Map 6 below.


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**Map 6: Assessment Zones at the site.**



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*3.4.2 Condition and Quality of Vegetation*

Vegetation within Zones 1 and 2 were assessed using the *BioMetric* methodology (Ayers et al. 2005). Vegetation within Zone 3 was visually inspected to confirm that it was in low condition with respect to overstorey cover and cover of exotic groundcover species.

Vegetation within Zone 1 was found to be in low condition due to the sparse overstorey cover and presence of an exotic dominated groundcover. A single, very large river redgum dominated the overstorey of this small zone with native groundcover species occurring sporadically. A summary of the assessment for this zone is provided in Table 8**Error! Reference source not found.** below.

Analysis of the results of the survey indicated that the vegetation within Zone 2 was in 'moderate to good' condition as canopy cover was greater than 25% of the lower canopy cover benchmark for box – gum woodland (Ayers et al. 2005). The understorey and groundcover vegetation within Zone 2 was dominated by exotic grasses and herbs with only a few native species recorded. A summary of the assessment for Zone 2 is provided in Table 8 below.

**Table 8: Site Assessment for Zone 1 using the *BioMetric Tool* (see Ayers et al. 2005). The table shows the benchmark values for the relevant vegetation community and the assessed values generated from plots within each assessment zone.**

| Variables | Benchmarks | | | Plot No. 1 |
|---|---|---|---|---|
| Native plant species | | ≥ | 9 | 8 |
| Native over-storey cover | 15 | to | 40 | 2 |
| Native mid-storey cover | 10 | to | 40 | 0 |
| Native ground cover (grasses) | 8 | to | 13 | 12 |
| Native ground cover (shrubs) | 23 | to | 60 | 0 |
| Native ground cover (other) | 8 | to | 50 | 12 |
| Exotic plant cover | | | | 74 |
| Number of trees with hollows | | ≥ | 2 | 1 |
| Overstorey regeneration | | | 1 | 0 |
| Total length of fallen logs | | ≥ | 56 | 1 |



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**Table 9: Site Assessment for Zone 2 using the *BioMetric Tool* (see Ayers et al. 2005). The table shows the benchmark values for the relevant vegetation community and the assessed values generated from plots within each assessment zone.**

| Variables | Benchmarks | | | Plot No. 2 |
|---|---|---|---|---|
| Native plant species | | ≥ | 19 | 22 |
| Native over-storey cover | 8 | to | 15 | 6 |
| Native mid-storey cover | 1 | to | 5 | 0.5 |
| Native ground cover (grasses) | 16 | to | 50 | 2 |
| Native ground cover (shrubs) | 0 | to | 4 | 0 |
| Native ground cover (other) | 1 | to | 5 | 10 |
| Exotic plant cover | | | | 70 |
| Number of trees with hollows | | ≥ | 5 | 1 |
| Overstorey regeneration | | | 1 | 1 |
| Total length of fallen logs | | ≥ | 50 | 10 |

*3.4.3 Vegetation Condition Categories*

The condition of vegetation at the site included 'moderate to good' condition yellow box woodland, low condition yellow box woodland, low condition river redgum forest and non-native vegetation (Map 6).

Low condition river redgum forest (Zone 1) in the south of the site contained a very large river redgum and numerous saplings and small trees of the same species. The groundcover in this zone was dominated by exotics with some native species such as *Juncus usitatus* and *Ranunculus* spp. also present.

'Moderate to good' condition yellow box woodland (Zone 2) occupied the ridge and slopes in the south of the site and extended north to Farrer Street. Vegetation in this area consisted of large and very large yellow box, Blakely's redgum and kurrajong (*Brachychiton populneaus*) trees overlying a mixed native and exotic groundcover. Understorey vegetation was generally absent from the area of 'moderate to good' condition vegetation however currawang (*Acacia doratoxylon*) as well as kurrajong, yellow box and Blakely's redgum saplings occasionally formed a very sparse shrub to small tree layer.

Zone 3 contained low condition yellow box woodland along the road reserves of Amundsen Street and Farrer Street which form the western and northern boundaries of the site. The yellow box woodland community in Zone 3 consisted of a sparse remnant eucalypt canopy overlying mixed native and exotic groundcover.

*3.4.4 Summary of Assessment Zone Information*

The site was found to contain 3 zones of vegetation (Map 7). Zone 1 contained river Redgum forest in low condition while Zones 2 and 3 contained box – gum woodland in 'moderate to good' and low condition respectively (Table 10). Understorey


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vegetation was sparse to absent in all zones and the groundcover in all zones was dominated by exotic species.

