Parkes Bypass

Biodiversity assessment report

Roads and Maritime Services | October 2018

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Abbreviations

BAM 2017	Biodiversity Assessment Methodology 2017 that supports the Biodiversity Conservation Act 2016
BBAM 2014	BioBanking Assessment Methodology 2014
BC Act	Biodiversity Conservation Act 2017
BOS	Biodiversity Offset Scheme under the BC Act
CEEC	Critically Endangered Ecological Community
CEMP	Construction Environmental Management Plan
CMA	Catchment Management Authority
DoEE	Department of Environment and Energy
DP&E	Department of Planning and Environment
DPI	Department of Primary Industries
EEC	Endangered ecological community
EPBC Act	Environmental Protection and Biodiversity Conservation Act 1999 (Commonwealth).
FM Act	Fisheries Management Act 1994 (NSW)
GDE	Groundwater dependent ecosystems
IBRA	Interim Biogeographically Regionalisation of Australia
MNES	Matters of National Environmental Significance
OEH	Office of Environment and Heritage
PCT	Plant Community Type
REF	Review of Environmental Factors
SEPP	State Environmental Planning Policy
TECs	Threatened Ecological Communities
TBDC	Threatened Biodiversity Data Collection
TSC Act	Threatened Species Conservation Act 1995 (NSW)
VEC	Vulnerable Ecological Community
VIS	Vegetation information system

Glossary

Biodiversity	The biological diversity of life is commonly regarded as being made up of the following three components: • Genetic diversity – the variety of genes (or units of heredity) in any population • Species diversity – the variety of species • Ecosystem diversity – the variety of communities or ecosystems.
Biodiversity offsets	Management actions that are undertaken to achieve a gain in biodiversity values on areas of land in order to compensate for losses to biodiversity values from the impacts of development (OEH 2017).
Construction footprint	The area to be directly impacted by the proposal during construction activities. Analogous with subject land (see definition for subject land).
Critical Habitat	The whole or any part or parts of an area or areas of land comprising the habitat of an endangered species, an endangered population or an endangered ecological community that is critical to the survival of the species, population or ecological community (Department of Environment and Conservation, 2004). Critical habitat is listed under both the Threatened Species Conservation Act 1995 and the Environment Protection and Biodiversity Conservation Act 1999 and both the State (OEH) and Federal (DoEE) environment agencies maintain a register of this habitat. Capitalisation of the term 'Critical Habitat' in this report refers to the habitat listed specifically under the relevant State and Commonwealth legislation.
Cryptic species	An inconspicuous species which can be difficult to identify
Cumulative impact	The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. Refer to Clause 228(2) of the EP&A Regulation 2000 for cumulative impact assessment requirements.
Department of the Environment and Energy (DoEE)	This Commonwealth Department develops and implements national policy, programs and legislation to protect and conserve Australia's natural environment and cultural heritage and administers the Environment Protection and Biodiversity Conservation Act 1999.
Department of Environment, Climate Change and Water (DECCW)	Former name for the NSW Office of Environment and Heritage (OEH).

Department of Sustainability, Environment, Water, Population and Communities (SEWPAC)	Former name for the Commonwealth Department of the Environment and Energy (2010–2013).
Department of the Environment, Water, Heritage and the Arts (DEWHA)	Former name of the Commonwealth Department of the Environment and Energy.
Direct impact	Direct impacts on biodiversity values include those related to clearing native vegetation and threatened species habitat, and impacts on biodiversity values prescribed by the Biodiversity Conservation Regulation 2017 (the BC Regulation) (BAM 2017)
Ecological community	An assemblage of species occupying a specific area.
Ecosystem credit	A measurement of the value of threatened ecological communities and threatened species habitat for species that can be reliably predicted to occur with a Plant Community Type (PCT). Ecosystem credits measure the loss in biodiversity values at a development site and the gain in biodiversity values at an offset site.
Environmental weed	Any plant that is not native to a local area and that has invaded native vegetation.
Habitat	An area or areas occupied, or periodically or occasionally occupied, by a species, population or ecological community, including any biotic or abiotic component.
Indirect impact	Indirect impacts include but not limited to: (a) indirect impacts on adjacent vegetation and habitat during construction (b) indirect impacts on adjacent vegetation and habitat during operation (c) impacts on adjacent vegetation and habitat arising from a change in land-use patterns (BAM 2017)
International Union for Conservation of Nature (IUCN)	The International Union for Conservation of Nature is an international organization working in the field of nature conservation and sustainable use of natural resources.
Key Threatening Processes	A process that threatens, or could threaten, the survival, abundance or evolutionary development of native species, populations or ecological communities (Department of Environment and Conservation, 2004). Key Threatening Processes are listed under the Threatened Species Conservation Act 1995, the Fisheries Management Act 1994 and the Environment Protection and Biodiversity Conservation Act 1999. Capitalisation of the term 'Key Threatening Processes' in this report refers to those processes listed specifically under the relevant state and Commonwealth legislation.

Likely	Taken to be a real chance or possibility (Department of Environment and Conservation, 2004).
Locality	The area within 10 km of the project area.
Local population	The population that occurs in the study area. In cases where multiple populations occur in the study area or a population occupies part of the study area, impacts on each subpopulation must be assessed separately (OEH 2017).
MNES	A matter of national environmental significance (MNES) protected by a provision of Part 3 of the EPBC Act
Migratory species	Species protected as Migratory under the Environment Protection and Biodiversity Conservation Act 1999. Listed migratory species are those listed in the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention), China-Australia Migratory Bird Agreement (CAMBA), Japan-Australia Migratory Bird Agreement (JAMBA) and Republic of Korea – Australia Migratory Bird Agreement (RoKAMBA). Listed migratory species also include any native species identified in an international agreement approved by the Minister (Matthei, 1995). Capitalisation of the term 'Migratory' in this report refers to those species listed as Migratory under the Environment Protection and Biodiversity Conservation Act 1999.
Mitchell landscape	Landscapes with relatively homogeneous geomorphology, soils and broad vegetation types, mapped at a scale of 1:250,000 (OEH 2014).
Mitigation	Action to reduce the severity of an impact (OEH 2014).
Mitigation measure	Any measure that facilitates the safe movement of wildlife and/or prevents wildlife mortality or injury.
Native vegetation	(a) trees (including any sapling or shrub or any scrub), (b) understorey *plants*, (c) groundcover (being any type of herbaceous vegetation), (d) *plants* occurring in a wetland. A *plant* is native to New South Wales if it was established in New South Wales before European settlement (BC Act).

Office of Environment and Heritage (OEH)	Following the 2010 NSW elections the NSW Department of Environment Climate Change and Water (DECCW) was abolished and is now known as the Office of Environment and Heritage. It has been incorporated into the Department of Premier and Cabinet. Broadly, the Office of Environment and Heritage work towards a healthy environment cared for and enjoyed by the whole NSW community: manages the state's natural resources, including biodiversity, soils and natural vegetation: manages natural and cultural heritage across the state's land and waters: acts to minimise the impact of climate change: promotes sustainable consumption, resource use and waste management: regulates activities to protect the environment: and conducts biodiversity, plant, environmental and cultural heritage research to improve decision making.
OEH BAM Calculator	An online application of the Biodiversity Assessment Method (BAM). The calculator uses the rules and calculations outlined in the BAM, and allows the user to apply the BAM at a site and observe the results of the assessment.
Operational footprint	The area that will be subject to ongoing operational impacts from the proposal. This includes the road, surrounding safety verges and infrastructure, fauna connectivity structures and maintenance access tracks and compounds.
Plant Community Type (PCT)	Plant community types (PCT) and their relationship to a vegetation formation and vegetation class is managed and maintained in the Vegetation Information System (VIS) Classification database. PCTs were developed as an unambiguous master community-level classification and consolidated two existing vegetation classifications - the NSW Vegetation Classification and Assessment database & the Biometric Vegetation Types database (Office of Environment and Heritage, 2017c).
Population	A group of organisms, all of the same species, occupying a particular area (BAM 2017).
Proposal	The construction of a new 10.5 kilometre two lane highway bypass about 600 metres west of the existing Newell Highway. Starting south of Parkes diverting depart away from the existing Newell Highway alignment near south Barkers of Barkers Road along the Newell Highway, diverting traffic 600 metres to the west of the existing Newell Highway and would and re-joining the existing Newell Highway to the north of Parkes near Macguire Road.
Proposal footprint	The area of land that is directly impacted on by the proposal that is under the EP&A Act, including access roads, and areas used to store construction materials (OEH 2014).
Protected species	Those species defined as protected under the National Parks and Wildlife Act 1974. Includes all native animals, and all native plants listed on Schedule 13 of the National Parks and Wildlife Act 1974.
Region	A bioregion defined in a national system of bioregionalisation. For this study, this is the Sydney Basin Bioregion as defined in the Interim Biogeographic Regionalisation for Australia (Thackway and Cresswell, 1995)

Significant	Important, weighty, or more than ordinary (as defined by the Department of Environment and Climate Change, 2007).
Species credit	The class of biodiversity credits created or required for the impact on threatened species that cannot be reliably predicted to use an area of land based on habitat surrogates. Species that require species credits are listed in the Threatened Species Profile Database.
Species Profile and Threats Database (SPRAT)	A government managed database to provide information about species and ecological communities listed under the Environment Protection and Biodiversity Conservation Act 1999.
Study area	The area directly affected by the development and any additional areas likely to be affected by the development, either directly or indirectly (OEH 2014).
Target species	A species has been identified within the study area or is considered to have a moderate to high likelihood of occurrence and may be impacted by the proposal.
Threatened biodiversity	Threatened species, populations or ecological communities, or their habitats as listed under the Biodiversity Conservation Act 2017, Fisheries Management Act 1994 or the Environment Protection and Biodiversity Conservation Act 1999.
Viable local population	A population that has the capacity to live, develop, and reproduce under normal conditions, unless the contrary can be conclusively demonstrated through analysis of records and references (Department of Environment and Climate Change, 2007).

Executive summary

Roads and Maritime Services (Roads and Maritime) proposes to build a new 10.5 kilometre bypass about 1.5 to 2.0 kilometres west of the existing Newell Highway in Parkes, NSW (the proposal).

The survey area occurs primarily on a travelling stock route that contains discrete patches of remnant native vegetation within large patch areas of pasture grassland and cropping paddocks.

General land use in the area includes residential, agricultural use and roadways. The proposal footprint is located approximately 600 m to the west of the existing road corridor of Newell Highway with much of the area being within disturbed agricultural land.

Four native plant community types were recorded within the survey area of which two are listed as threatened ecological communities:

- PCT80/BVT LA153 – Western Grey Box – White Cypress Pine Tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion – Endangered under NSW Biodiversity Conservation Act 2016 (BC Act) & Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act)
- PCT 267/BVT LA218 White Box – White Cypress Pine – Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion – Endangered under BC Act (within the survey area this community does not meet EPBC Act condition threshold criteria)
- PCT 70 / BVT LA223 – White Cypress Pine woodland on sandy loams in central NSW wheat belt
- PCT 176/BVT LA148 – Green Mallee – White Cypress Pine very tall mallee woodland on gravel rises mainly in the Cobar Peneplain Bioregion.

Most of the survey area is non-native vegetation types that have been assigned as miscellaneous ecosystems that comprise of pasture grasslands, areas of agricultural cropping, landscape plantings and farm dams.

One threatened animal species was recorded:

- Grey-crowned Babbler (Pomatostomus temporalis temporalis); listed as Vulnerable under the BC Act.

Based on the habitat characteristics of the survey area, a further 18 threatened species are considered to have a moderate or high likelihood of occurrence, which include:

- 17 threatened animal species
- One threatened plant species.

The proposal will require the removal of about 61.44 ha of vegetation within the proposal footprint, of this 1.39 ha is native vegetation and 60.05 ha is miscellaneous ecosystems predominately made up of pasture grassland, cropping, landscape plantings. Of the native vegetation to be cleared, about 0.94 ha forms threatened ecological communities (0.84 ha of Inland Grey Box Woodland and 0.1 ha of White Box-Yellow Box-Blakely's Red Gum). The main impact of the proposal is vegetation clearing which is likely to lead to loss of habitat for threatened species. An assessment of the proposal impact against the Guideline for Biodiversity Offsets (RMS 2016) reveals that an offset for this proposal is not required.

Assessments of significance were conducted for all threatened species, populations and ecological communities considered likely to be affected by the proposal. Through these assessments, it was concluded that the proposal is unlikely to have a significant impact on any threatened species, population or ecological community.

Given the proposal is not considered likely to lead to a significant impact on threatened species, populations, ecological communities or their habitats, a Species Impact Statement (SIS) is not required to support this proposal. In respect to Matters of National Environmental Significance (MNES) this report has been prepared consistent with the Roads and Maritime EPBC Act strategic assessment. Significance assessments have been completed for all MNES matters including threatened flora, fauna and communities, these assessments have concluded that a referral of this proposal for consideration as a controlled action under the EPBC Act is not required.

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1 Introduction

1.1 Proposal background

Roads and Maritime Services (Roads and Maritime) is proposing to design and construct a new 10.5 kilometre long bypass as part of the Newell Highway Upgrade at Parkes that would divert vehicles away from the town centre of Parkes (the Parkes Bypass). The Parkes Bypass is part of the state government's $500 million investment in improving roads and freight movement across the state.

The Newell Highway is a national highway and major route for freight vehicles which travel from the Victorian and New South Wales border at Tocumwal through to the New South Wales and Queensland border at Goondiwindi.

The Newell Highway currently passes through Parkes town centre and includes four 90 degree bends which create a major constraint for heavy and longer road train vehicles to navigate around the bends safely. Other constraints include the safety of pedestrians crossing the highway due to heavy vehicle traffic and delays associated with the rail level crossings.

Parkes is known as a major transport link for freight travelling east to west across Australia and north to south across the state. Parkes is located at the intersection of two major railway lines (the Broken Hill railway line and Parkes-Narromine railway line) and is the most eastern town in which trains can be double stacked and have longer lengths. Further east, trains are a single container high due to height restrictions and tunnels.

Since the 1950's, Parkes Shire Council has identified the need for a ring road to divert heavy vehicle traffic away from Parkes town centre along a new alignment for the Newell Highway (Virtue, 2014). In 2011, Parkes Shire Council sought to construct an access road to the PNLH and bypass the existing Newell Highway through Parkes and prepared a review of environmental factors (REF) for this proposal termed the 'Western Ring Road'. Parkes Shire Council was unable to continue with the proposal due to cost constraints, however, realised the importance of the proposal and sought to include need for a bypass at Parkes into the Newell Highway Corridor Strategy (Virtue, 2014).

1.2 The proposal

The proposal includes the construction of a new 10.5 kilometre long, two lane bypass about 1.5 to 2.0 kilometres west of the existing Newell Highway. It would depart from the existing Newell Highway alignment south of Barkers Road and would re-join the existing Newell Highway to the north of Parkes near Maguire Road. The location of the proposal is shown in Figure 1-1.

The proposal's key features include:

- A new two-lane bypass (one lane in each direction) with four key intersections comprising:
  - T-intersections where the new bypass connects to the existing highway near Barkers Road (south) and Maguire Road (north)
  - A staggered T-intersection at London Road
  - A four-way roundabout at Condobolin Road
- A bridge over the Broken Hill and Parkes to Narromine rail lines and Hartigan Avenue and a shared pedestrian/cycleway bridge over the Parkes Bypass connecting Victoria Street and Back Trundle Road
- An extension of Hartigan Avenue that would connect to Brolgan Road (west of the bypass) and Condobolin Road
- Changes to local roads to tie in with the new bypass.

It is anticipated that construction would start in 2020 and would take about three years to complete. This would be subject to funding, weather and access considerations.

1.3 Legislative context

A Review of Environmental Factors (REF) is prepared to satisfy Roads and Maritime Services duties under s.111 of the EP&A Act to "examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of that activity" and s.112 in making decisions on the likely significance of any environmental impacts. This biodiversity impact assessment forms part of the REF being prepared for the Parkes Bypass, and assesses the biodiversity impacts of the proposal to meet the requirements of the EP&A Act.

Sections 7.2 A of the BC Act and Part 7A of the FM Act require that the significance of the impact on threatened species, and endangered ecological communities is assessed using a five-part test. Where a significant impact is likely to occur, a species impact statement (SIS) must be prepared in accordance with the Director-General's requirements or a Biodiversity Development Assessment Report (BDAR) must be prepared by an accredited assessor in accordance with the BAM.

Until such time as the DoEE endorse the Biodiversity Assessment Method, a BDAR will not be pursued as an assessment option by RMS for projects with significant impacts on MNES without further consultation with DoEE.

In September 2015, a "strategic assessment" approval was granted by the Federal Minister in accordance with the EPBC Act. The approval applies to Roads and Maritime activities being assessed under Part 5.1 (formerly Part 5) of the EP&A Act with respect to potential impacts on nationally listed threatened species, ecological communities and migratory species.

As a result, Roads and Maritime proposals assessed via an REF:

- Must address and consider potential impacts on nationally listed threatened species, populations, ecological communities and migratory species, including application of the "avoid, minimise, mitigate and offset" hierarchy
- Do not require referral to the Federal Department of the Environment for these matters, even if the activity is likely to have a significant impact.

To assist with this, assessments are required in accordance with the *Matters of National Environmental Significance: Significant impact guidelines 1.1. Environment Protection and Biodiversity Conservation Act 1999* (DoE 2013).

The NSW *Biodiversity Conservation Act 2016* (BC Act) came into effect on the 25 August 2017. This Act repealed the *Threatened Species and Conservation Act 1995* (TSC Act), *Native Vegetation Act 2003* and parts of the *National Parks and Wildlife Act 1974*. All threatened entities previously listed under the TSC Act have now been listed under the schedules of the BC Act.

The BC Act outlines the framework for addressing impacts on biodiversity from development and clearing. It establishes a framework to avoid, minimise and offset impacts on biodiversity from development through the Biodiversity Offsets Scheme. The Biodiversity Offsets Scheme creates a transparent, consistent and scientifically based approach to biodiversity assessment and offsetting for all types of development that are likely to have a significant impact on biodiversity (Office of Environment and Heritage 2017).

The commencement of the BC Act has affected the operation of the strategic assessment in the following ways:

- The previous biodiversity assessment method, the Framework for Biodiversity Assessment, (FBA) has been superseded by the BAM
- DoEE have not (yet) endorsed the BAM as a suitable method to assess impacts or calculate offsetting requirements
- DoEE have not (yet) endorsed the Biodiversity Offset Fund as a suitable avenue to meet offset obligations.

Until DoEE have endorsed the BAM, a BDAR should not be used to assess project impacts or calculate offset requirements for Division 5.1 REF projects that are likely to have a significant impact on nationally listed species and communities without consultation with DoEE.

Map: 2270437A_GIS_012_A2_A | Author: David.Naiken
Date: 30/08/2018 | Approved by: Isabella.See

Data source: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, © OpenStreetMap contributors, and the GIS User Community © Department of Finance, Services & Innovation 2018

Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A3

Parkes Bypass Biodiversity Assessment
Figure 1.1
Proposal Location

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2 Methods

2.1 Personnel

The contributors to the preparation of this report, their qualification and roles are provided in Table 2-1.

Table 2-1 Contributors and their roles

Name	Qualifications	Role
Mark Stables	Bachelor of Science (Hons)	Senior Ecologist – field surveys and report preparation
Troy Jennings	Bachelor of Biodiversity and Conservation Masters of Wildlife Management	Ecologist – field survey and report preparation
Julia Wyllie	Bachelor of Biodiversity and Conservation	Ecologist – report preparation
Adam Labruyere	Bachelor of Development Studies	Mapping and data management – GIS operator
Selga Harrington	Bachelor of Science (Hons)	Principal Ecologist – Technical review
Nathan Cooper	Bachelor of Environmental Science	Bat call analysis

All work was carried out under the appropriate licences, including scientific licences as required under Clause 22 of the *National Parks and Wildlife Regulations 2002*, Section 132C of the NPW Act (License Number: SL100630) as well as an animal research authority issued by the Department of Trade and Investment, Regional Infrastructure and Services.

2.2 Background research

The aim of this background research was to identify threatened flora and fauna species, populations and ecological communities, Commonwealth listed Migratory species or critical habitat which has been recorded previously or is predicted to occur in the locality.

This allowed for known habitat characteristics of threatened biodiversity to be compared with those present within the survey area to determine the likelihood of occurrence of each species or populations. These results informed the identification of appropriate field survey effort and the groups likely to occur.

Records of threatened species, populations and ecological communities known or predicted to occur in the locality of the survey area were obtained from a range of databases as detailed in Table 2-2.

Table 2-2 Standard data source searches

Data source	Search timing	Area/criteria searched	Purpose	Reference
BioNet Atlas of NSW Wildlife (flora and fauna)	1/11/2016	50 km x 50 km area centred on the middle point of the proposal footprint.	Identify threatened species and populations and migratory species for consideration.	Office of Environment and Heritage (Office of Environment & Heritage, 2017)
EPBC Protected Matters Search Tool (Commonwealth listed biodiversity)	1/11/2016	Proposal footprint and a 50 km buffer surrounding it.	Identify threatened biodiversity and migratory species for consideration. Identify threats to biodiversity.	(Department of the Environment and Energy, 2017a)
NSW Department of Primary Industries Listed threatened species, populations and ecological communities web page (fish and aquatic invertebrates)	1/11/2016	Lachlan catchment	Identify threatened aquatic invertebrate species for consideration.	(Department of Primary Industries, 2017a)
Critical habitat registers				
TSC Act Critical habitat register now replaced by Areas of Outstanding Biodiversity (AOBVs) under the BC Act	1/11/2016	Sites within 50 km of the proposal footprint.	Identify the presence or absence of critical habitat within the proposal footprint and locality.	(Office of Environment and Heritage, 2017a)
FM Act Register of critical habitat				Department of Primary Industries (2017b)
EPBC Act Register of critical habitat				(Department of Environment and Energy, 2017b)
OEH vegetation information system (VIS) database (OEH) Vegetation Types Database	Survey planning phase Habitat assessment	Plant Community Types (PCTs) in Bioregion – sub-region.	Correlate vegetation mapping with defined Plant Community Types (PCTs).	(Office of Environment and Heritage, 2017b)
Bureau of Meteorology Atlas of Groundwater Dependent Ecosystems (GDE)	18/11/2016	Mapped ecosystems within 5 km of the proposal footprint.	Identify the presence or absence of predicted areas of GDEs within the proposal footprint and in the locality.	(Australian Bureau of Meteorology, 2017)

Data source	Search timing	Area/criteria searched	Purpose	Reference
Department of the Environment and Energy – Directory of important wetlands	1/11/2016	Proposal footprint and a 5 km buffer surrounding it.	Identify the presence or absence of nationally important (including Ramsar) wetlands within the proposal footprint and in the locality.	(Department of Environment and Energy, 2017a)
Coastal Wetlands (State Environmental Planning Policy No. 14) – SEPP 14 spatial data	1/11/2016	Proposal footprint and a 5 km buffer surrounding it.	Identify the presence or absence of SEPP 14 Wetlands within the proposal footprint and in the locality.	(NSW Planning & Environment, 2006)

2.3 Habitat assessment

A habitat assessment was completed to assess the likelihood of occurrence of each threatened species, population and community (threatened biodiversity) identified with the potential to occur in the survey area. All threatened biodiversity identified during background research were considered. The habitat assessment was utilised to inform the identification of appropriate targeted surveys and was revisited after the surveys were completed based on the habitat components identified in the survey area. The assessment was based on the habitat profile for the species and other habitat information in the Threatened Species Profile Database (Office of Environment & Heritage, 2016). The assessment also included consideration of the dates and locations of nearby records and information about species populations in the locality. The assessment results are summarised in section 3 and are provided in full in in the likelihood of occurrence assessments (Appendix B and Appendix D).

For this study, the likelihood of occurrence of threatened and migratory species and populations was determined based on the criteria shown in Table 2-3 and Table 2-4 below.

Table 2-3 Likelihood of occurrence criteria for threatened species and populations of animals

Likelihood	Criteria
Known	The species was observed in the survey area either during the current survey or during another survey less than one year prior.
High	A species has a high likelihood of occurrence if: • The survey area contains or forms part of a large area of high quality suitable habitat • Important habitat elements (i.e. For breeding or important life cycle periods such as winter foraging periods) are abundant within the survey area • The species has been recorded recently in similar habitat in the locality • The survey area is likely to support resident populations or to contain habitat that is visited by the species during regular seasonal movements or migration.
Moderate	A species has a moderate likelihood of occurrence if: • The survey area contains or forms part of a small area of high quality suitable habitat • The survey area contains or forms part of a large area of marginal habitat • Important habitat elements (i.e. For breeding or important life cycle periods such as winter foraging periods) are sparse or absent within the survey area • The survey area is unlikely to support resident populations or to contain habitat that is visited by the species during regular seasonal movements or migration but is likely to be used occasionally during seasonal movements and/or dispersal.

Likelihood	Criteria
Low	A species has a moderate likelihood of occurrence if: • Potentially suitable habitat exists but the species has not been recorded recently (previous 10 years) in the locality despite intensive survey (i.e. The species is considered to be locally extinct) • The species is considered to be a rare vagrant, likely only to visit the survey area very rarely; e.g. during juvenile dispersal or exceptional climatic conditions (e.g. extreme drought conditions in typical habitat of inland birds).
None	Suitable habitat is absent from the survey area.

Table 2-4 Likelihood of occurrence criteria for threatened species and populations of plants

Likelihood	Criteria
Known	The species was observed in the survey area either during the current survey or during another survey less than one year prior.
High	A species has a high likelihood of occurrence if: • The survey area contains or forms part of a large area of high quality suitable habitat that has not been subject to recent disturbance (e.g. Fire), the species is known to form a persistent soil seedbank and the species has been recorded recently (within 10 years) in the locality • The species is a cryptic flowering species that has been recorded recently (within 10 years) in the locality and has a large area of high quality potential habitat within the proposal footprint that was not seasonally targeted by surveys.
Moderate	A species has a moderate likelihood of occurrence if: • The species: — Has a large area of high quality suitable habitat in the survey area that has not been subject to Recent disturbance (e.g. Fire) — The species is known to form a persistent soil seedbank, but — The species has not been recorded recently (within 10 years) in the locality. • The species: — Has a small area of high quality suitable habitat or a large area of marginal habitat in the survey area That has not been subject to recent disturbance (e.g. Fire) — The species is known to form a persistent soil seedbank — The species has been recorded recently (within 10 years) in the locality • The species is a cryptic flowering species, with a small area of high quality potential habitat or a large area of marginal habitat within the proposal footprint, that was not seasonally targeted by surveys.
Low	A species has a low likelihood of occurrence if: • It is not a cryptic species nor a species known to have a persistent soil seedbank species and was not detected despite targeted searches • The species is a cryptic flowering species, with a small area of high quality potential habitat or a large area of marginal habitat within the proposal footprint, that was not seasonally targeted by surveys as the species has not been recorded within 50 years in the locality.
None	Suitable habitat is absent from the proposal footprint.

2.4 Field survey

The field survey aimed to ground-truth the results of the background research and habitat assessment. As such, all threatened species, populations and communities that were considered likely to occur within the survey area were targeted during the field survey to determine presence or likely occurrence.

Parts of the survey area are located in an environment that has been subject to clearing and modification of habitat and hence many of the threatened species that were historically found in the area are likely to have been lost. The potential for these species to occur is more reliably assessed through consideration of previous records combined with field-based assessment of habitat characteristics. This approach also has the advantage of minimising potential animal welfare considerations associated with survey methods such as harp-trapping and elliot trapping.

Weather conditions can affect activity (and therefore detectability) of some species. If adverse weather conditions occur during field surveys the validity of survey techniques are affected and can impact the probability of detecting a species if it was present within the study area. During the field survey (8–10 November 2016), warm to hot weather conditions with no rainfall were recorded. These conditions were reasonably favourable and are outlined in Table 2-5.

Table 2-5 Field survey dates and weather conditions

Date	Temperature		Wind direction (km/hr)	Rain (mm)
	Min	Max		
08/11/2016	12.4	30.0	NNW (35 km/hr)	0
09/11/2016	9.8	22.3	N (41 km/hr)	0
10/11/2016	9.9	28.0	WSW (43 km/hr	0

Note: Source from Parkes Airport AWS (Station 065068)

2.4.1 Vegetation surveys

The vegetation survey was completed in accordance with the Biobanking Assessment Methodology 2014 (BBAM) (Office of Environment and Heritage, 2014). A plot-based full floristic survey was completed, based on a 20 metre x 50 metre quadrat.

Recorded native vegetation was classified according to the Plant Community Types (PCTs) in the OEH Vegetation Information System (VIS) Classification Database (Office of Environment and Heritage, 2017b). Native vegetation means any of the following types of indigenous vegetation:

- Trees (including any sapling or shrub)
- Understorey plants
- Groundcover (being any type of herbaceous vegetation)
- Plants occurring in a wetland.

Areas of non-native vegetation were also identified and mapped. Plot data was collected in these areas to show the composition and abundance of non-native vegetation within the survey area.

Native vegetation recorded within the survey area was identified by formation, class and type and corresponding Threatened Ecological Community (where applicable), utilising VIS (Office of Environment and Heritage, 2017b).

The condition of vegetation was assessed firstly against the BBAM definitions of ‘low’ and ‘moderate to good’ broad conditions and secondly against the biometric condition benchmark data for the relevant vegetation type and other parameters such as intactness, diversity, history of disturbance, weed invasion and health.

Under FBA, vegetation in 'low' broad condition is:

> *woody native vegetation with native over-storey percent foliage cover less than 25% of the lower value of the over-storey percent foliage cover benchmark for that vegetation type, and where either: – less than 50% of ground cover vegetation is indigenous species, or greater than 90% of ground cover vegetation is cleared*

OR

> *native grassland, wetland or herbfield where either: – less than 50% of ground cover vegetation is indigenous species, or more than 90% of ground cover vegetation is cleared.*

'Moderate to good' broad condition is native vegetation that is not in 'low' broad condition.

Three condition sub-categories within the 'moderate to good' broad BBAM condition class were used to further define the condition of the vegetation using factors such as levels of disturbance, weed invasion, resilience and comparison with BioBanking benchmark data:

- **Condition sub-category 'Good quality condition'**: Vegetation still retains the species complement and structural characteristics of the pre-European equivalent. The vegetation displays resilience to weed invasion due to intact groundcover, shrub and canopy layers. Native species diversity is relatively high. Weeds may exist in this vegetation type but exhibit <10% foliage cover.
- **Condition sub-category 'Medium quality condition':** Vegetation has retained a native canopy (greater than or equal to 25% of the lower benchmark value) but the understorey and groundcover layers are generally co-dominated by exotic species that exhibit between 10–40% foliage cover.
- **Condition sub-category 'Poor quality condition':** Vegetation has retained a native canopy (greater than or equal to 25% of the lower benchmark value) but the understorey and groundcover layers are generally dominated or co-dominated by exotic species that exhibit between 41–70% foliage cover. Native species diversity is generally relatively low and the mid and low stratums have been structurally modified due to weed incursions.
- The field survey included description and mapping of each of the identified PCTs and their condition classes, also known as vegetation zones (a relatively homogenous area of native vegetation on a development site that is the same PCT and broad condition type) under the BBAM (Office of Environment and Heritage, 2014).

The number of plots completed for each identified vegetation zone is provided in Table 2-6 with the location of each transect/plot identified in Table 2-7 and Figure 2-1 below.

Table 2-6 Minimum number of transects/plots required per zone area

Vegetation zone	Area of vegetation zone in survey area (ha)	Minimum number of transects/ plots required (BBAM)	Number of transects/ plots completed
PCT 80/BVT LA153 – Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion (moderate to good)	18.85	3	4 (Q1, Q3, Q5, Q6)
PCT 70/BVT LA223 – White Cypress Pine woodland on sandy loams in central NSW wheat belt (moderate to good)	2.84	2	2 (Q4, Q7)

Vegetation zone	Area of vegetation zone in survey area (ha)	Minimum number of transects/ plots required (BBAM)	Number of transects/ plots completed
PCT 176/BVT LA148 – Green Mallee – White Cypress Pine very tall mallee woodland on gravel rises mainly in the Cobar Peneplain Bioregion (moderate to good)	1.17	1	1 (Q2)
PCT 267/BVT LA218 – White Box – White Cypress Pine – Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion (moderate to good)	0.43	1	1 (Q8)
Miscellaneous ecosystems – Highly disturbed areas with no or limited native vegetation (Pasture grassland)	208.06	–	N/A
Miscellaneous ecosystems – Highly disturbed areas with no or limited native vegetation (Landscape plantings)	16.33	–	N/A
Miscellaneous ecosystems – Highly disturbed areas with no or limited native vegetation (Cropping)	151.06	–	N/A
Miscellaneous ecosystems – Water bodies, rivers, lakes, streams (Farm dams)	1.53	–	N/A
Total number of transect/plots			**8**

Table 2-7 Location of transects/plots

Plot/transect	Vegetation zone	Zone	Easting	Northing
Q1	PCT 80/BVT LA153 – Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion (moderate to good)	55	605593	6327689
Q2	PCT 176/BVT LA148 – Green Mallee – White Cypress Pine very tall mallee woodland on gravel rises mainly in the Cobar Peneplain Bioregion (moderate to good)	55	605707	6327845
Q3	PCT 80/BVT LA153 – Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion (moderate to good)	55	607051	6328798
Q4	PCT 70/BVT LA223 – White Cypress Pine woodland on sandy loams in central NSW wheat belt (moderate to good)	55	607196	6328991

Plot/transect	Vegetation zone	Zone	Easting	Northing
Q5	PCT 80/BVT LA153 – Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion (moderate to good)	55	606877	6328555
Q6	PCT 80/BVT LA153 – Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion (moderate to good)	55	607150	6332339
Q7	PCT 70/BVT LA223 – White Cypress Pine woodland on sandy loams in central NSW wheat belt (moderate to good)	55	607340	6332796
Q8	PCT 267/BVT LA218 – White Box – White Cypress Pine – Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion (moderate to good)	55	609105	6336375

2.4.2 Fauna surveys

Fauna surveys were mainly observational (i.e. no trapping) due to limited availability of continuous native vegetation within the survey area. This survey method was undertaken for threatened species which may have habitat within the survey area. Such surveys were conducted within the seasonal activity periods of majority of threatened fauna and/or by targeting local resources within the survey area to which they would likely be attracted. During surveys for threatened species, habitat assessments were conducted to assess the value of the habitats present for other threatened fauna, during which opportunistic observations of more common fauna and other threatened species were recorded.

Nocturnal surveys

Nocturnal surveys consisted of spotlighting, call playback, ultrasonic bat survey and amphibian survey. The methodologies of each survey technique are described below.

Spotlighting

The objective of this survey technique was to target arboreal, flying and large ground-dwelling mammals, as well as nocturnal birds, reptiles and amphibians. Spotlighting was done after dusk within suitable habitat within the survey area. Two person hours of survey effort was carried out each night on foot using two spotlights. The speed of the spotlight survey was about 1 km per hour. The survey concentrated on areas that contained suitable habitat for nocturnal species, with sighted animals identified to the species level.