The site contains vegetation of moderate to high value in a regional context owing to the sites location within the Junee Hills and Slopes and Murrumbidgee – Tarcutta Channels and Floodplain Mitchell Landscapes. Both these landscapes have been heavily cleared for agricultural production. The site, while displaying limited connectivity, is a known flyway of the superb parrot.

**Table 10: Summary Information on Vegetation Assessment**

| Assessment Zone No. | Area | Vegetation Type | Vegetation Condition | Landscape Value | Biometric Score | No. of large and very large trees. |
|---|---|---|---|---|---|---|
| 1 | 21.52 ha | Box – Gum Woodland | Moderate to good | 0 | 49 | 76 |
| 2 | 3.95 ha | Box – Gum Woodland | Low | | N/A | 10 |
| 3 | 0.83 ha | River Redgum Forest | Low | | 24 | 2 |



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**Map 7 – Vegetation condition at the site**



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# 4. Threatened Species

## 4.1 Threatened Species

No threatened species were observed at the site during the current study however the superb parrot (*Polytelis swainsonii*) is known to utilise the site (Leigh Thompson pers. obs.). A review of state and federal threatened species databases identified 5 species; grey-crowned babbler (*Pomatostomus temporalis temporalis*) diamond firetail, yellow-bellied sheathtail bat, little pied bat (*Chalinolobus picatus*) and swift parrot (*Lathamus discolour*) as likely, or with the potential to, occur at the site (see Appendix 1: Flora species recorded during survey of the Boorooma East site.). The site is considered to provide potential foraging habitat for two bird species, cattle egret and white-throated needletail, listed as migratory under the Commonwealth EPBC Act.

No threatened flora were considered likely or potentially occurring at the site.

The extent of habitat available for threatened species known or potentially occurring at the site is presented in Table 11 below. Available habitat for threatened species is generally low across the site.

**Table 11: Habitat available for threatened species considered likely or potentially occurring at the site.**

| Species | Breeding Habitat | | Foraging Habitat | | Roosting/Shelter Habitat | |
|---|---|---|---|---|---|---|
| | Description | Habitat on Site (ha or No. trees) | Description | Habitat on Site (ha or No. trees) | Description | Habitat on Site (ha or No. trees) |
| Diamond Firetail | Open eucalypt forests, woodlands, either in the shrubby understorey, or higher up, especially under hawk's or raven's nests. | No | As per breeding habitat. | Yes. A total of 21.52 ha of 'moderate to good' condition yellow box, 3.95 ha of low condition yellow box, and 0.83 ha of low condition river red gum forest was present on the site. | As per breeding habitat. | Yes. A total of 21.52 ha of 'moderate to good' condition yellow box, 3.95 ha of low condition yellow box, and 0.83 ha of low condition river red gum forest was present on the site. |
| Grey Crowned Babbler | Nests in shrubs and eucalypt saplings or | Yes. A total of 21.52 ha of 'moderate to | Inhabits open Box-gum Woodlands | Yes. A total of 21.52 ha of 'moderate to good' condition yellow box, | Inhabits open Box-gum | Yes. A total of 21.52 ha of 'moderate to good' condition |



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| Species | Breeding Habitat | | Foraging Habitat | | Roosting/Shelter Habitat | |
|---|---|---|---|---|---|---|
| | Description | Habitat on Site (ha or No. trees) | Description | Habitat on Site (ha or No. trees) | Description | Habitat on Site (ha or No. trees) |
| | outermost leaves of low branches of mature eucalypts. | good' condition yellow box, 3.95 ha of low condition yellow box, and 0.83 ha of low condition river red gum forest was present on the site. | on the slopes, and Box-Cypress-pine and open Box Woodlands | 3.95 ha of low condition yellow box, and 0.83 ha of low condition river red gum forest was present on the site. | Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands | yellow box, 3.95 ha of low condition yellow box woodland was present on the site. |
| Little Pied bat | Tree hollows, fissures or cracks, buildings, power poles, fence posts, caves, cliff crevices, mineshafts, tunnels. | Yes. A total of 88 large to very large trees was present on the site which may contain hollows. | Dry open forest, open woodland, mulga woodlands, chenopod shrublands, cypress-pine forest, mallee, Bimbil box. | Yes. A total of 21.52 ha of 'moderate to good' condition yellow box, 3.95 ha of low condition yellow box, and 0.83 ha of low condition river red gum forest was present on the site. | Tree hollows, fissures or cracks, buildings, power poles, fence posts, caves, cliff crevices, mineshafts, tunnels for roosting. | Yes. A total of 88 large to very large trees was present on the site which may contain hollows. |
| Swift parrot | Does not breed in mainland Australia | No | Forests, woodlands, plantations, banksias, street trees and gardens on the mainland | Yes. A total of 21.52 ha of 'moderate to good' condition yellow box, 3.95 ha of low condition yellow box, and 0.83 ha of low condition river red gum forest was present on the site. | As per foraging habitat. | Yes. A total of 21.52 ha of 'moderate to good' condition yellow box, 3.95 ha of low condition yellow box, and 0.83 ha of low condition river red gum forest was |