Stag watching was also carried out during dusk within suitable habitat within the survey area. Two person hours of survey effort was carried out each evening at dusk on foot using two spotlights. Stag watching focused on identified habitat (i.e. hollow-bearing trees) in the survey area to observe the exit of any nocturnal fauna species from roosting sites or nesting hollows. All sighted animals were identified to the species level.

Call playback

Call playback was used to survey for Barking Owl using the methods of Kavanagh (Kavanagh and Peake, 1993) and Debus (Debus, 1995). Call playback was conducted after dusk each night, within suitable habitat in the survey area. For this survey an initial listening period of 10 minutes was undertaken, followed by a spotlight search for 10 minutes to detect any animals in the immediate vicinity.

The calls of the target species were then played intermittently for five minutes (Barking Owl) followed by a 10 minute listening period. After the calls were played, another 10 minutes of spotlighting was carried out in the vicinity to check for animals attracted by the calls, but not vocalising. Calls were broadcast using an MP3 player and amplified through a megaphone.

Microchiropteran bat surveys

Ultrasonic Anabat Bat Detection (Anabat Express Bat Detector – Titley Electronics) was used to record and identify the echolocation calls of microchiropteran bats foraging across the survey area each night of the study period (8 & 9 November 2016). Bat call analysis was undertaken by Nathan Cooper. Bat calls of New South Wales southern region (Pennay et al., 2004) was used as a reference collection for bat call identification.

Diurnal bird surveys

Bird surveys were completed by actively walking through the nominated site (transect) over a period of 20 minutes. All birds were identified to the species level, either through direct observation or identification of calls. Bird surveys were completed during different times of the day, but generally occurred in the morning. Birds were also recorded opportunistically during all other surveys.

Blossom nomads such as the Swift Parrot, Regent Honeyeater and Little Lorikeet are dependent on the variable mosaic of blossom resources at local, regional and state scales. Whilst the Little Lorikeet is generally locally nomadic in response to blossom resources, the Swift Parrot and Regent Honeyeater are usually only winter visitors to coastal NSW regions for blossom; the Swift Parrot more so, as the entire population retires to Tasmania during the summer breeding period. Opportunistic blossom surveys were undertaken within remnant vegetation in the survey area for Little Lorikeet and other blossom nomad activity. In addition, habitat and blossom resources were noted and identified within the survey area for the potential utilisation by threatened blossom nomads.

2.4.3 Aquatic surveys

The habitat value of waterways (i.e. habitat sensitivity and classification of waterways for fish passage) is characterised in accordance with NSW DPI (Fisheries) document Policy and Guidelines for fish habitat conservation and management (Department of Primary Industries, 2013). Detailed aquatic fauna survey is warranted if a project crosses any Class 1 watercourse (Major fish habitat) or a Class 2 watercourse (Moderate fish habitat) that has been identified as having a moderate or high potential to be occupied by a threatened aquatic species of animal.

The proposal does not cross any Class 1 or Class 2 watercourses and no detailed aquatic surveys were conducted.

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Figure 2.1

Field Survey Locations

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Figure 2.1
Field Survey Locations
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Figure 2.1
Field Survey Locations
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Figure 2.1
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Figure 2.1
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Figure 2.1
Field Survey Locations
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Figure 2.1
Field Survey Locations
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2.5 Limitations

2.5.1 Field survey limitations

No sampling technique can eliminate the possibility that a species is present within a survey area. For example, some species of plant may be present in the soil seed bank and some fauna species use habitats on a sporadic or seasonal basis and may not be present within the survey area during surveys. The conclusions in this report are based upon data acquired for the proposal and the environmental field surveys, therefore, they are merely indicative of the environmental condition of the survey area at the time of preparing the report, including the presence or otherwise of species. It should be recognised that survey area conditions, including the presence of threatened species, can change with time.

Targeted surveys have been conducted to detect target sedentary animal species and threatened flora species that are considered likely to occur within the survey area based on habitat characteristics and previous records. As the actual distribution and the range of habitat utilised by some species is not fully understood, there is always a small possibility that other species could occur on the site despite being considered to have a low likelihood of occurrence based on their known range and known habitats.

Flora surveys were conducted during spring and as such a high proportion of grasses recorded were exotic annual species. This finding was consistent with the Preliminary Ecological Investigation conducted by GHD (2015). The species richness and cover abundance of exotic annual grasses is expected to fluctuate depending on seasonality and climatic conditions.

2.5.2 Other limitations

Other limitations relating to the conclusions contained in this report are detailed in the following sections.

Reliance on externally supplied information

In preparing this study, WSP has relied upon data, surveys, analyses, designs, plans and other information provided by the client and other individuals and organisations. Except as otherwise stated in the study, WSP has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in this study (conclusions) are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. WSP will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to WSP.

3 Existing environment

This section describes the environmental context of the survey area including abiotic and biotic features of the landscape area. The context of the survey area assists in assessing likelihood of occurrence for threatened species and determining plant community types.

3.1 Landscape and land use context

The landscape context of the survey area, including Interim Biogeographically Regionalisation of Australia (IBRA) bioregions and subregions, Mitchell landscapes, catchment areas and land uses are described in Table 3-1.

Table 3-1 Landscape context

IBRA bioregion and subregion	Catchment	Mitchell landscape	National parks and other conservation areas NEXT TO survey area	Current and recent land uses
NSW South Western Slopes (Inland Slopes)	Lachlan	Goonumbla Hills	None	RMS road reserve Crown land – stock route Private property

3.2 Abiotic influences on biodiversity

Abiotic influences on biodiversity including geology, soils, landforms and climate are described in Table 3-2.

Table 3-2 Abiotic influences

Geology	Soils	Landform	Climate
The bioregion lies wholly in the eastern part of the Lachlan Fold Belt which consists of a complex series of north to north-westerly trending folded bodies of Cambrian to Early Carboniferous sedimentary and volcanic rocks. Granites are common and mostly located in large scale upfolded bodies of rock. Granite landscapes occur either as central basins surrounded by steep hills formed on contact metamorphic rocks, or as high blocky plateau features with rock outcrops and tors (OEH 2017).	The overall pattern of soils in these landscapes is one where shallow, stony soils are found on the tops of ridges and hills. Moving downslope, texture contrast soils are the norm with subsoils derived from the underlying weathered rock and the topsoils being a homogenised surface mantle of coarser material derived from all parts of the slope. On valley floors subsoils have drabber colours indicative of poor drainage and they may accumulate soluble salts. Alluvial sands and loams are more common than clays in most parts of the landscape but alluvial clays become more important nearer to the Riverine Plain. Over the Quaternary, soils in these landscapes have accumulated a considerable quantity of wind-blown silt and clay from western NSW (OEH 2017).	Complex alluvial fan with numerous distributary channels and floodplains, depression plains, and abandoned lake beds with lunettes (OEH 2017).	Dominated by a sub-humid climate characterised by hot summers and no dry season. Rainfall is distributed across the south western slopes with high (1200 mm) mean annual rainfall in the east and lower (400 mm) mean annual rainfall in the west (OEH 2017).

3.3 Plant community types

The following community types were recorded during field surveys within the survey area and proposal footprint (Table 3-3 and Figure 3-1).

Table 3-3 Plant community types recorded within the survey area

Name of community (abbreviation)	Vegetation formation	Vegetation class	Condition class	BC Act status	EPBC Act status	Area (ha) within survey area	Area (ha) within proposal footprint
PCT80/ BVT LA153 Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion	Grassy Woodlands	Floodplain Transition Woodlands	Moderate to Good	**Endangered:** Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions	**Endangered:** Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia	18.85	0.84
PCT 70/ BVT LA223 White Cypress Pine woodland on sandy loams in central NSW wheatbelt	Grassy Woodlands	Floodplain Transition Woodlands	Moderate to Good	Not listed	Not Listed	2.84	0.45
PCT 176/ BVT LA148 Green Mallee – White Cypress Pine very tall mallee woodland on gravel rises mainly in the Cobar Peneplain Bioregion	Semi-arid Woodlands (Shrubby sub-formation)	Inland Rocky Hill Woodlands	Moderate to Good	Not listed	Not Listed	1.17	0.00
PCT 267/ BVT LA218 White Box – White Cypress Pine – Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion	Grassy Woodlands	Western Slopes Grassy Woodlands	Moderate to Good	**Endangered:** White Box Yellow Box Blakely's Red Gum Woodland	**Critically Endangered:** White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	0.43	0.10

Name of community (abbreviation)	Vegetation formation	Vegetation class	Condition class	BC Act status	EPBC Act status	Area (ha) within survey area	Area (ha) within proposal footprint
Pasture Grasslands	Miscellaneous Ecosystem	Highly disturbed areas with no or limited native vegetation	Low	Not listed	Not Listed	208.06	36.17
Landscape Plantings	Miscellaneous Ecosystem	Highly disturbed areas with no or limited native vegetation	Low	Not listed	Not Listed	16.33	1.94
Cropping	Miscellaneous Ecosystem	Highly disturbed areas with no or limited native vegetation	Low	Not listed	Not Listed	151.06	21.71
Farm Dams	Miscellaneous Ecosystem	Water bodies, rivers, lakes, streams (not wetlands)	Low	Not listed	Not Listed	1.53	0.22
Total area of native vegetation						**23.30**	**1.39**
Total area						**400.27**	**61.44**

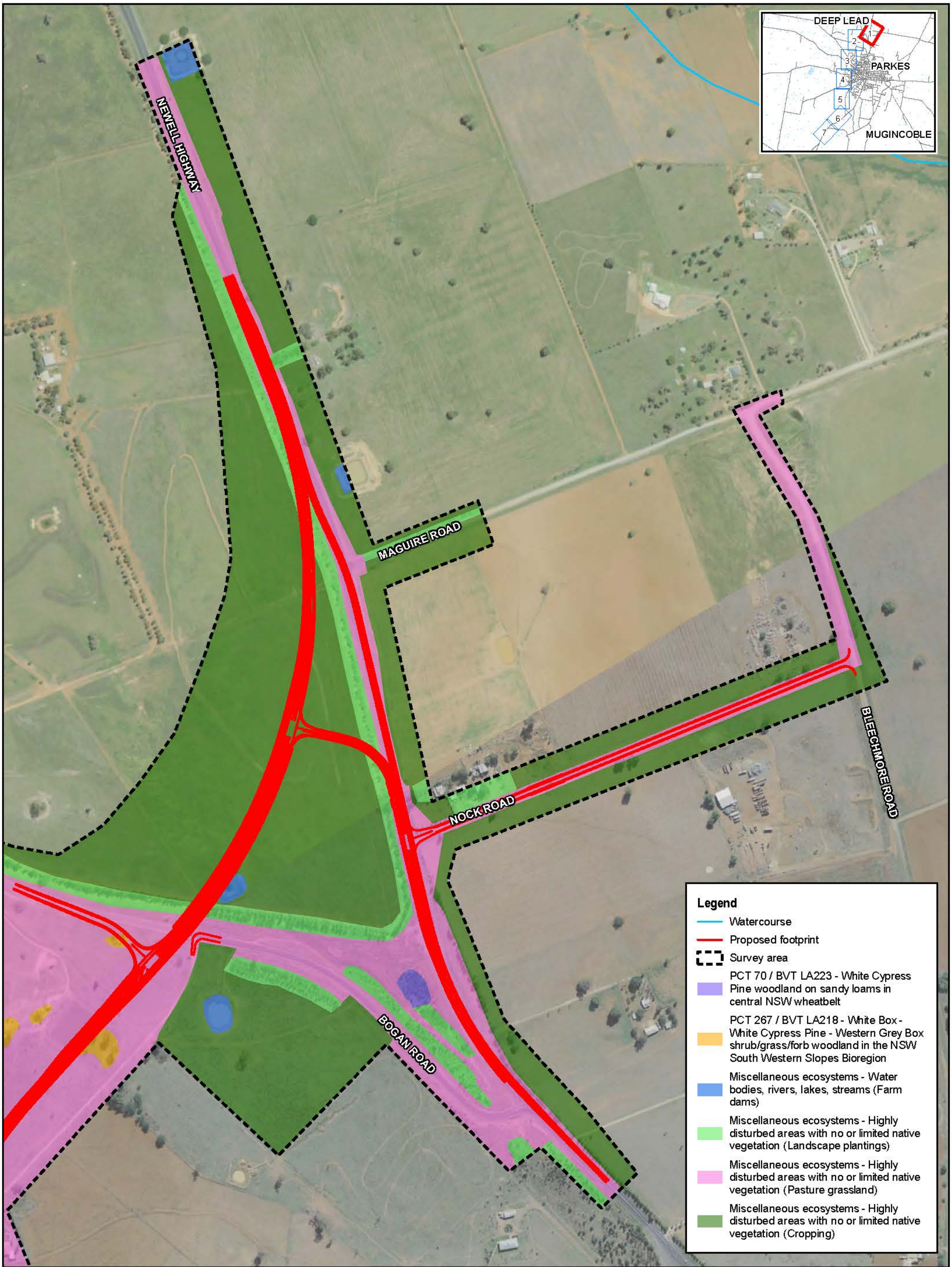

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Figure 3.1
Vegetation communities within the survey area
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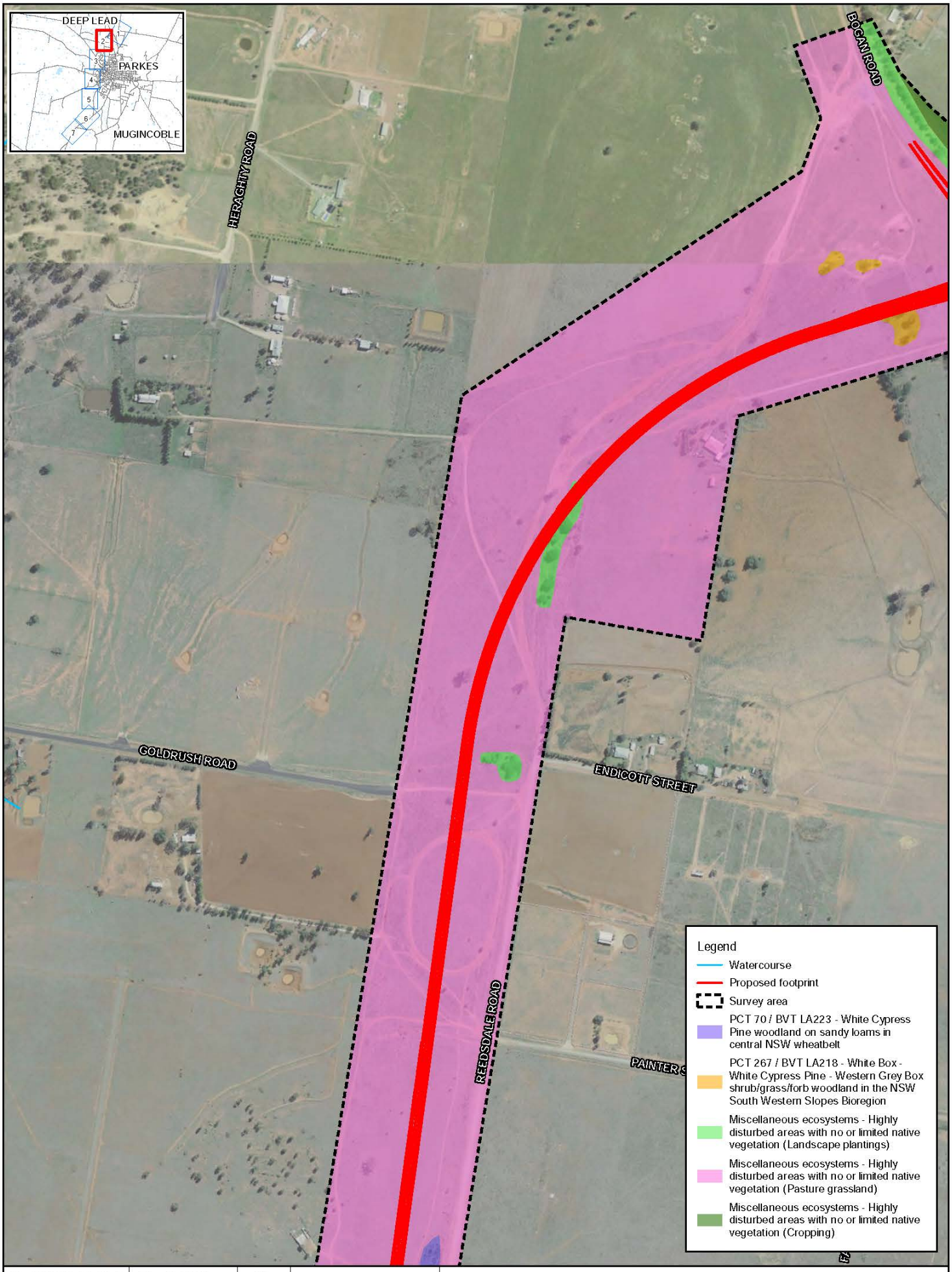

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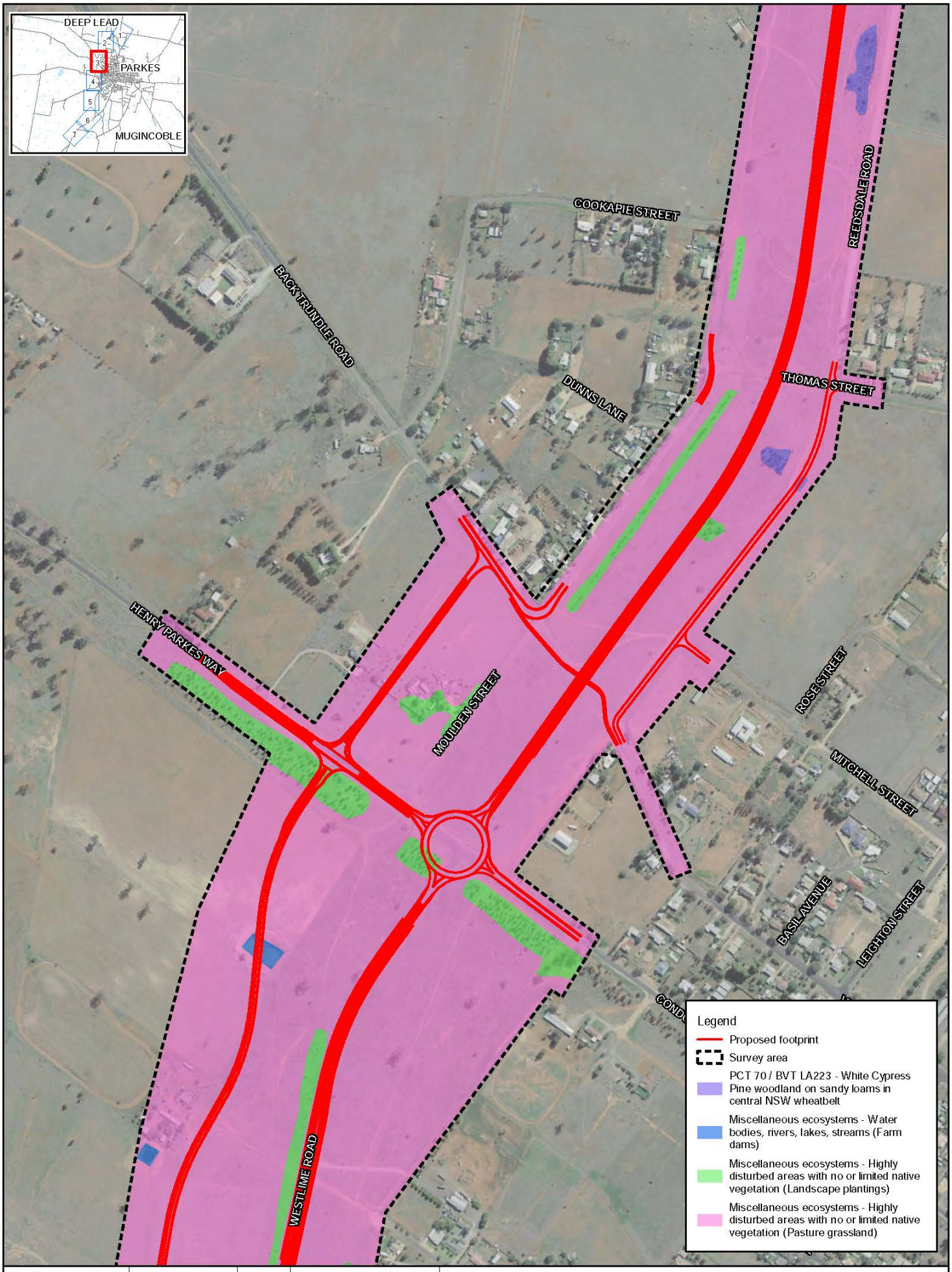

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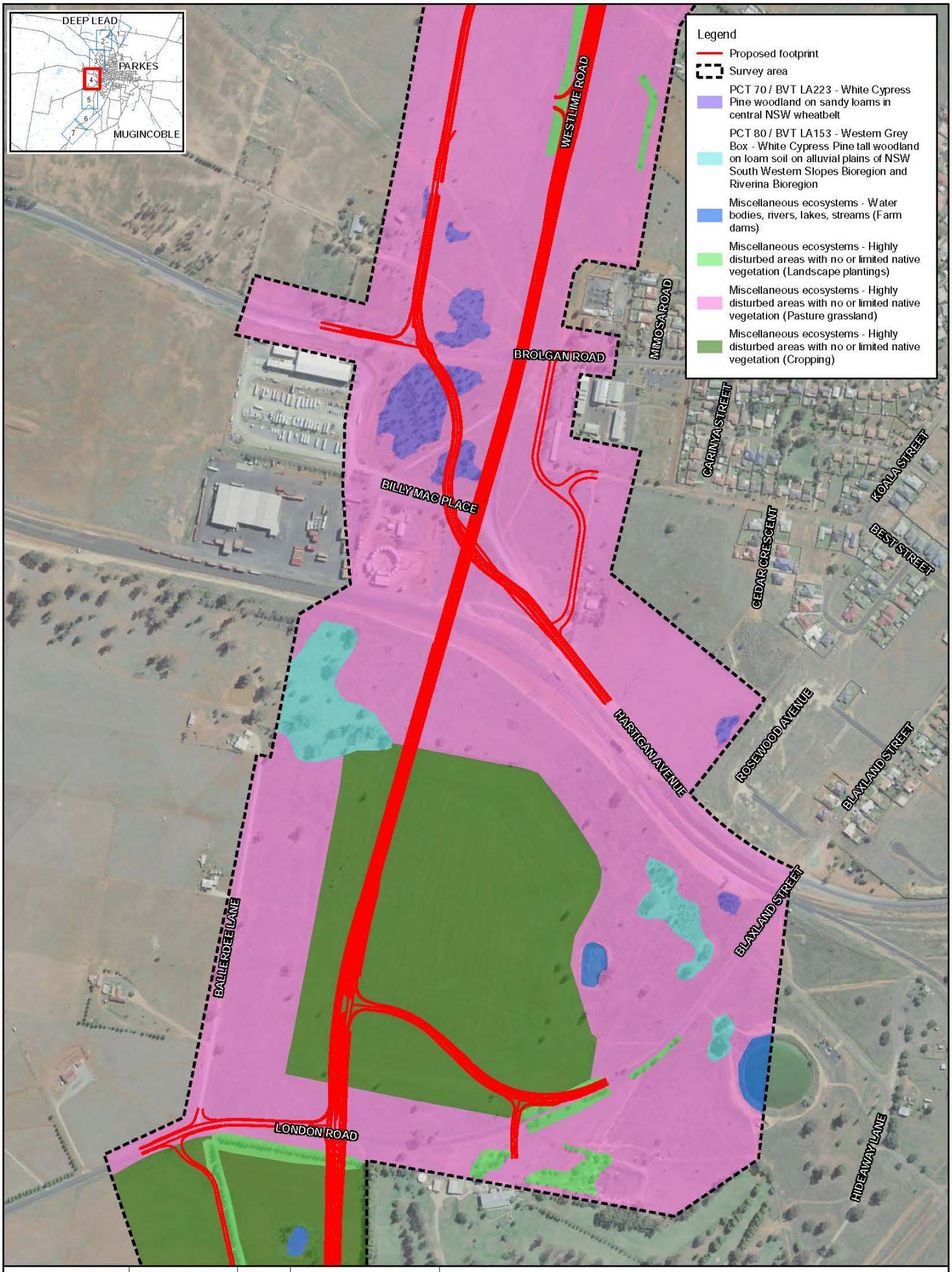

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Figure 3.1
Vegetation communities within the survey area
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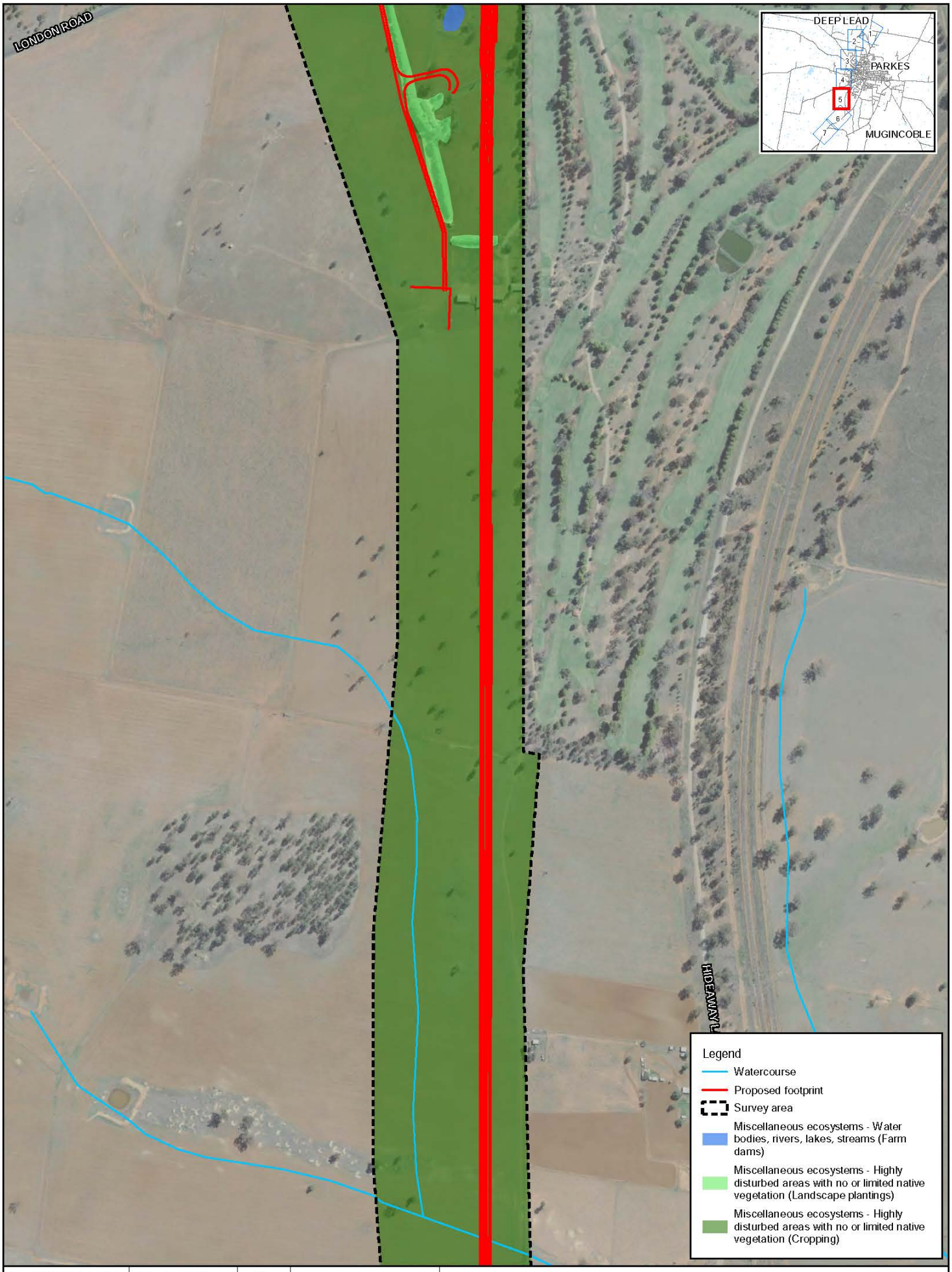

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Figure 3.1
Vegetation communities within the survey area

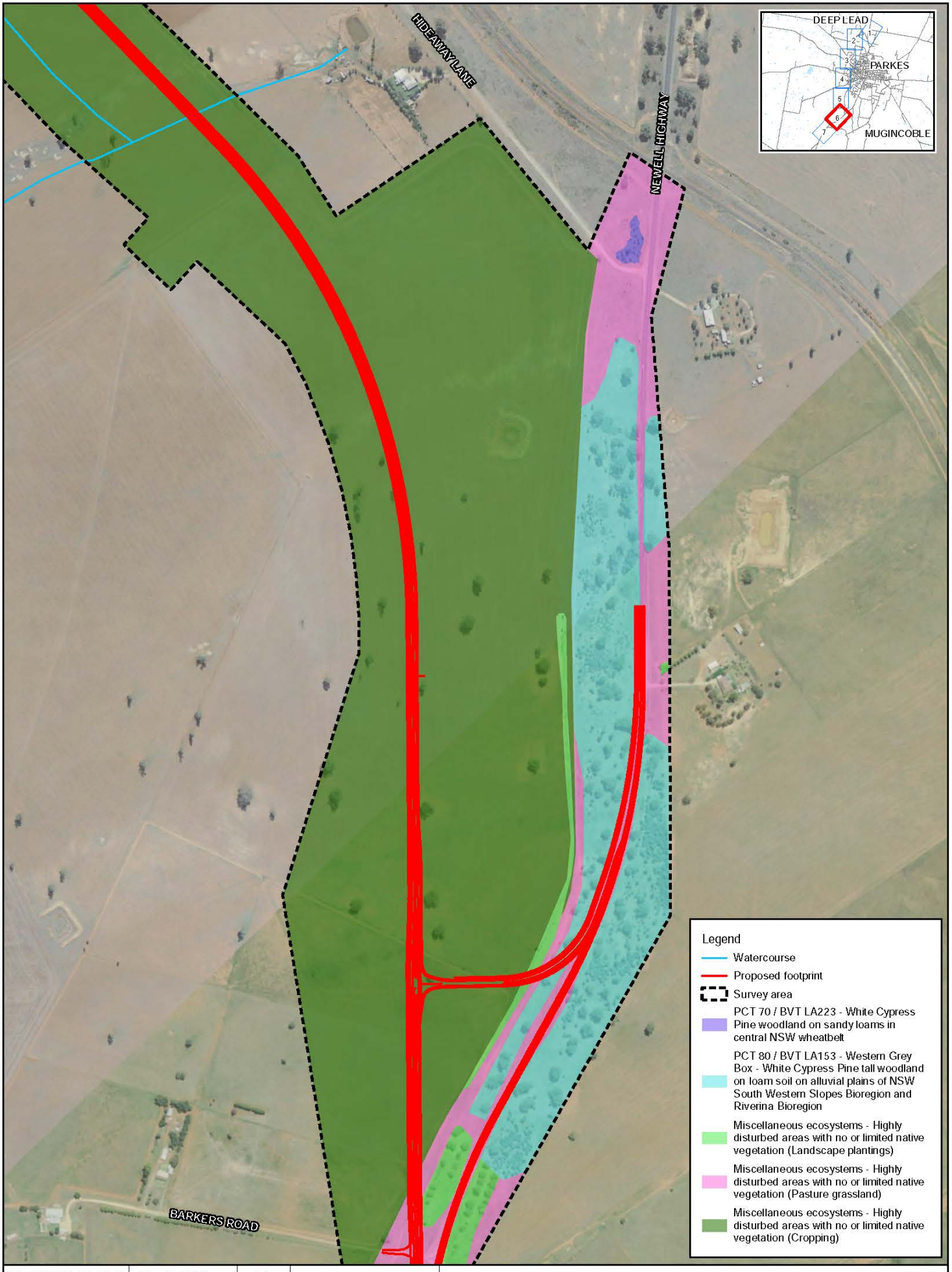

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Figure 3.1
Vegetation communities within the survey area

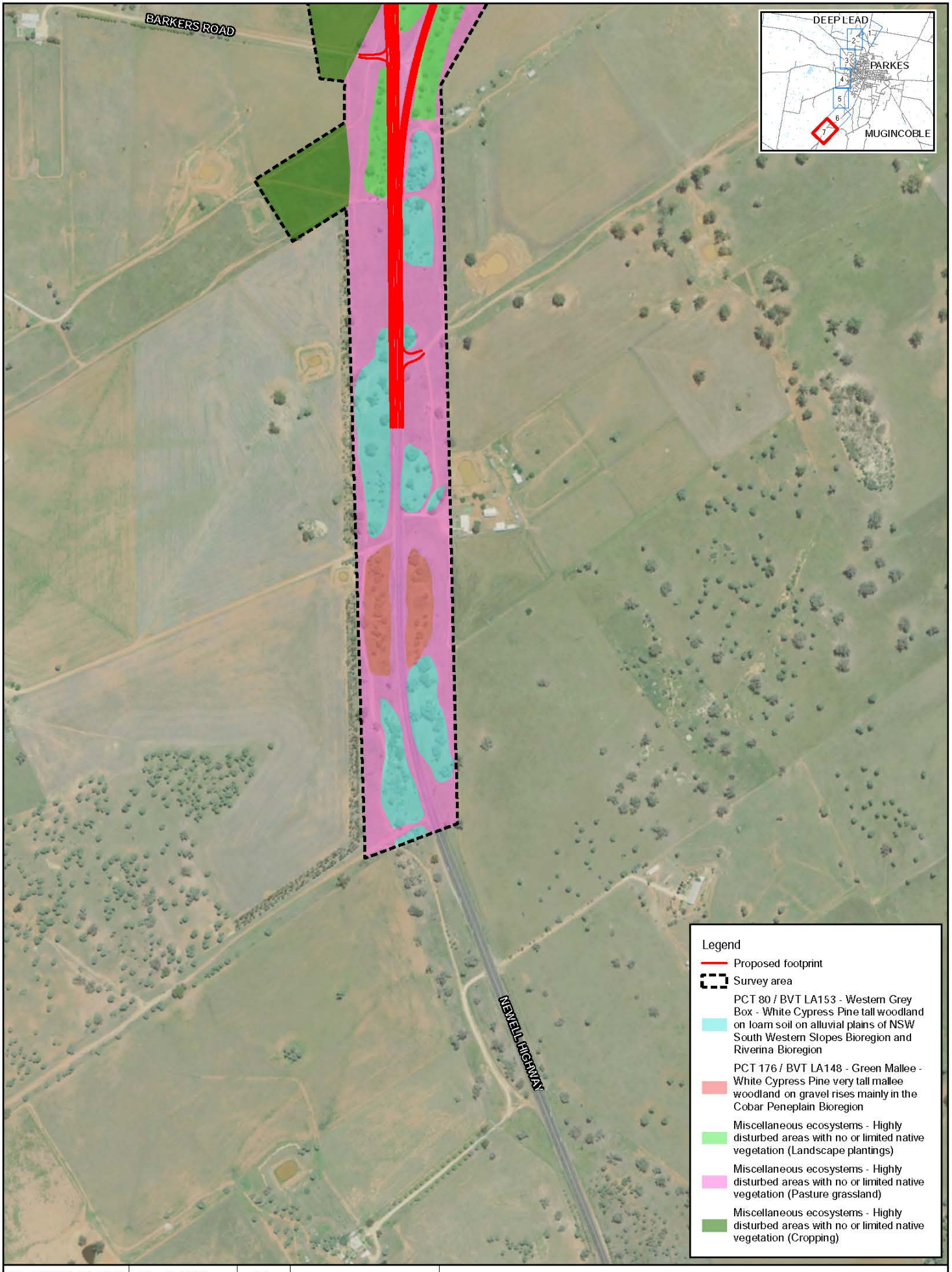

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Figure 3.1
Vegetation communities within the survey area

3.3.1 PCT 80 / BVT LA153 – Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion

This plant community type was primarily recorded in the southern portion of the survey area associated with the travelling stock route that fringes the Newell Highway. Several small isolated patches of this PCT were also recorded within an area next to Ballerdee Lane to the south of the Broken Hill railway line (Figure 3-1).