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| Species | Breeding Habitat | | Foraging Habitat | | Roosting/Shelter Habitat | |
|---|---|---|---|---|---|---|
| | Description | Habitat on Site (ha or No. trees) | Description | Habitat on Site (ha or No. trees) | Description | Habitat on Site (ha or No. trees) |
| | | | | | | present on the site. |
| Superb Parrot | Breeds along inland rivers in river red gum. Living or dead trees with hollows > 5 cm diameter. | No. Only 0.83 ha of habitat in moderate condition is present on the site | Feeds in box woodland with 10km of nest tree. West of dividing range. | Yes. A total of 21.52 ha of 'moderate to good' condition yellow box, 3.95 ha of low condition yellow box, and 0.83 ha of low condition river red gum forest was present on the site. | As per foraging type. | Yes. A total of 21.52 ha of 'moderate to good' condition yellow box, 3.95 ha of low condition yellow box, and 0.83 ha of low condition river red gum forest was present on the site. |
| Yellow bellied Sheathtail bat | Live or dead hollow bearing trees | Yes. A total of 88 large to very large trees was present on the site which may contain hollows. | Forages in most habitats across its very wide range, with and without trees. | Yes. A total of 21.52 ha of 'moderate to good' condition yellow box, 3.95 ha of low condition yellow box, and 0.83 ha of low condition river red gum forest was present on the site. | Live or dead hollow bearing trees, under exfoliating bark, in burrows of terrestrial mammals in treeless areas, bird nests or sugar glider nests. | Yes. A total of 88 large to very large trees was present on the site which may contain hollows. |

Proposed development of the study site may result in the loss of 3 paddock trees. For the majority of threatened species identified as potentially occurring at the site, the loss of this habitat is not likely to result in a significant impact. The extent of habitat with the potential to be removed under the current proposal is summarised in Table 12**Error! Reference source not found.** below together with an assessment of whether this loss would be acceptable and whether the loss would require offsetting.


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**Table 12: Standards for maintaining threatened species habitats.**

| Species | Ability to sustain a temporary reduction in the population / habitat on this property | Loss of habitat by proposal | Acceptability of loss/ Offset |
|---|---|---|---|
| Diamond Firetail | Yes – up to 10 % loss but no loss of riparian habitats | 3 paddock trees | Yes, with offsetting |
| Grey Crowned Babbler | Yes – up to 10 % loss of habitat, but no loss of connectivity. | 3 paddock trees | Yes, with offsetting |
| Little Pied bat | Yes | 3 paddock trees | Yes, with offsetting |
| Superb Parrot | Upper and lower slopes of Murrumbidgee: no loss of *Eucalyptus camaldulensis* with hollows > 5cm (ECH) and < 100 m from the Murrumbidgee River, 100m – 200m from the river up to 7 % loss ECH, > 200m from the river up to 10 % loss ECH. 10 % loss of foraging habitat. | 3 paddock trees | Yes, with offsetting |
| Swift parrot | Yes – 5 % loss of foraging habitat except for mature *Eucalyptus albens* and *E. sideroxylon*. | 3 paddock trees | Yes, with offsetting |
| Yellow bellied Sheathtail bat | Up to 10 % loss of foraging habitat. Up to 10 % loss of hollow bearing trees. | 3 paddock trees | Yes, with offsetting |


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### 4.2 Threatened Populations

No threatened populations are considered likely to occur within the site. An endangered squirrel glider population occurs within the Wagga Wagga LGA however due to the highly fragmented nature of vegetation at the site, squirrel gliders are unlikely to utilise the site.

### 4.3 Endangered Ecological Communities

The Yellow Box woodland vegetation type recorded within the site is consistent with the white box, yellow box, Blakely's redgum ecological community which is listed as endangered under Part 3, Schedule 1 of the TSC Act. 'Moderate to good' condition Yellow Box Woodland, excluding grassland vegetation running north from the rise at the centre of the site, is consistent with the box – gum woodland critically endangered ecological community listed under the Commonwealth EPBC Act.

Box – gum woodland occurs in the study area as a continuous band of 'moderate to good' condition woodland stretching east to west across the site and as low condition remnants along the Amundsen and Farrer Street road reserves (Map 8). 'Moderate to good' condition box – gum woodland occupies an area of approximately 21.52 ha across the site while the low condition woodland occupies and area of approximately 3.95 ha (Table 13).

This community is generally highly modified with respect to species composition. Both low and 'moderate to good' condition box – gum woodland at the site is characterised by mixed native and exotic groundcover and very sparse to absent shrub layer vegetation. The community has been depleted to such an extent throughout its range that all remnants are of conservation significance (Priday and Mulvaney 2005).

**Table 13: Area of EEC at the site.**

| EEC | Area of EEC | | |
|---|---|---|---|
| | Moderate to good condition | Low condition | Total |
| Box – Gum Woodland | 21.52 ha | 3.95 ha | 25.47 ha |



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**Map 8: Extent of EECs at the site.**



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# 5. Structure Plan

The Boorooma East site contains 21.52 ha of 'moderate to good' condition woodland consistent with the box – gum woodland EEC. Under the Native Vegetation Act (2003), box-gum woodland at the site is not permitted to be cleared, regardless of available offsets or management actions because:

- It is in 'moderate to good' condition
- Is listed as an endangered ecological community under the TSC Act (1995).
- Is of a vegetation type that is greater than 70% cleared across its range (see Table 6)
- It occurs within 2 Mitchell landscapes which are greater than 70% cleared (see Table 5)

The area of 'moderate to good' condition box – gum woodland which traverses the site is of high biodiversity value and occurs within a landscape which has been heavily cleared of native vegetation. Moderate to good' condition box – gum woodland within the Boorooma East site is therefore considered highly constrained and unavailable for development (Map 9).

In addition to retaining 'moderate to good' condition woodland at the site, it is recommended that low condition box-gum woodland also be retained, particularly along Farrer Road (Map 9). Retention of low condition vegetation at the site will allow for connectivity between vegetation to be maintained and improved, both within the site and to the north of the site. Moreover, areas of low condition woodland contain numerous large and very large trees, the retention of which could be used to offset losses at other sites (Map 9).

The site contains three large, cropped paddocks which are not considered to offer any significant conservation values. These areas have been mapped as 'potentially developable' and it is recommended that development be restricted to these areas at the site (Map 9). Development within these areas would require the removal of only a few large paddock trees.

An offset ratio of 1.92:1 is required for box – gum woodland in low condition and 10:1 is required for paddock trees at the Boorooma East site DEC (2005). This means that for every large tree (i.e. > 40 cm diameter at breast height DBH) removed, 10 large trees of the same species must be retained at the site. Furthermore, the removal of a small tree (i.e. < 40 cm DBH) must be offset through the planting of 10 trees of the same species.

Offset areas are required to be reserved and managed for conservation. This means that 'open space' zoning is not sufficient for offset areas, rather zoning must reflect the conservation objectives of the offset area and a conservation management plan for offset areas must be prepared and implemented. As a consequence, any low condition vegetation not located within 'conservation' area must be considered as cleared and the loss offset using the above ratios. Offsets for scattered paddock trees must be located within areas zoned 'open space' or 'conservation (i.e. not residential).


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The total loss of paddock trees, assuming that low and moderate condition native vegetation is retained, is presented in Table 14 below. Also shown is the number of trees required to be retained, for each species, in order to achieve the offset ratio of 10:1. An offset of 7.58 ha of box – gum woodland would be required to offset the loss of low condition box – gum woodland at the site.

**Table 14: Proposed loss and required offset of paddock trees at the proposed Boorooma East development site.**

| Species Name | Common Name | No. of trees | | Required Offset | | |
|---|---|---|---|---|---|---|
| | | Large | Very Large | Large | Very Large | Total Offset |
| *Eucalyptus melliodora* | Yellow Box | 1 | - | 10 | - | **10** |
| *Eucalyptus blakelyi* | Blakely's Redgum | 2 | - | 20 | - | **10** |
| | | | | | **Overall Total** | **20** |

Sufficient offsets for the loss of paddock trees are likely to be available within retained lands at the site, particularly if low condition box – gum woodland is retained. However, the precise extent of retained areas relative to potentially developable areas will need to be determined in the context of other constraints to development (*i.e.* geotechnical, flooding, bushfire, etc), the impacts on threatened species and the potential to provide offsets to the losses associated with the potentially developable areas. The determination of the appropriate mix of retained areas and potentially developable areas is an iterative process that will require further liaison between DECC and WWCC. As part of this process, the quantum of offsets associated with each potential mix of retained areas and potentially developable areas will need to be calculated. The data that has been collected for this report provides a basis for these calculations.

While paddock trees positioned within residential zoned land (or similar) are required to be offset, it is recommended that paddock trees –particularly those containing hollows – be retained where possible at the site. Future master planning should aim to incorporate existing paddock trees into the urban/industrial landscape and so retain their values as fauna habitat.