This community formed 5.1% of the survey area (18.85 ha) and occurred entirely in moderate to good condition BBAM condition class.

A general description of Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion is described in Table 3-4 and illustrated in Photo 3-1. A comparison of this plant community type against biometric benchmark data is presented in Table 3-5.

Table 3-4 PCT 80/BVT LA153 – Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion

PCT 80 / BVT LA153 Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion			
Description			
PCT justification	This plant community type is dominated by *Eucalyptus microcarpa* (Western Grey Box) and *Callitris glaucophylla* (White Cypress Pine) and occurs as woodland structure within the Lachlan IBRA subregion in the Riverina IBRA region		
Conservation Status	**Endangered:** Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions (BC Act) **Endangered:** Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia (EPBC Act)		
CMA % cleared	Within the Lachlan CMA, the recorded percentage cleared of this plant community type is 85%		
Extent	18.85 ha recorded in survey area with 0.84 ha occurring within the proposal footprint		
Plot & transect	Q1, Q3, Q5, Q6		
Condition	This community met the 'moderate to good' BBAM condition class definition		
Strata	**Height (average)**	**Plant foliage cover (%)**	**Dominant species**
Canopy	16–22 (18)	25–30	*Eucalyptus microcarpa* (Western Grey Box), *Eucalyptus albens* (White Box)
Mid stratum	6–10 (8)	15–25	*Eucalyptus microcarpa* (Western Grey Box), *Callitris glaucophylla* (White Cypress Pine)
Shrub stratum	4–8 (6)	20–25	*Callitris glaucophylla* (White Cypress Pine), *Senna artemisioides subsp. zygophylla*, *Acacia salicina* (Cooba), *Eucalyptus microcarpa* (Western Grey Box)
Ground layer	0.1–1.8 (0.8)	75–80	*Avena barbata** (Bearded Oats), *Bromus diandrus** (Great Brome), *Austrostipa scabra* (Speargrass), *Austrostipa blackii* (Crested Speargrass), *Rytidosperma sp.* (Wallaby Grass), *Wahlenbergia luteola* (Bluebell), *Maireana enchylaenoides* (Wingless Bluebush), *Einadia nutans subsp. nutans, Lolium rigidum** (Wimmera Ryegrass), *Ermophylla debilis, Medicago polymorpha** (Burr Medic).

Photo 3-1 PCT 80/BVT LA153 – Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion

Table 3-5 Comparison of PCT 80/BVT LA153 – Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion plot & transect data against the VIS biometric benchmark

Plots	Plant species richness	Native overstory (% cover)	Native mid-story (% cover)	Native groundcover (% cover)			Number of trees with hollows	Length of fallen timber (m)	Exotic plant (% cover)	Proportion of canopy regen (0–1)	Easting	Northing	Zone
				Grasses	Shrubs	Other							
Benchmark[1]	25	8–35	3–10	13–50	3–5	3–15	1	75					
Q1	26	12	10.5	28	6	16	1	7*	64	1	605593	6327689	55
Q3	19	16	12.5	38	8	18	0*	35	26	1	607051	6328798	55
Q5	13	19.5	25.5	42	8	22	1	0*	32	1	606877	6328555	55
Q6	10	9.5	<1*	8	0*	6	2	7*	86	1	607150	6332339	55

(1) Benchmark data for equivalent community in Lachlan IBRA subregion (PCT 80/BVT LA153 – Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion, Vegetation Formation: KF_CH3 Grassy Woodland, Vegetation Class: Floodplain Transitional Woodlands: source (NSW VIS 2.1 accessed May 2017 and cross referenced with Biobanking credit calculator V4.0 OEH): Red font indicates results outside benchmark value: * indicates, less than 25% of lower benchmark value.

3.3.2 PCT 70 / BVT LA223 – White Cypress Pine woodland on sandy loams in central NSW wheat belt

This plant community type occurred as small discrete patches throughout the survey area and was generally associated with areas along the travelling stock route in the central and southern sections and fringes the Newell Highway (Figure 3-1).

This community formed <1% of the survey area (2.84 ha) and occurred entirely in moderate to good condition BBAM condition class.

A general description of White cypress pine woodland on sandy loams in central NSW wheat belt is described in Table 3-6 and illustrated in Photo 3-2. A comparison of this plant community type against biometric benchmark data is presented in Table 3-7.

Table 3-6 PCT 70 / BVT LA223 – White Cypress Pine woodland on sandy loams in central NSW wheat belt

PCT 70 / BVT LA223 White Cypress Pine woodland on sandy loams in central NSW wheat belt			
Description			
PCT justification	This plant community type is dominated by *Callitris glaucophylla* (White Cypress Pine) and occurs as woodland structure on flats and rises on alluvial plains within the Lachlan catchment area on the Western Slopes and Plains.		
Conservation Status	This native plant community type is not commensurate with any final determination listing for a threatened ecological community under either the BC Act or the EPBC Act.		
CMA % cleared	Within the Lachlan CMA, the recorded percentage cleared of this plant community type is 60%		
Extent	2.84 ha recorded in survey area with 0.45 ha occurring within the proposal footprint		
Plot & transect	Q4, Q7		
Condition	This community met the 'moderate to good' BBAM condition class definition The mid and ground stratums have been the subject of historic and ongoing grazing and subsequently exhibit moderate to high foliage cover of exotic annual and perennial grasses and forbs.		
Strata	**Height (average)**	**Plant Foliage Cover (%)**	**Dominant Species**
Canopy	None	None	None present
Mid stratum	4–8 (6)	40–45	*Callitris glaucophylla* (White Cypress Pine)
Shrub stratum	1.8–4 (3)	10–15	*Callitris glaucophylla* (White Cypress Pine), *Lycium ferocissimum** (African Boxthorn)
Ground layer	0.1–1.8 (1.2)	75–80	*Vulpia myuros** (Rats Tail Fescue), *Avena barbata** (Bearded Oats), *Austrostipa scabra* (Speargrass), *Rytidosperma* sp. (Wallaby Grass), *Marrubium vulgare** (Horehound), *Trifolium arvense** (Haresfoot Clover), *Avena fratua** (Wild Oats)

Photo 3-2 PCT 70 / BVT LA223 – White Cypress Pine woodland on sandy loams in central NSW wheat belt

Table 3-7 Comparison of PCT 70 / BVT LA223 – White Cypress Pine woodland on sandy loams in central NSW wheat belt to Biobanking community benchmark data

Plots	Plant species richness	Native overstory (% cover)	Native mid-story (% cover)	Native groundcover (% cover)			Number of trees with hollows	Length of fallen timber (m)	Exotic plant (% cover)	Proportion of canopy regen (0–1)	Easting	Northing	Zone
				Grasses	Shrubs	Other							
Benchmark[1]	35	10–35	3–25	3–20	5–25	8–15	3	73					
Q4	14	15	0*	26	8	16	0	0*	58	1	0607196	6328991	55
Q7	5*	0*	21.5	0*	0*	4	0*	0*	50	0*	0607340	6332796	55

1. Benchmark data for equivalent community in Lachlan IBRA subregion (PCT 70 / BVT LA223 – White Cypress Pine woodland on sandy loams in central NSW wheat belt, Vegetation Formation: KF_CH3 Grassy Woodland, Vegetation Class: Floodplain Transitional Woodlands: source (NSW VIS 2.1 accessed May 2017 and cross referenced with Biobanking credit calculator V4.0 OEH): Red font indicates results outside benchmark value: * indicates, less than 25% of lower benchmark value.

3.3.3 PCT 176/ BVT LA148 – Green Mallee – White Cypress Pine very tall mallee woodland on gravel rises mainly in the Cobar Peneplain Bioregion

This plant community type was recorded in the most southerly portion of the survey area in one occurrence fringing the Newell Highway, as illustrated in Figure 3-1.

This community formed <1% of the survey area (1.17 ha) and occurred entirely in moderate to good BBAM condition class.

A general description of Green Mallee – White cypress pine very tall mallee woodland on gravel rises mainly in the Cobar Peneplain bioregion is described in Table 3-8 and illustrated in Photo 3-3. A comparison of this plant community type against biometric benchmark data is presented in Table 3-9.

Table 3-8 PCT 176/BVT LA148 – Green Mallee – White Cypress Pine very tall mallee woodland on gravel rises mainly in the Cobar Peneplain Bioregion

PCT 176/BVT LA148 – Green Mallee – White Cypress Pine very tall mallee woodland on gravel rises mainly in the Cobar Peneplain Bioregion			
Description			
PCT justification	This community is considered to form part of historical native plantings although is covered under PCT176 due to the mature age class of *Eucalyptus viridis* (Green Mallee) specimens and the occurrence of native groundcover species.		
Conservation Status	Not listed		
CMA % cleared	Within the Lachlan Catchment, 20% of PCT 176 is estimated to be cleared.		
Extent	1.17 ha with survey area, 0 ha were located within the proposal footprint		
Plot & transect	Q2		
Condition	This community met the 'moderate to good' BBAM condition class definition		
Strata	**Height (average)**	**Plant Foliage Cover (%)**	**Dominant Species**
Trees	10–12 (11)	15–20	*Eucalyptus viridis* (Green Mallee), *Eucalyptus albens* (White Box)
Small trees	1.5–3 (2)	5–7	*Callitris glaucophylla* (White Cypress Pine)
Shrubs	0.7–1.5 (1)	2–5	*Acacia salicina* (Cooba)
Ground covers	0.1–0.8 (0.5)	45–60	*Vittadinia cervicularis* (Annual New Holland Daisy), *Einadia nutans subsp. nutans, Rytidosperma caespitosum* (Ringed Wallaby Grass), *Echium plantagineum** (Paterson's Curse), *Rapistrum rugosum** (Turnip Weed), *Medicago polymorpha** (Burr Medic), *Hordeum leporinum** (Barley Grass), *Lolium rigidum** (Rye Grass)
Vines/ climbers and epiphytes	None	None	None present

Photo 3-3 PCT 176/BVT LA148 – Green Mallee – White Cypress Pine very tall mallee woodland on gravel rises mainly in the Cobar Peneplain Bioregion

Table 3-9 A comparison of PCT 176/BVT LA148 – Green Mallee – White Cypress Pine very tall mallee woodland on gravel rises mainly in the Cobar Peneplain Bioregion to Biobanking community benchmark data

Plots	Plant species richness	Native overstory (% cover)	Native mid-story (% cover)	Native groundcover (% cover)			Number of trees with hollows	Length of fallen timber (m)	Exotic plant (% cover)	Proportion of canopy regen (0–1)	Easting	Northing	Zone
				Grasses	Shrubs	Other							
Benchmark[1]	27	8–30	3–35	3–25	5–20	3–8	1	30					
Q2	19	6.5	3	6	2	4	1	0*	86	1	605707	6327845	55

1. Benchmark data for equivalent community in Lachlan IBRA subregion (PCT 176/BVT LA148 – Green Mallee – White Cypress Pine very tall mallee woodland on gravel rises mainly in the Cobar Peneplain Bioregion, Vegetation Formation: KF_CH11B Semi-arid Woodlands (Shrubby sub-formation), Vegetation Class: Inland Rocky Hill Woodlands: source (NSW VIS 2.1 accessed May 2017 and cross referenced with Biobanking credit calculator V4.0 OEH): Red font indicates results outside benchmark value: * indicates, less than 25% of lower benchmark value.

3.3.4 PCT 267/ BVT LA218 – White Box – White Cypress Pine – Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion

This plant community type was recorded in patchy locations in the northern sections of the survey area. In all occurrences, the community was surrounded by Pasture Grasslands, as outlined in Figure 3-1. This community formed <1% of the survey area (0.43 ha) and occurred entirely in moderate to good BBAM condition class.

A general description of White Box – White Cypress Pine – Western Grey Box shrub/grass/forb woodland in the NSW south western slopes bioregion is described in Table 3-10 and illustrated in Photo 3-4. A comparison of this plant community type against biometric benchmark data is presented in Table 3-11.

Table 3-10 PCT 267/BVT LA218 White Box White Cypress Pine Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion

PCT 267/BVT LA218 White Box White Cypress Pine Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion			
Description			
PCT justification	Eucalyptus (mostly grassy) Box Woodlands of the Tablelands and Western slopes		
Conservation Status	**Endangered:** White Box Yellow Box Blakely's Red Gum Woodland (BC Act) **Critically Endangered:** White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (EPBC Act)		
CMA % cleared	Within the Lachlan CMA the recorded percentage cleared of this plant community type is 90%		
Extent	0.43 ha was recorded within the survey area with 0.1 ha within the proposal footprint		
Plot & transect	Q8		
Condition	This community met the 'moderate to good' BBAM condition class definition		
Strata	**Height (average)**	**Plant Foliage Cover (%)**	**Dominant Species**
Canopy	10–18 (16)	15–25	*Eucalyptus albens* (White Box)
Mid stratum	None	None	None present
Shrub stratum	None	None	None present
Ground layer	0.1–1.4 (0.6)	65–80	*Avena barbata** (Bearded Oats), *Lolium rigidum** (Wimmera Ryegrass), *Hordeum leporinum** (Barley Grass)

Photo 3-4 PCT 267/BVT LA218 White Box White Cypress Pine Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion

Table 3-11 A comparison of PCT 267/BVT LA218 White Box White Cypress Pine Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion against the VIS biometric benchmark data

Plots	Plant species richness	Native overstory (% cover)	Native mid-story (% cover)	Native groundcover (% cover)			Number of trees with hollows	Length of fallen timber (m)	Exotic plant (% cover)	Proportion of canopy regen (0–1)	Easting	Northing	Zone
				Grasses	Shrubs	Other							
Benchmark[1]	23	8-35	1-20	15-70	3-5	3-20	0.8	66					
Q8	12	2.5	0	8	0	4	1	9*	84	0*	0609105	6336375	55

1. Benchmark data for equivalent community in Lachlan IBRA subregion (PCT 267/BVT LA218 White Box White Cypress Pine Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion, Vegetation Formation: KF_CH3 Grassy Woodland, Vegetation Class: Western Slopes Grassy Woodlands: source (NSW VIS 2.1 accessed May 2017 and cross referenced with Biobanking credit calculator V4.0 OEH): Red font indicates results outside benchmark value: * indicates, less than 25% of lower benchmark value.

3.4 Other ecosystems not associated with PCTs

Four other distinct vegetation associations were recorded in the survey area in parts which have been subject to substantial physical, hydrological and chemical alteration of soils. These vegetation associations are not consistent with any naturally occurring plant community types and are described below.

3.4.1 Pasture grassland

This vegetation association is dominated by exotic annual grasses such as *Avena barbata** (Bearded Oats)*, Lolium rigidum** (Wimmera Ryegrass)*, Hordeum leporinum** (Barley Grass). At the time of survey (November 2016), native grass and forb cover ranged from 0-5% with scattered occurrences of *Austrostipa scabra* (Speargrass), *Austrostipa blackii* (Crested Speargrass) and *Rytidosperma sp.* (Wallaby Grass). Pasture grassland occurs over most the travelling stock route in the northern and central portion of the survey area and covers about 53% of 208.06 hectares in area.

It should be noted that as the field surveys were conducted during spring, most this vegetation association was dominated by exotic pasture grass species. It is considered likely that exotic grass species cover will fluctuate throughout the year based on seasonality and climatic conditions. Given the floristic composition at the time of field survey, pasture grassland vegetation was not considered to form part of any derived native grassland vegetation type. It is however acknowledged that patches of derived native grassland may occur through this vegetation type based on seasonal and climatic variation although given the absence of remnant tree through much of this area any patches are not considered likely to form part of any threatened ecological community.

This vegetation association is illustrated in Photo 3-5 and its location within the survey area is shown in Figure 3-1.

Photo 3-5 Pasture grassland occurring within the travelling stock route

3.4.2 Landscape plantings

Linear areas of predominantly native landscape plantings occur in the northern portion of the survey area, this vegetation fringes Newell Highway and Bogan Road. Native landscape plantings are relatively wide spread throughout Parkes and line Reedsdale Road, Moulden Street, Henry Parkes Way, Condobolin Road, Westlime Road, London Road and Parkes Golf Course within the central portion of the survey area.

This vegetation association has been recorded to cover 16.33 ha of the survey area with the proposal footprint impacting 1.94 ha. The occurrence of Landscape Planting within the survey area is shown in Figure 3-1 and illustrated in Photo 3-6.

Photo 3-6 Landscape plantings fringing Condobolin Road within the central portion of the survey area

3.4.3 Cropping

Areas subject to cropping occur mostly in the southern portion of the survey area and are associated with rural land holdings. The dominant crops growing at the time of survey were *Brassica* sp.* (Canola) and *Trifolium pratense** (Red Clover).