The areas proposed for retention, development and offsets at Boorooma East, as determined on the basis of current investigation at the site, are presented in Map 9 below. The site is a known flyway for superb parrots travelling to and from the Murrumbidgee River. In general, the location of offsets at the site should aim to:

- Elevate patches of native vegetation from moderate to good condition
- Decrease edge effects currently experienced by native vegetation remnants
- Increase connectivity between currently isolated woodland patches within the site


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- Increase connectivity of the site to areas of remnant vegetation outside the site boundaries

Management actions within retained vegetation at the site will further help to offset loss of scattered paddock trees across the site. Woodland vegetation at the site is resilient and likely to regenerate over time provided that factors currently preventing regeneration are managed. Management actions which are likely to enhance the condition of moderate condition woodland, within the Boorooma East site include:

- Fencing and protection of the site
- Grazing exclusion (initial 3 years) and grazing control
- Control of feral pests
- Erosion control
- Retention of dead timber
- Control of weeds
- Retention of all native regrowth
- Fire management / ecological burning
- Replanting of shrub and understorey species in treed areas
- Revegetation


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**Map 9: Boorooma East Structure Plan**



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# 7. Appendices

**Appendix 1: Flora species recorded during survey of the Boorooma East site.**

| | | Survey Type | | | |
|---|---|---|---|---|---|
| | | Traverse | | Vegetation Plot | |
| **Species Name** | **Common Name** | **1** | **2** | **1** | **2** |
| Acacia doratoxylon | Currawang | | √ | | |
| Amyema miquelii | | | √ | | |
| Aristida spp. | | | √ | | |
| Arthropodium spp. | | √ | - | √ | - |
| Austrodanthonia spp. | | √ | - | √ | √ |
| Austrostipa bigeniculata | | √ | - | √ | - |
| Austrostipa spp. | | | √ | | |
| Bothriochloa spp. | | √ | √ | √ | - |
| Brachychiton populneus | Kurrajong | √ | √ | √ | - |
| Bromus catharticus# | Prairie Grass | | | | √ |
| Bromus diandrus# | Great Brome | √ | - | √ | - |
| Bromus spp.# | Brome | | | | √ |
| Cheilanthes sieberi | | √ | - | √ | - |
| Chondrilla juncea | Skeleton Weed | - | - | √ | - |
| Convolvulus erubescens | | - | - | √ | - |
| Crassula sieberiana | Australian Stonecrop | - | - | √ | - |
| Digitaria spp. | | - | - | √ | - |
| Echium plantagineum# | Patterson's Curse | √ | √ | √ | √ |
| Einadia nutans | Climbing Saltbush | - | - | √ | - |
| Enneapogon nigricans | | √ | | | |
| Enteropogon acicularis | | √ | - | √ | - |
| Erodium botrys | Long Storksbill | √ | | | |
| Erodium crinitum | Blue Storksbill | | √ | | |
| Eucalyptus blakelyi | Blakely's Red Gum | √ | √ | √ | - |
| Eucalyptus camaldulensis | River Redgum | | | | √ |
| Eucalyptus melliodora | Yellow Box | √ | | | |
| Fumaria spp.# | Smoke Weed | √ | | | |
| Galium aparine | Goosegrass | √ | - | √ | - |
| Galium spp. | | - | - | √ | - |
| Geranium solanderi | Native Geranium | √ | - | √ | - |
| Hordeum leporinum | | | √ | | |
| Hypericum perforatum# | St Johns Wort | √ | | | |
| Hypochaeris radicata# | Catsear | - | - | √ | √ |
| Juncus usitatus | | | | | √ |
| Lactuca serriola# | Prickly Lettuce | √ | - | √ | √ |
| Lolium rigidum# | Wimmera Ryegrass | √ | √ | √ | √ |
| Lomandra multiflora | | √ | √ | √ | - |
| Lycium ferocissimum# | African Boxthorn | √ | | | |
| | | | | | |
| Malva parviflora# | Small-flowered | | √ | | |



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| | | Survey Type | | | |
|---|---|---|---|---|---|
| | | Traverse | | Vegetation Plot | |
| **Species Name** | **Common Name** | **1** | **2** | **1** | **2** |
| | Mallow | | | | |
| Marsilea drummondii | Common Nardoo | | | | √ |
| Olea europaea# | Common Olive | √ | - | √ | - |
| Oxalis perennans | | - | - | √ | - |
| Panicum effusum | Poison or Hairy Panic | √ | √ | √ | - |
| Phytolacca octandra# | Inkweed | - | - | √ | - |
| Ranunculus spp. | | | | | √ |
| Romulea rosea# | Onion grass | √ | √ | √ | √ |
| Rumex brownii | Swamp Dock | √ | √ | √ | √ |
| Rumex crispus | Curled Dock | | | | |
| Sonchus oleraceus# | Common Sowthistle | - | - | √ | √ |
| Stellaria spp. | | - | - | √ | - |
| Tricoryne elatior | Yellow Autumn-lily | √ | - | √ | - |
| Trifolium arvense# | Haresfoot Clover | - | - | √ | √ |
| Trifolium spp.# | | √ | √ | √ | √ |
| Trifolium subterraneum# | Subterraneum Clover | - | - | √ | - |
| Wahlenbergia spp. | | - | - | √ | - |