This vegetation association has been recorded to cover 151.07 ha of the survey area with the proposal footprint impacting 21.71 ha. The occurrence of Cropping within the survey area is shown in Figure 3-1 and illustrated in Photo 3-7.

Photo 3-7 Cropping of Canola and Red Clover within the survey area

3.4.4 Farm dams

Throughout the survey area Farm Dams associated with agricultural land use were recorded within Pasture Grassland, Cropping and Landscape plantings. These dams were generally small in extent and scattered with no connectivity between water bodies or remnant vegetation. They covered 1.53 ha within the survey area with the proposal footprint impacting on 0.22 ha. The occurrence of Farm Dams within the survey area is shown in Figure 3-1 and illustrated in Photo 3-8.

Photo 3-8 A farm dam within the survey area

3.5 Noxious weeds

A total of 39 weeds were recorded within survey area, of these, three are declared noxious within the local control authority area of Parkes Shire Council under the *Noxious Weeds Act* (NSW Department of Primary Industries 2017) and two are listed as weeds of national significance (WoNS) (Weeds in Australia 2017). Noxious and WoNS species recorded within the survey area are listed in Table 3-12.

Table 3-12 Noxious weeds recorded within the survey area and their associated weed classes

Noxious weed species		**Weed class**	**WONS**
Scientific name	**Common name**	**Parkes Shire Council**	
*Hypericum perforatum**	St John's Wort	Class 4 Regionally Controlled Weed The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread	N/A
*Lycium ferocissimum**	African Boxthorn	Class 4 Regionally Controlled Weed The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread	Yes
Solanum elaeagnifolium	Silverleaf Nightshade	Class 4 Regionally Controlled Weed The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread	Yes

3.6 Threatened ecological communities

The presence and extent of recorded plant community types and their aligning threatened ecological communities (TECs) under the BC Act, in the survey area and proposal footprint are described in Table 3-13. A comparison between each recorded PCT and the final determination criteria of the aligning threatened ecological community is outlined in section 3.6.1.

Table 3-13 PCTs recorded within the survey area and their aligning TECs under BC Act

Plant community type	Aligning threatened ecological community listed under the BC Act	Area (ha) within survey area	Area (ha) within proposal footprint
PCT 80/BVT LA153 – Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion	Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions (Endangered)	18.85	0.84
PCT 267/BVT LA218 – White Box – White Cypress Pine – Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion	White Box Yellow Box Blakely's Red Gum Woodland (Endangered)	0.43	0.10

3.6.1 Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions

PCT 80/BVT LA153 – Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion and was recorded in discrete patches throughout the southern portion of the survey area. This community forms part of the threatened ecological community Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions.

The final determination for this threatened ecological community outlines criteria which depict the typical vegetation structure, floristic assemblage, soils and locality. To determine if the recorded community meets the criteria which will qualify it for BC Act status, PCT 80/BVT LA153 has been compared to the final determination for Inland Grey Box Woodland (NSW Scientific Committee 2011). An overview of this comparison is outlined in Table 3-14.

Table 3-14 A comparison of Inland Grey Box Woodland TEC final determination criteria against PCT80 / BVT LA153 attributes within the survey area

Descriptive criteria	Inland Grey Box Woodland Final determination criteria	PCT80 / BVT LA153 attributes within the survey area
Geographical	In NSW the community principally occurs within the Riverina and South West Slopes Bioregions and is also found in portions of the Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions.	Occurs in the South West Slopes Bioregion
Floristic – canopy	Inland Grey Box Woodland includes those woodlands in which the most characteristic tree species – *Eucalyptus microcarpa* – is often found in association with *Eucalyptus populnea* subsp. *bimbil* (Bimbil Box), *Callitris glaucophylla* (White Cypress-pine), *Brachychiton populneus* (Kurrajong), *Allocasuarina luehmannii* (Buloke) or *Eucalyptus melliodora* (Yellow Box), and sometimes with *Eucalyptus albens* (White Box).	The canopy is dominated by *Eucalyptus microcarpa* (Western Grey Box) and *Callitris glaucophylla* (White Cypress-pine).
Floristic composition	A total of 72 characteristic species are listed under Paragraph 3	Number of total characteristic species / species richness per sample plot: • Q1 – 14/23 (61%) • Q3 – 8/19 (42%) • Q5 – 7/13 (54%) • Q6 – 2/10 (20%) – canopy species present
Local Government Area	Paragraph 5 Local Government Areas of Albury, Berrigan, Bland, Blayney, Boorowa, Cabonne, Carrathool, Conargo, Coolamon, Cootamundra, Corowa, Cowra, Deniliquin, Dubbo, Forbes, Gilgandra, Greater Hume, Griffith, Gundagai, Gunnedah, Gwyder, Inverell, Jerilderie, Junee, Lachlan, Leeton, Liverpool Plains, Lockhart, Mid-western Regional, Murray, Murrumbidgee, Narrabri, Narrandera, Narromine, Parkes, Temora, Upper Lachlan, Urana, Wagga Wagga, Wakool, Warrumbungle, Weddin, Wellington and Young.	Parkes LGA
Soils and Geology	Soils of Tertiary and Quaternary alluvial (or occasionally colluvial or eluvial) origin, largely corresponding with the Red Brown Earths	Red clay derived soils
Floristic - specific	Gradients in floristic diversity with reference to dominant native grass species including *Austrostipa scabra*, *Austrodanthonia* spp. and *Enteropogon* spp.	Dominated by Austrostipa scabra & Austrodanthonia spp.
Vegetation Class	The nominated community belongs to 'Floodplain Transition Woodlands' vegetation class of Keith (2004).	Corresponds to the NSW Vegetation Class - Floodplain Transition Woodlands
Meets BC listing criteria?	–	Yes

3.6.2 White Box Yellow Box Blakely's Red Gum Woodland

PCT 267/BVT LA218 White Box White Cypress Pine Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion was recorded in several small patches in the northern portion of the survey area. In all occurrences, the community was surrounded by Pasture Grasslands. This plant community type aligns to the threatened ecological community listed as White Box Yellow Box Blakely's Red Gum Woodland under the BC Act. The occurrence of this community was compared to the scientific determination criteria of White Box Yellow Box Blakely's Red Gum Woodland to determine whether it meets BC Act status (NSW Scientific Committee 2011). An overview of this comparison is outlined in Table 3-15.

Table 3-15 A comparison of White Box Yellow Box Blakely's Red Gum Woodland final determination criteria against PCT267 / BVT LA218 attributes within the survey area

Descriptive criteria	White Box Yellow Box Blakely's red gum woodland final determination criteria	PCT267 / BVT LA218 attributes within the survey area
Geographical	The community occurs within the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands and NSW South Western Slopes Bioregions.	Yes, occurs in the South West Slopes Bioregion
Floristic – canopy	Characteristic tree species include one or more of the following species in varying proportions and combinations - *Eucalyptus albens* (White Box), *Eucalyptus melliodora* (Yellow Box) or *Eucalyptus blakelyi* (Blakely's Red Gum). Grass and herbaceous species generally characterise the ground layer. In some locations, the tree overstorey may be absent as a result of past clearing or thinning and at these locations only an understorey may be present. Shrubs are generally sparse or absent, though they may be locally common.	Yes, the canopy is dominated by *Eucalyptus albens* (White Box). The shrub layer is generally absent with the ground layer containing some native grass and herbaceous species.
Floristic composition	A total of 95 characteristic species are listed under Paragraph 3.	Within the recorded quadrat 8 of the recorded 12 species (58%) are characteristic of White Box Yellow Box Blakely's Red Gum Woodland.
Floristic - specific	Woodlands with *Eucalyptus albens* are most common on the undulating country of the slopes region.	Yes, woodland structure dominated by *Eucalyptus albens* (White Box) with native grass species such as *Rytidosperma sp.* present.
Vegetation Class	The understorey may be highly modified by grazing history and disturbance.	The occurrence within the survey area, being within a travelling stock route, has been subject grazing and historic disturbances
Meets BC listing criteria?	–	Yes

3.7 Groundwater dependent ecosystems

Groundwater dependant ecosystems (GDEs) are communities of plants, animals and other organisms whose extent and life processes are dependent on groundwater (Department of Land and Water Conservation, 2002). When considering GDEs, groundwater is generally defined as the saturated zone of the regolith (the layer of loose rock resting on bedrock, constituting the surface of most land) and its associated capillary fringe, however it excludes soil water held under tension in soil pore spaces (the unsaturated zone or vadose zone) (Eamus et al., 2006).

GDEs include a diverse range of ecosystems from those entirely dependent on groundwater to those that may use groundwater while not having a dependency on it for survival (i.e. ecosystems or organisms that use groundwater opportunistically or as a supplementary source of water) (Hatton and Evans, 1998). Eamus *et al.* (2006) considers the following broad classes of these ecosystems:

- Aquifer and cave ecosystems, where stygofauna (groundwater-inhabiting organisms) may reside within the groundwater resource. The hyporheic zones (see ecosystem 5 in Figure 3-2) of rivers and floodplains are also included in this category because these ecotones often support stygobites (obligate groundwater inhabitants).
- All ecosystems dependent on the surface expression of groundwater. This category includes base-flow rivers and streams, wetlands (see ecosystems 2 and 3 in Figure 3-2), some floodplains and mound springs and estuarine seagrass beds. While it is acknowledged that plant roots are generally below ground, this class of groundwater dependant ecosystems requires a surface expression of groundwater, which may, in many cases, then soak below the soil surface and thereby become available to plant roots.
- All ecosystems dependent on the subsurface presence of groundwater, often accessed via the capillary fringe (non-saturated zone above the saturated zone of the water table) when roots penetrate this zone. This class includes terrestrial ecosystems such as River Red Gum (*Eucalyptus camaldulensis*) forests on the Murray–Darling basin (see ecosystems 1 and 4 in Figure 3-2). No surface expression of groundwater is required in this class of groundwater dependant ecosystems.

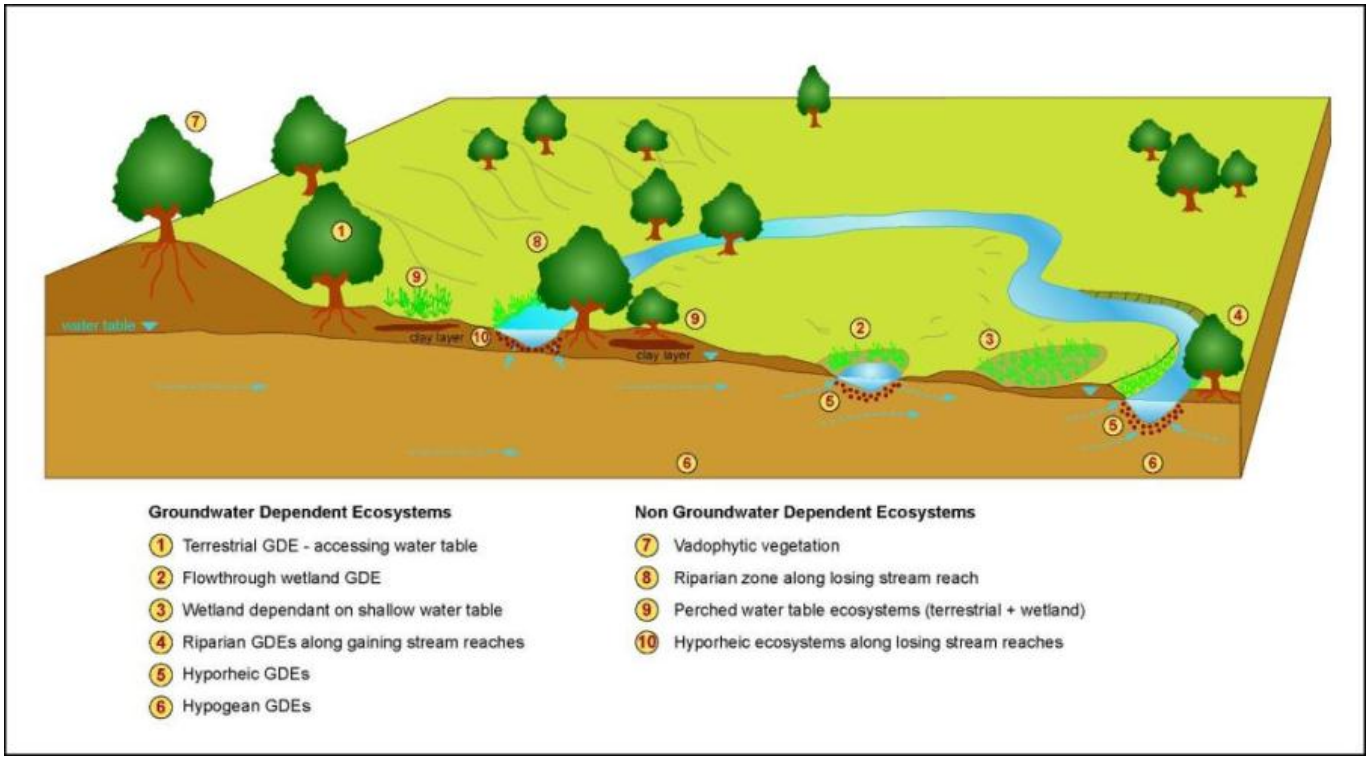


Figure 3-2 Conceptual biophysical model of groundwater dependent ecosystems

GDEs possess a range of values, including being important and sometimes rare ecosystems in themselves, as well as providing important ecosystem services such as water purification (Department of Land and Water Conservation, 2002).

The dependence (or interaction) of the vegetation communities identified within the proposal footprint, on groundwater was determined by aligning them with the groundwater dependant ecosystem types identified by Eamus *et al.* (2006) (Figure 3-2).

No GDE mapped in the *Atlas of Groundwater Dependent Ecosystems* (Bureau of Meteorology, 2016) occurs in close proximity to the survey area. Plant community types identified within the survey area are considered likely to be classified as "vadophytic vegetation" (Figure 3-2) as these communities were found on slopes associated with well drained soils and disconnected from localised groundwater systems. As such, no groundwater aquifer or cave systems, wetlands or other potential groundwater dependant ecosystems were identified within the survey area from the field surveys and desktop assessment.

The proposal would require excavation and shaping of the upper soil profile and minor alterations to drainage, however it is unlikely to require groundwater extraction or significant impact on groundwater dependant ecosystems within the locality.

3.8 Threatened species

This section contains a discussion of the known or likely presence and distribution of threatened flora and fauna species and populations, migratory species and threatened ecological communities and their habitats in the survey area and surrounds. It also includes discussion, where relevant, of the local and regional significance of species, populations and ecological communities likely to occur.

The results of the desktop assessment of the likely occurrence of threatened species and populations as well as the result of field surveys are presented in the following sections.

3.8.1 Threatened flora

No threatened species of plant were recorded within the survey area during recent and previous field surveys. Based on the habitat characteristics of the survey area, one threatened species of plant is considered to have a moderate likelihood of occurrence based on the presence of suitable potential habitat (Table 3-16).

Table 3-16 Threatened flora species (moderate – high likelihood)

Scientific name	Common name	Status		Potential occurrence
		BC Act[1]	EPBC Act[2]	
Austrostipa wakoolica	–	E1	E	**Moderate.** Within the Lachlan major catchment a total of 22 vegetation types are identified to provided potential habitat for this species (Office of Environment & Heritage 2017). Of these, LA153 and LA218 have been recorded within the survey area and collectively provided about 21 hectares of habitat for this species. Records within locality of the survey area are dated between 1991 and 1992 with the closest record being about 11 km to the west of the survey area. No individuals of this species were recorded during field surveys.

Note:

1. Endangered (E1), as listed on the BC Act
2. Endangered (E) as listed on the EPBC Act

Threatened fauna

One threatened species of animal was recorded within the survey area (Table 3-17).

Table 3-17 Recorded threatened fauna

Scientific name	Common name	Status		Potential occurrence
		BC Act[1]	EPBC Act[2]	
Pomatostomus temporalis temporalis	Grey-Crowned Babbler (Eastern subspecies)	V	Not listed	**Recorded**. Utilising Grey Box woodland and understorey shrubby habitat in southern portions of survey area along the road reserve of the Newell Highway. No nests were recorded in alignment at the time of survey.

Note:

1. Vulnerable (V) listing on the BC Act
2. Endangered (E) listing on the EPBC Act

Based on the habitat characteristics of the survey area, a further 15 threatened species of animal are considered to have a moderate to high likelihood of occurrence (refer Table 3-18).

Table 3-18 Threatened fauna species (moderate –high likelihood)

Scientific name	Common name	Status		Potential occurrence
		BC Act[1]	EPBC Act[2]	
Birds[3]				
Anthochaera phrygia (syn. Xanthomyza phrygia)	Regent Honeyeater	CE	EM	**Moderate.** May occur within survey area during seasonal movements and utilise blossoming eucalypts.
Artamus cyanopterus	Dusky Woodswallow	V	Not listed	**Moderate**. Potential foraging habitat in survey area in associated with remnant vegetation and roadside remnants.
Circus assimilis	Spotted Harrier	V	Not listed	**Moderate**. Potential foraging habitat within survey area.
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	V	Not listed	**Moderate**. Potential foraging habitat within remnant vegetation.
Daphoenositta chrysoptera	Varied Sittella	V	Not listed	**Moderate**. Potential foraging habitat within remnant vegetation.
Falco subniger	Black Falcon	V	Not listed	**Moderate**. Potential foraging habitat within survey area.
Glossopsitta pusilla	Little Lorikeet	V	Not listed	**Moderate**. Potential foraging habitat within remnant vegetation.