#Exotic species



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**Appendix 2: Likelihood of occurrence table for threatened species, endangered populations and endangered ecological communities recorded within the Wagga Wagga LGA.**

| Scientific Name | Common Name | Status | | Likelihood | Habitat |
|---|---|---|---|---|---|
| | | TSC Act | EPBC Act | | |
| **Threatened species - Fish** | | | | | |
| *Maccullochella peelii peelii* | Murray Cod | | V | No | Waterways of the Murray–Darling Basin in a wide range of warm water habitats that range from clear, rocky streams to slow flowing turbid rivers and billabongs. The upper reaches of the Murray and Murrumbidgee Rivers are considered too cold to contain suitable habitat. |
| *Macquarie australasica* | Macquarie Perch | | E | No | Occurs widely in riverine and lake habitats. In Sydney basin only known from Cataract and Cordeaux River catchments. Upland streams and migrates upstream to gravel beds to spawn. |
| **Threatened species - Frogs** | | | | | |
| *Litoria booroolongensis* | Booroolong Frog | E | | No | Restricted to NSW and north-eastern Victoria, predominantly along the western-flowing streams of the Great Dividing Range. Live along permanent streams with some fringing vegetation cover such as ferns, sedges or grasses |
| *Litoria raniformis* | Southern Bell Frog | E | V | No | Usually found in or around permanent or ephemeral Black Box/Lignum/Nitre Goosefoot swamps, Lignum/Typha swamps and River Red Gum swamps or billabongs along floodplains and river valleys. They are also found in irrigated rice crops, particularly where there is no available natural habitat |



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| Scientific Name | Common Name | Status | | Likelihood | Habitat |
|---|---|---|---|---|---|
| | | TSC Act | EPBC Act | | |
| **Threatened species - Snakes** | | | | | |
| *Aprasia parapulchella* | Pink-tailed Worm-lizard | V | V | Unlikely | In general, lizards occur in open grassland habitats that have a substantial cover of small rocks |
| *Delma impar* | Striped Legless Lizard | V | V | Unlikely | Lowland native grasslands |
| **Threatened species - Birds** | | | | | |
| *Ardea alba* | Great Egret, White Egret | | M | No | Shallows of rivers, estuaries, tidal mudflats, freshwater wetlands, larger dams |
| *Ardea ibis* | Cattle Egret | | M | Potential | Stock paddocks, pastures, croplands, garbage tips, wetlands, tidal mudflats |
| *Burhinus grallarius* | Bush Stone-curlew | E | | No | Well wooded floodplain forests, amongst fallen timber |
| *Cacatua leadbeateri* | Major Mitchell's Cockatoo | V | | Unlikely | Near water on timbered watercourses |
| *Callocephalon fimbriatum* | Gang-gang Cockatoo | V | | No | Wetter forests, and woodlands, from sea level to 2000m on divide. From timbered foothills and valleys to suburban gardens. |
| *Climacteris picumnus victoriae* | Eastern subspecies of Brown Treecreeper | V | | Yes | Drier forests / woodlands / scrubs with fallen branches. |
| *Gallinago hardwickii* | Latham's Snipe, Japanese Snipe | | M | No | Soft wet ground or shallow water with tussocks and other green and dead growth. Wet drainage areas |
| *Grus rubicundis* | Brolga | V | | No | Though Brolgas often feed in dry grassland or ploughed paddocks or even desert claypans, they are dependent on wetlands too, especially shallow swamps, where they will forage with their head entirely submerged |
| *Haliaeetus leucogaster* | White-bellied Sea-Eagle | | M | No | Rivers, large dams. Roost and nest on large platforms built in large Eucalypts |


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| Scientific Name | Common Name | Status | | Likelihood | Habitat |
|---|---|---|---|---|---|
| | | TSC Act | EPBC Act | | |
| *Hirundapus caudacutus* | White-throated Needletail | | M | Potential | Open space above canopy. Forages over large areas |
| *Lathamus discolor* | Swift Parrot | E | E, M | Potential | Forests, woodlands, plantations, banksias, street trees and gardens on the mainland |
| *Leipoa ocellata* | Malleefowl | E | V, M | No | Predominantly inhabit mallee communities, preferring the tall, dense and floristically-rich mallee found in higher rainfall (300-450 mm mean annual rainfall) areas. Less frequently found in other eucalypt woodlands |
| *Melanodryas cucullata* | Hooded Robin | V | | Unlikely | Prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas |
| *Melithreptus gularis gularis* | Black-chinned Honeyeater (eastern subspecies) | V | | Unlikely | Ironbark woodlands, extensively wooded areas |
| *Merops ornatus* | Rainbow Bee-eater | | M | Unlikely | Open woodlands with sandy, loamy soils, dunes, cliffs, mangroves golf courses |
| *Myiagra cyanoleuca* | Satin Flycatcher | | M | Unlikely | Heavily vegetated gullies in forests, and taller woodlands of coastal south-east Australia. Also occurs in various sites during migration including farms and parks |
| *Neophema pulchella* | Turquoise Parrot | V | | Unlikely | Open grassy woodland, with dead trees, near permanent water and forested hills. |
| *Ninox connivens* | Barking Owl | V | | Unlikely | Open forests, woodlands, dense scrubs, other large trees near watercourses. Nest in tree hollow. |
| *Pachycephala inornata* | Gilbert's Whistler | V | | No | The Gilbert's Whistler occurs in ranges, plains and foothills in arid and semi-arid timbered |


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| Scientific Name | Common Name | Status | | Likelihood | Habitat |
|---|---|---|---|---|---|
| | | TSC Act | EPBC Act | | |
| | | | | | habitats. In NSW it occurs mostly in mallee shrubland, but also in box-ironbark woodlands, Cypress Pine and Belah woodlands and River Red Gum forests. |
| *Pedionomus torquatus* | Plains Wanderer | E | V | No | Most of the vegetation is <5 cm high but some vegetation up to a maximum of 30 cm is important for concealment, grass tussocks are spaced 10-20 cm apart |
| *Polytelis swainsonii* | Superb Parrot | V | V | Yes | Breeds along inland rivers in river red gum, feeding in box woodland with 10km of nest tree. West of dividing range. |
| *Pomatostomus temporalis temporalis* | Grey-crowned Babbler (eastern subspecies) | V | | Potential | Inhabits open Box-gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains |
| *Pyrrholaemus sagittatus* | Speckled Warbler | V | | Unlikely | Well vegetated woodlands, diverse structure |
| *Rostratula australis* | Australian Painted Snipe | | V | Unlikely | Well vegetated margins of wetlands |
| *Rostratula benghalensis australis* | Painted Snipe (Australian subspecies) | E | V, M | Unlikely | Well vegetated margins of wetlands |
| *Stagonopleura guttata* | Diamond Firetail | V | | Potential | Open eucalypt forests, woodlands. |
| *Stictonetta naevosa* | Freckled Duck | V | | No | Prefer permanent freshwater swamps and creeks with heavy growth of Cumbungi, Lignum or Tea-tree. During drier times they move from ephemeral breeding swamps to more permanent waters such as lakes, reservoirs, farm dams and sewage ponds |
| *Grantiella picta* | Painted Honeyeater | V | - | Unlikely | Boree, Brigalow and Box-gum woodlands and box –ironbark forests. Inhabits vegetation with 5 or more |


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| Scientific Name | Common Name | Status | | Likelihood | Habitat |
|---|---|---|---|---|---|
| | | TSC Act | EPBC Act | | |
| | | | | | mistletoe per hectare. |
| *Xanthomyza phrygia* | Regent Honeyeater | E | E, M | No | Dry open forests, woodlands, especially red ironbark, yellow box, yellow gum |
| **Threatened species - Mammals** | | | | | |
| *Dasyurus maculatus* | Spotted-tailed Quoll | V | E | No | Occurs in wide variety of habitats in large remnants. Dens in tree hollows, hollow log or rock crevice |
| *Macrotis lagotis* | Bilby | Ex | V | No | Sandy desert areas in spinifex (*Triodia* species) grasslands |
| *Myotis adversus* | Large-footed Myotis | V | | Unlikely | Known from a range of habitats close to water from lakes, small creeks to large lakes and mangrove lined estuaries |
| *Saccolaimus flaviventris* | Yellow-bellied Sheathtail Bat | V | - | Potential | Forages in most habitats across its very wide range, with and without trees. Roosts and breeds in living or dead hollow bearing trees. |
| *Chalinolobus picatus* | Little Pied bat | V | - | Potential | Dry open forest, open woodland, mulga woodlands, chenopod shrublands, cypress pine forest, malle and bramble box. Roosts and breeds in tree hollows, fissures or cracks, buildings, power poles, fence posts, caves, cliff crevices, mineshafts and tunnels. |
| *Nyctophilus timoriensis* (south eastern form) | Eastern Long-eared Bat | V | V | No | Inhabits a variety of vegetation types, including mallee, bulloak Allocasuarina luehmannii and box eucalypt dominated communities, but it is distinctly more common in box/ironbark/cypress-pine vegetation that occurs in a north-south belt along the western slopes and plains of NSW and |