Scientific name	Common name	Status		Potential occurrence
		BC Act[1]	EPBC Act[2]	
Hieraaetus morphnoides	Little Eagle	V	Not listed	**Moderate**. Potential foraging habitat within survey area.
Lathamus discolor	Swift Parrot	E	E	**Moderate.** May occur within survey area during seasonal movements and utilise blossoming eucalypts.
Ninox connivens	Barking Owl	V	Not listed	**Moderate**. Potential foraging habitat within survey area.
Petroica phoenicea	Flame Robin	V	Not listed	**Moderate**. Potential foraging habitat within remnant vegetation.
Polytelis swainsonii	Superb Parrot	V	V	**Moderate.** Potential foraging habitat within remnant vegetation.
Stagonopleura guttata	Diamond Firetail	V	Not listed	**Moderate**. Potential foraging habitat within remnant vegetation.
Mammals				
Chalinolobus picatus	Little Pied Bat	V	Not listed	**Moderate**. Potential foraging and roosting habitat within remnant vegetation.
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	Not listed	**Moderate**. Potential foraging and roosting habitat within remnant vegetation.

Note:

1. Vulnerable (V), Endangered (E), Critically Endangered (CE) as listed on the BC Act
2. Vulnerable (V), Endangered (E), Critically Endangered (CE), as listed on the EPBC Act
3. EPBC Migratory species that are not listed as Threatened have not been included in the table, these species have been included in Section 3.12 below.

Aquatic habitat

As an objective of the *Fisheries Management Act 1991*, the Department of Primary Industries has defined Key Fish Habitat as habitats which are important to the "sustainability of the recreational and commercial fishing industries, the maintenance of fish populations generally and the survival and recovery of threatened aquatic species" (Department of Primary Industries, 2013). Detailed aquatic fauna surveys are warranted if a proposal crosses any Class 1 watercourse (major fish habitat) or a Class 2 watercourse (moderate fish habitat) that has been identified as having a moderate or high potential to be occupied by a threatened aquatic species of animal.

The proposal does not cross any Class 1 or Class 2 watercourses and no detailed aquatic surveys were conducted.

Minor aquatic habitat within the proposal footprint consists of ephemeral drainage lines and farm dams. Most aquatic habitat was in the form of artificial dams utilised for agricultural purposes. During the time of surveys several common aquatic species were identified including Smooth Toadlet (*Uperoleia laevigata*) and Peron's Tree Frog (*Litoria peronii*). Whilst much of the aquatic habitats were artificial they can still provide habitat for a number of fauna including birds, amphibians and reptiles. However, due to their

artificial nature and locations within a fragmented landscape, the utilisation of these water bodies by fauna is generally by species which are mobile and well adapted to moving across fragmented landscapes.

3.9 Critical habitat or Areas of Outstanding Biodiversity Value (AOBV)

The registers of critical habitat listed under the EPBC Act, TSC Act and FM Act were checked during the desktop analysis and no critical habitat was found to occur within or in the locality of the survey area.

Areas of declared critical habitat under the *Threatened Species Conservation Act 1995*, (including Little Penguin and Wollemi Pine declared areas), have become the first Areas of Outstanding Biodiversity Value (AOBV) in NSW with the commencement of the *Biodiversity Conservation Act 2016*.

The *Biodiversity Conservation Regulation 2017* establishes the criteria for declaring AOBVs. The criteria have been designed to identify the most valuable sites for biodiversity conservation in NSW. No AOBVS are found to occur within or in the locality of the survey area.

3.10 Wildlife connectivity corridors

Wildlife corridors are generally links of native vegetation that join two or more areas of similar habitat and are critical for sustaining ecological processes, such as provision for animal movement and the maintenance of viable populations (Department of Environment, 2016).

No wildlife corridors are mapped within the survey area. Habitat in the survey area has been largely disturbed by broad scale agricultural practices and residential use with some intact remnant habitat still occurring along the road reserve of Newell Highway. The impact or removal of a relatively small linear area of remnant vegetation would not result in a key barrier to wildlife movement or primary corridor links.

3.11 SEPP 44 Koala Habitat

One SEPP 44 Schedule 2 feed tree species, *Eucalyptus albens* (White Box) was recorded within the survey area. In addition, Parkes LGA is listed in Schedule 1 of SEPP 44, whilst SEPP 44 does not apply to proposals being assessed under division 5.1 of the EP&A Act, it is still considered within this assessment and the potential impact to Koalas reviewed.

The definition of "potential koala habitat" within SEPP 44 policy states – "*…areas of native vegetation where the trees listed in Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component."* Within the survey area *Eucalyptus albens* (White Box) does constitute 15% of the upper canopy or lower tree component, although the patch size is very small <0.35 hectares and is generally isolated and this reason the survey area is not classified as potential Koala habitat.

Furthermore, the lack of recent sightings within the greater locality or within the survey area suggests that the presence of Koala's is likely to be low and not consistent with the definition of "core koala habitat" – "*…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".* It is unlikely that Koalas regularly inhabit or rely on the resources within the survey area and therefore the disturbance of native vegetation within the survey area would not constitute to disturbance of core Koala habitat.

3.12 Matters of National Environmental Significance

The focus of this section is threatened species, populations and communities and migratory species listed under the EPBC Act. It also included a discussion of the following MNES as they relate to biodiversity:

- World and national heritage
- Wetlands of international and national importance.

3.12.1 Threatened species of flora listed under the EPBC Act

No threatened species of plant were recorded within the survey area during recent and previous field surveys. Based on the habitat characteristics of the survey area, one threatened species of plant is considered to have a moderate likelihood of occurrence based on the presence of suitable potential habitat (Table 3-19).

Table 3-19 Threatened species of plants listed under the EPBC Act

Scientific name	Common name	Status		Potential occurrence
		BC Act[1]	EPBC Act[2]	
Austrostipa wakoolica	–	E1	E	**Moderate.** Within the Lachlan major catchment a total of 22 vegetation types are identified to provided potential habitat for this species (Office of Environment & Heritage 2017). Of these, LA153 and LA218 have been recorded within the survey area and collectively provided about 21 hectares of habitat for this species. Records within locality of are dated between 1991 and 1992 with the closest record being about 11 km to the west of the survey area. No individuals of this species were recorded during field surveys. The proposal will impact on about 0.94 ha of potential habitat for this species.

Note:

1. Endangered (E1), as listed on the BC Act
2. Endangered (E), as listed on the EPBC Act

3.12.2 Threatened species of fauna listed under the EPBC Act

Threatened species of fauna listed under the EPBC Act considered likely to occur within the survey area, based on desktop and field based habitat assessment, are shown in Table 3-20. During the field surveys, none of these species were recorded. The detailed likelihood of occurrence assessment for species considered during the desktop study is presented in Appendix D.

Table 3-20 Threatened species of animal listed under the EPBC Act

Scientific name	Common name	Status		Potential occurrence
		BC Act[1]	EPBC Act[2]	
Birds				
Anthochaera phrygia (syn. Xanthomyza phrygia)	Regent Honeyeater	CE	EM	**Moderate**. May occur within survey area during seasonal movements and utilise blossoming eucalypts.
Lathamus discolor	Swift Parrot	E1	E	**Moderate.** May occur within survey area during seasonal movements and utilise blossoming eucalypts.
Polytelis swainsonii	Superb Parrot	V	V	**Moderate.** Potential foraging habitat within remnant vegetation.

Note:

1. Vulnerable (V), Endangered (E1), Critically Endangered (CE) as listed on the BC Act.
2. Vulnerable (V), Endangered (E), Critically Endangered (CE), as listed on the EPBC Act

3.12.3 Nationally threatened ecological communities

Based on desktop analysis, two endangered ecological communities were considered likely to occur within the survey area:

- Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia
- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland.

Field surveys established the presence of Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia in the form of vegetation type PCT 80/BVT LA153 - Western Grey Box - White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion. Based on patch size and condition thresholds this vegetation type is considered to form part of this threatened ecological community listing and was confirmed to cover 18.85 hectares within the survey area.

- Vegetation type PCT 267/BVT LA218 White Box White Cypress Pine Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion, recorded within the survey area, does not meet EPBC Act condition thresholds for White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland
- An overview of each community and condition threshold assessment is provided below.

Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia

In determining if vegetation type PCT 80/BVT LA153 - Western Grey Box - White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion forms part of this threatened ecological community listing it must meet condition thresholds outlined in the listing advice (Threatened Species Scientific Committee 2010). An overview of PCT 80/BVT LA153 - Western Grey Box - White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion against condition threshold is outlined in Table 3-21.

This assessment observed that Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia occurred within the survey area as three patches; being:

- Western side fringing Newell Highway - > 0.5 hectares
- Eastern side fringing Newell Highway - > 0.5 hectares
- In vicinity of Ballerdee Land - > 0.5 hectares.

Based on this assessment, the total extant area of Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia within the survey area is 18.61 hectares with the proposal impacting on a total area of 0.57 hectares.

Table 3-21 Condition thresholds for the Grey Box (E. microcarpa) Grassy Woodlands and Derived Native Grasslands of South-Eastern Australia ecological community.

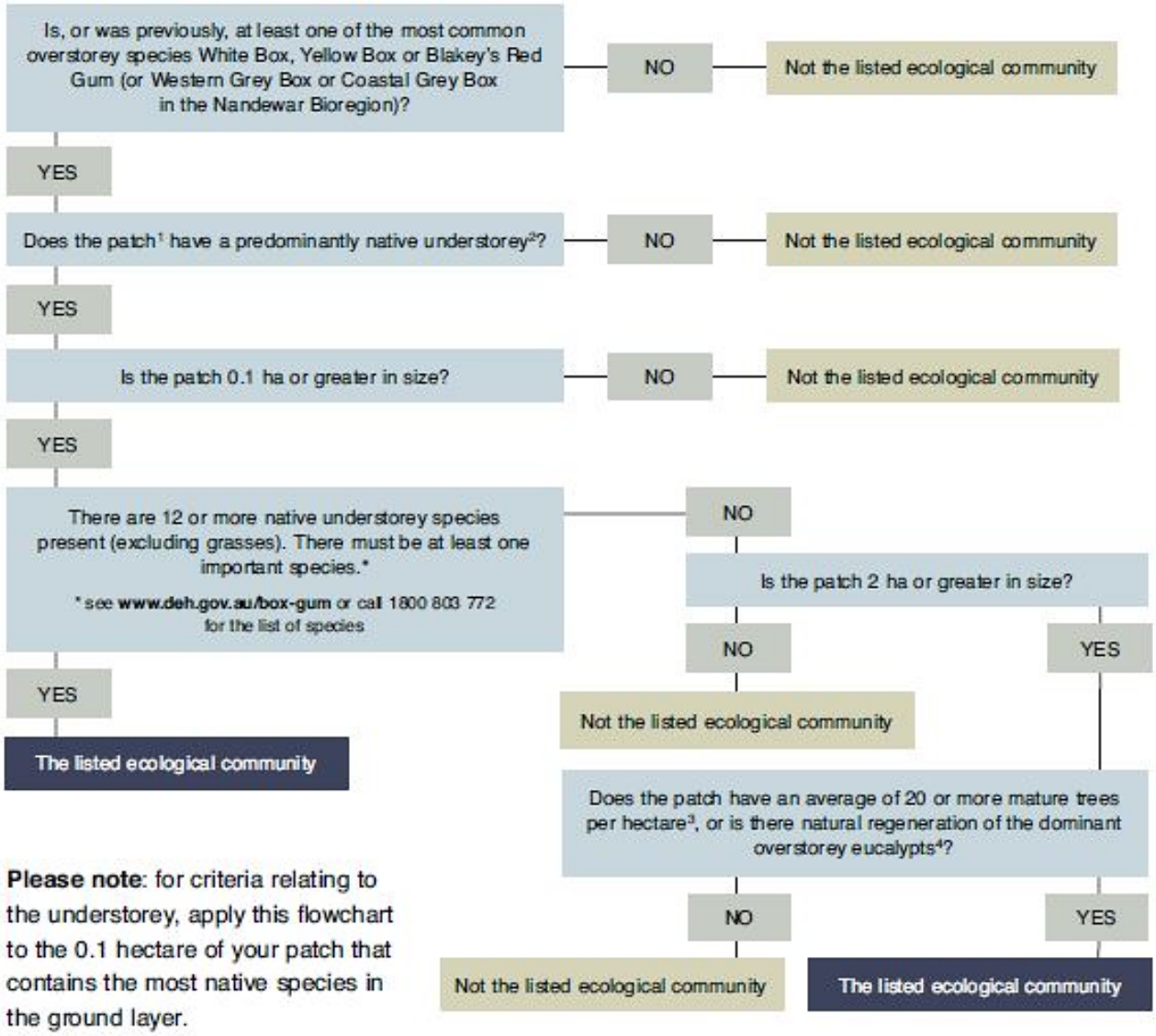
Category and rationale	Thresholds	PCT 80 / BVT LA153 within the survey area
Criteria that are broadly applicable	1a. The minimum patch size is 0.5 hectare; and 1b. The canopy layer contains Grey Box (E. microcarpa) as the dominant or co-dominant tree species; and 1c. The vegetative cover of non-grass weed species in the ground layer is less than 30% at any time of the year.	Yes Yes Yes – forms part of the TEC listing
Additional criteria that apply to smaller woodland patches (0.5 to <2 ha in area) with tree crown cover >10%	2a. At least 50% of the vegetative cover in the ground layer comprises perennial native species at any time of the year; and 2b. 8 or more perennial native species (6 or more in the Flinders Lofty Block Bioregion of South Australia) are present in the mid and ground layers at any time of the year.	N/A
Additional criteria that apply to larger woodland patches with a well-developed canopy (2 ha or more in area)	3a. At least 8 trees/ha are hollow bearing or have a diameter at breast height of 60 cm or more10; and 3b. at least 10% of the vegetative ground cover comprises perennial native grasses at any time of the year; or 4a. At least 20 trees/ha have a diameter at breast height of 12 cm or more; and 4b. at least 50% of the vegetative cover in the ground layer comprises perennial native species.	N/A

Category and rationale	Thresholds	PCT 80 / BVT LA153 within the survey area
Additional criteria that apply to patches where the canopy is less developed or absent (derived grassland) (≥0.5 ha in area)	5a. Woodland density does not meet criteria 3a or 4a, or is a derived grassland with clear evidence that the site formerly was a woodland with a tree canopy dominated or co-dominated by E. microcarpa; and 5b. At least 50% of the vegetative cover in the ground layer is made up of perennial native species at any time of the year; and 5c. 12 or more native species are present in the ground layer at any time of the year.	N/A
Meets EPBC Act listing criteria?	–	Yes – forms part of the TEC listing

White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland

In determining if vegetation type PCT 267/BVT LA218 White Box White Cypress Pine Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion meets EPBC Act condition threshold criteria for this threatened ecological community, recorded plot data and vegetation mapping was assessed against the determination flow chart outlined under the EPBC Act policy statement for this listing (Table 3-22).

Table 3-22 Community determination flow chart for White Box – Yellow Box – Blakely's Red Gum grassy woodlands and derived native grasslands



[1] Patch – a patch is a continuous area containing the ecological community (areas of other ecological communities such as woodlands dominated by other species are not included in a patch). In determining patch size it is important to know what is, and is not, included within any individual patch. The patch is the larger of:

- an area that contains five or more trees in which no tree is greater than 75 m from another tree, or
- the area over which the understorey is predominantly native.

Patches must be assessed at a scale of 0.1 ha (1000m^2) or greater.

[2] A predominantly native ground layer is one where at least 50 per cent of the perennial vegetation cover in the ground layer is made up of native species. The best time of the year to determine this is late autumn when the annual species have died back and have not yet started to regrow. (At other times of the year, you can determine whether something is perennial or not is if it is difficult to pull out of the soil. Annual species pull out very easily.)

[3] Mature trees are trees with a circumference of at least 125 cm at 130 cm above the ground.

[4] Natural regeneration of the dominant overstorey eucalypts when there are mature trees plus regenerating trees of at least 15 cm circumference at 130 cm above the ground.

Based on the flow chart condition threshold criteria, the following assessment is provided for the occurrence of PCT 267/BVT LA218 White Box White Cypress Pine Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion within the survey area (Table 3-23).

Table 3-23 Assessment of condition threshold criteria for White Box – Yellow Box – Blakely's Red Gum grassy woodlands and derived native grasslands

Condition threshold criteria	PCT 267 / BVT LA218 within the survey area
1. Is, or was previously, at least one of the most common overstorey species White Box, Yellow Box or Blakey's Red Gum (or Western Grey Box or Coastal Grey Box in the Nandewar Bioregion)?	Yes (white Box)
2. Does the patch have a predominately native understory	No – exotic weed cover was assessed to be > 50% (84%)
3. Is the patch 0.1 ha or greater in size?	Yes (0.43 ha)
4. There are 12 or more native understorey species present (excluding grasses). There must be at least one important species	No 5 native understorey species including 1 important species were recorded
Is the patch 2 ha or greater in size?	No
Does the patch have an average of 20 or more mature trees per hectare, or is there natural regeneration of the dominant overstorey eucalypts?	No
Meets EPBC Act listing criteria?	**No – it does not form part of this listing**

Based on condition threshold criteria assessment, the occurrence of vegetation type PCT 267/BVT LA218 White Box White Cypress Pine Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion within the survey area is not considered to form part of the threatened ecological community White Box – Yellow Box – Blakely's Red Gum grassy woodlands and derived native grasslands. Given this, no further consideration of this community is required under this assessment.

Migratory species listed under the EPBC Act

Migratory species are protected under international agreements, to which Australia is a signatory, including JAMBA, CAMBA, RoKAMBA and the Bonn Convention on the Conservation of Migratory Species of Wild Animals. Migratory species are considered Matters of NES and are protected under the EPBC Act.