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| Scientific Name | Common Name | Status | | Likelihood | Habitat |
|---|---|---|---|---|---|
| | | TSC Act | EPBC Act | | |
| | | | | | southern Queensland |
| *Petaurus norfolcensis* | Squirrel Glider | V | | Unlikely | In the region occurs in Box-gum woodlands, box-ironbark woodlands and river red gum woodland. |
| *Phascolarctos cinereus* | Koala | V | | No | Inhabit eucalypt woodlands and forests |
| *Phascogale tapoatafa* | Brush-tailed Phascogale | V | - | No | Prefer dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter. Also inhabit heath, swamps, rainforest and wet sclerophyll forest. |
| **Threatened species - Plants** | | | | | |
| *Ammobium craspedioides* | Yass Daisy | V | V | No | Known from natural temperate grassland sites. |
| *Amphibromus fluitans* | River Swamp Wallaby-grass | V | V | No | Swamps or low-lying areas which become periodically water-logged, usually on clayey soils. |
| *Austrostipa wakoolica* | | E | E | No | Grows on floodplains of the Murray River tributaries, in open woodland on grey, silty clay or sandy loam soils; habitats include the edges of a lignum swamp with box and mallee; creek banks in grey, silty clay; mallee and lignum sandy-loam flat; open Cypress Pine forest on low sandy range; and a low, rocky rise |
| *Brachycome muelleroides* | Claypan Daisy | V | V | No | Grows in damp areas on the margins of claypans in moist grassland with *Pycnosorus globosus*, *Agrostis avenacea* and *Austrodanthonia duttoniana* |
| *Brachycome papillosa* | Mossigiel Daisy | V | V | No | Recorded primarily in clay soils on Bladder Saltbush (*Atriplex vesicaria*) and *Maireana aphylla* plains, but also in grassland and in Grey Box (*Eucalyptus* |


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| Scientific Name | Common Name | Status | | Likelihood | Habitat |
|---|---|---|---|---|---|
| | | TSC Act | EPBC Act | | |
| | | | | | *microcarpa*) - Cypress Pine (*Callitris spp*.) woodland |
| *Diuris sheaffiana* | Tricolour Diuris | V | V | No | Sporadically distributed on the western slopes of NSW. Associated species include Callitris glaucophylla, Eucalyptus populnea, Eucalyptus intertexta, Ironbark and Acacia shrubland. The understorey is often grassy with herbaceous plants such as Bulbine species |
| *Senecio garlandii* | Wooly Ragwort | V | V | No | Woolly Ragwort occurs on sheltered slopes of rocky outcrops |
| *Swainsona murrayana* | Slender Darling-pea | V | V | No | Grows in a variety of vegetation types including bladder saltbush, black box and grassland communities on level plains, floodplains and depressions and is often found with *Maireana* species. Plants have been found in remnant native grasslands or grassy woodlands that have been intermittently grazed or cultivated. |
| *Swainsona recta* | Small Purple-pea | E | E | No | Before European settlement Mountain Swainson-pea occurred in the grassy understorey of woodlands and open-forests dominated by Blakely's Red Gum *Eucalyptus blakelyi*, Yellow Box *E. melliodora*, Candlebark Gum *E. rubida* and Long-leaf Box *E. goniocalyx* |
| *Thesium australe* | Austral Toadflax | V | V | No | Often found in damp sites in association with Kangaroo Grass (*Themeda australis*) |
| **Threatened Ecological Populations** | | | | | |



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| Scientific Name | Common Name | Status | | Likelihood | Habitat |
|---|---|---|---|---|---|
| | | TSC Act | EPBC Act | | |
| *Petaurus norfolcensis* – endangered population Wagga Wagga | Squirrel Glider population in the Wagga Wagga LGA | E | | No | Inhabits a wide range of open forest, woodland and riverine forest habitats. Utilise remnants of various sizes, including small remnants and even small stands of trees within Travelling Stock Reserves, roadside reserves or private land. Often utilise linear remnant vegetation along roadsides or rivers and streams |
| **Threatened Ecological Communities** | | | | | |
| | White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland | E | CE | Yes | Western slopes and plains |



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