No migratory species listed under the EPBC Act have been recorded in the survey area during field surveys. A total of five species listed as migratory under the EPBC Act were identified with a moderate or high likelihood of occurrence within the survey area, however majority of habitat is not likely to be important habitat for these species (refer to Table 3-24).

Table 3-24 Threatened fauna migratory species (moderate – high likelihood)

Scientific name	Common name	EPBC status[1]	Potential occurrence
Apus pacificus	Fork-tailed Swift	M	**Moderate**. Potential foraging habitat available. May occur intermittently within survey area during seasonal movements.
Ardea (Bulbulcus) ibis	Cattle Egret	M	**Moderate**. Potential foraging habitat available. May occur intermittently within agricultural land during seasonal movements.
Hirundapus caudacutus	White-throated Needletail	M	**Moderate.** May occur over survey area during seasonal movements.
Merops ornatus	Rainbow Bee-eater	M	**Moderate**. Potential to occur within remnant vegetation during seasonal movements
Plegadis falcinellus	Glossy Ibis	M	**Moderate**. Potential foraging habitat within agricultural areas.

Note:

1. Migratory (M) as listed on the EPBC Act

These species (Table 3-24) have the potential to utilise a wide variety of habitats, including disturbed/modified areas. Although these species are listed as migratory, they are not threatened species and populations are considered secure.

Under the EPBC Act, an action is likely to have a significant impact on a Migratory species if it substantially modifies, destroys or isolates an area of important habitat for the species (Department of Environment 2013). The site does not comprise important habitat for any species of Migratory bird known or considered likely to occur, as it does not contain:

- Habitat used by a Migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species
- Habitat that is of critical importance to the species at particular life-cycle stages
- Habitat used by a Migratory species that is at the limit of the species' range
- Habitat within an area where the species is declining (Department of Environment 2013).

The habitats within the survey area are unlikely to constitute important habitat for any of these migratory species. Therefore, this group has not been considered further.

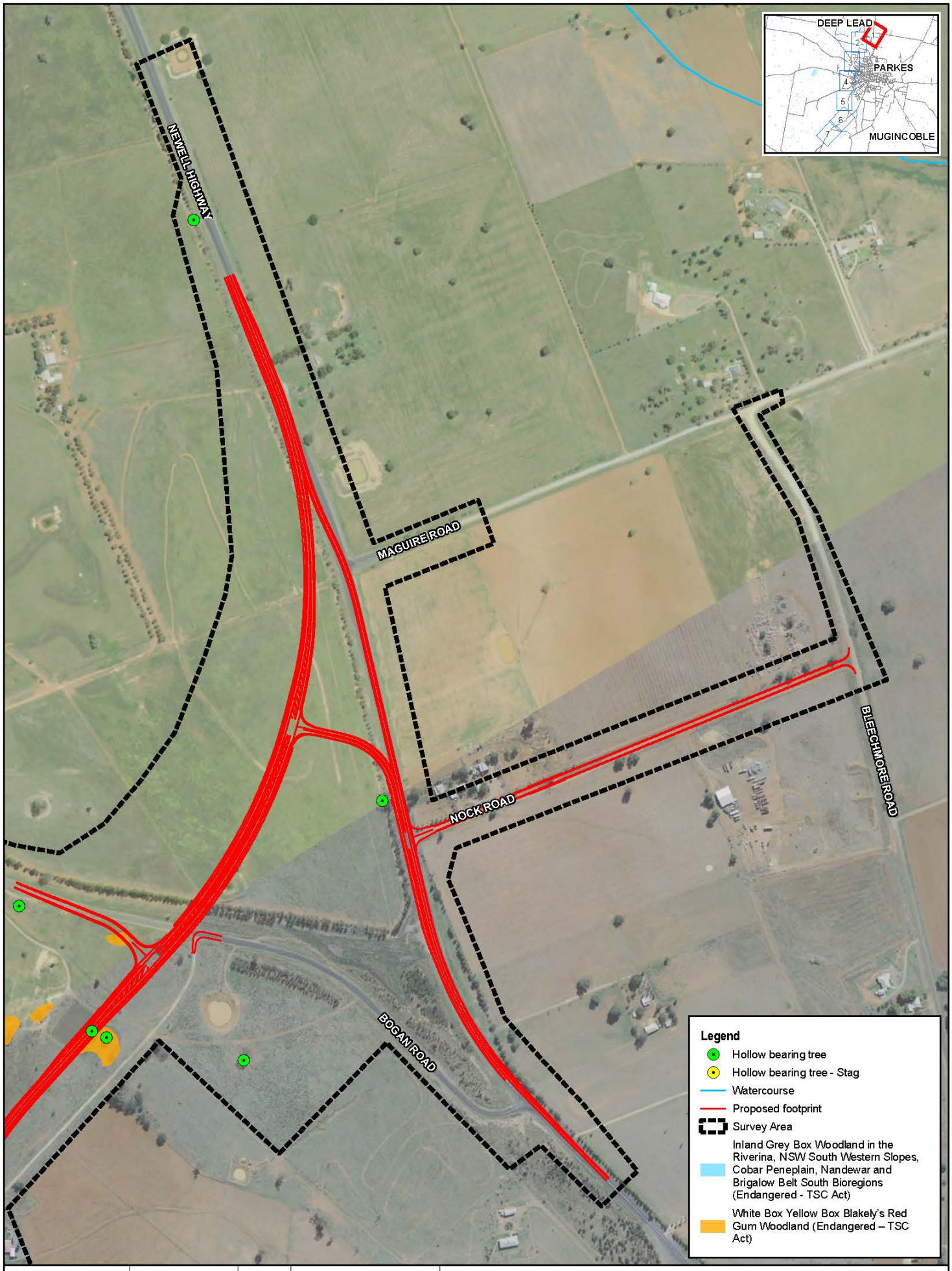
World and National heritage

Databases searches revealed no occurrence of any listed world or national heritage places within 20 kilometres of the survey area.

Wetlands of international and national importance

Databases searches revealed no occurrence of any wetlands of international importance within 20 kilometres of the survey area.

Due to the scale and nature of the proposal it is considered that the work will not likely impact any wetlands of national importance within the locality of the proposal footprint.



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Parkes Bypass Biodiversity Assessment
Figure 3.3
Threatened species, communities and habitat features

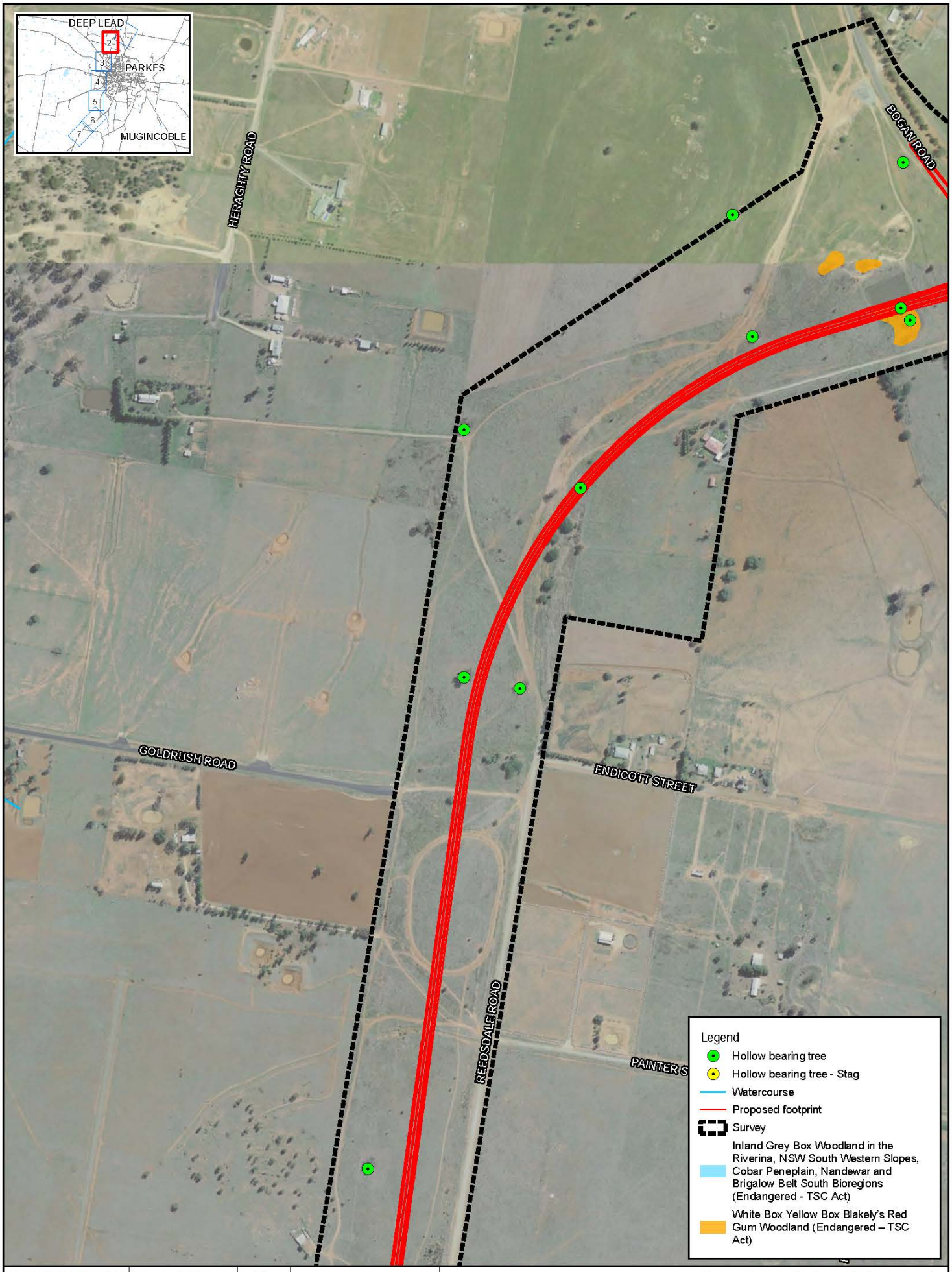

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Figure 3.3
Threatened species, communities and habitat features
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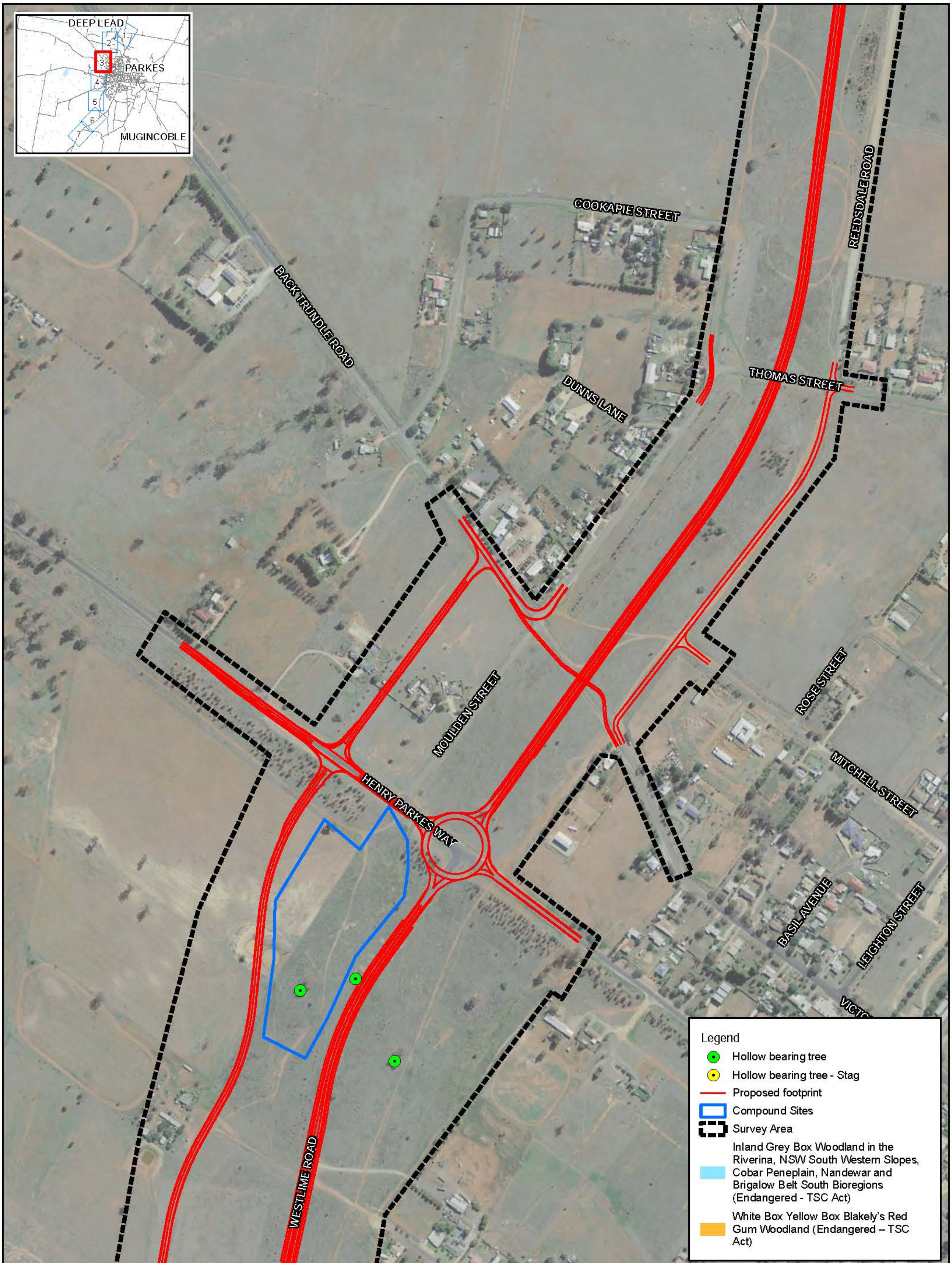

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Figure 3.3

Threatened species, communities and habitat features

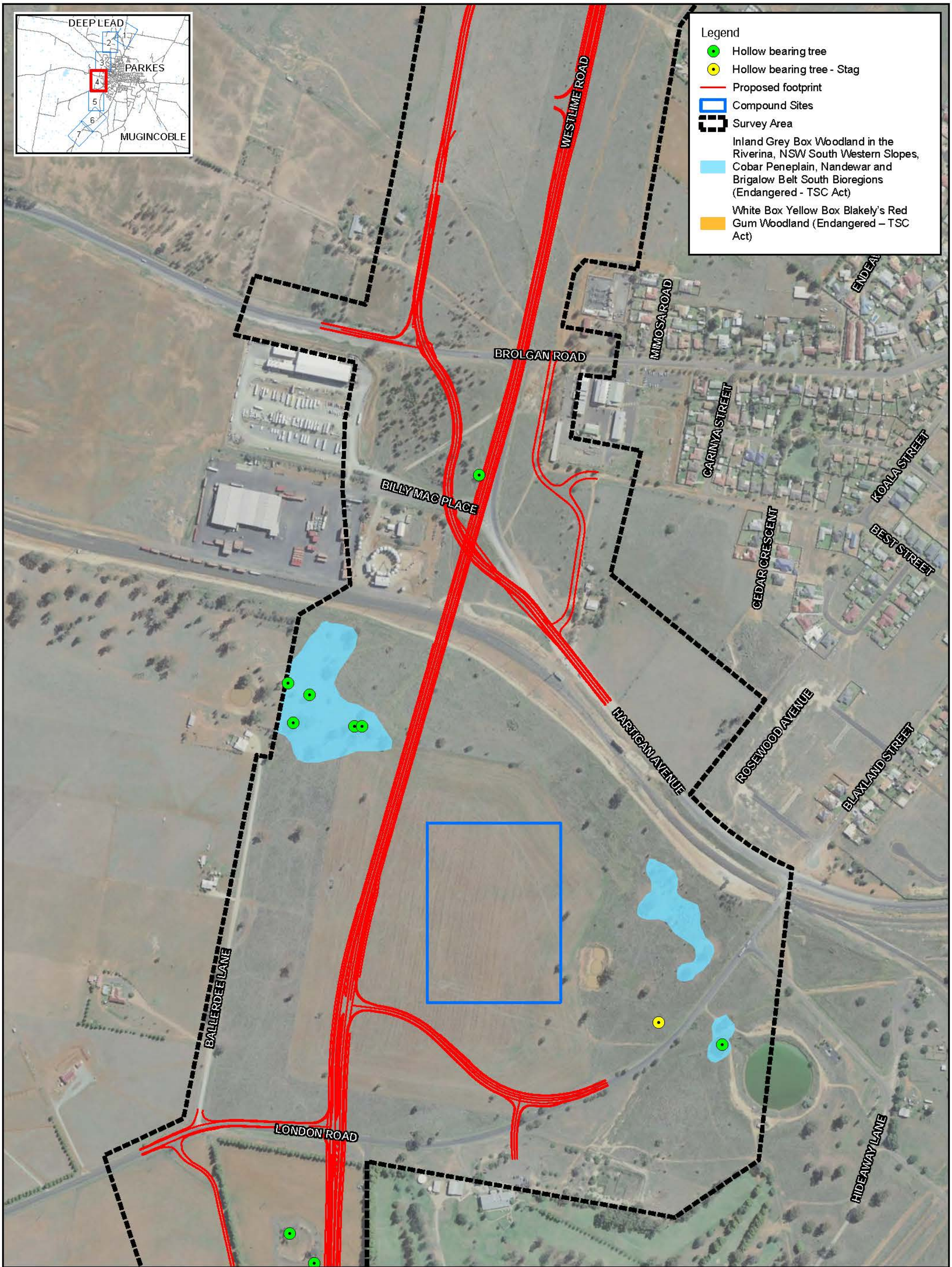

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Figure 3.3

Threatened species, communities and habitat features

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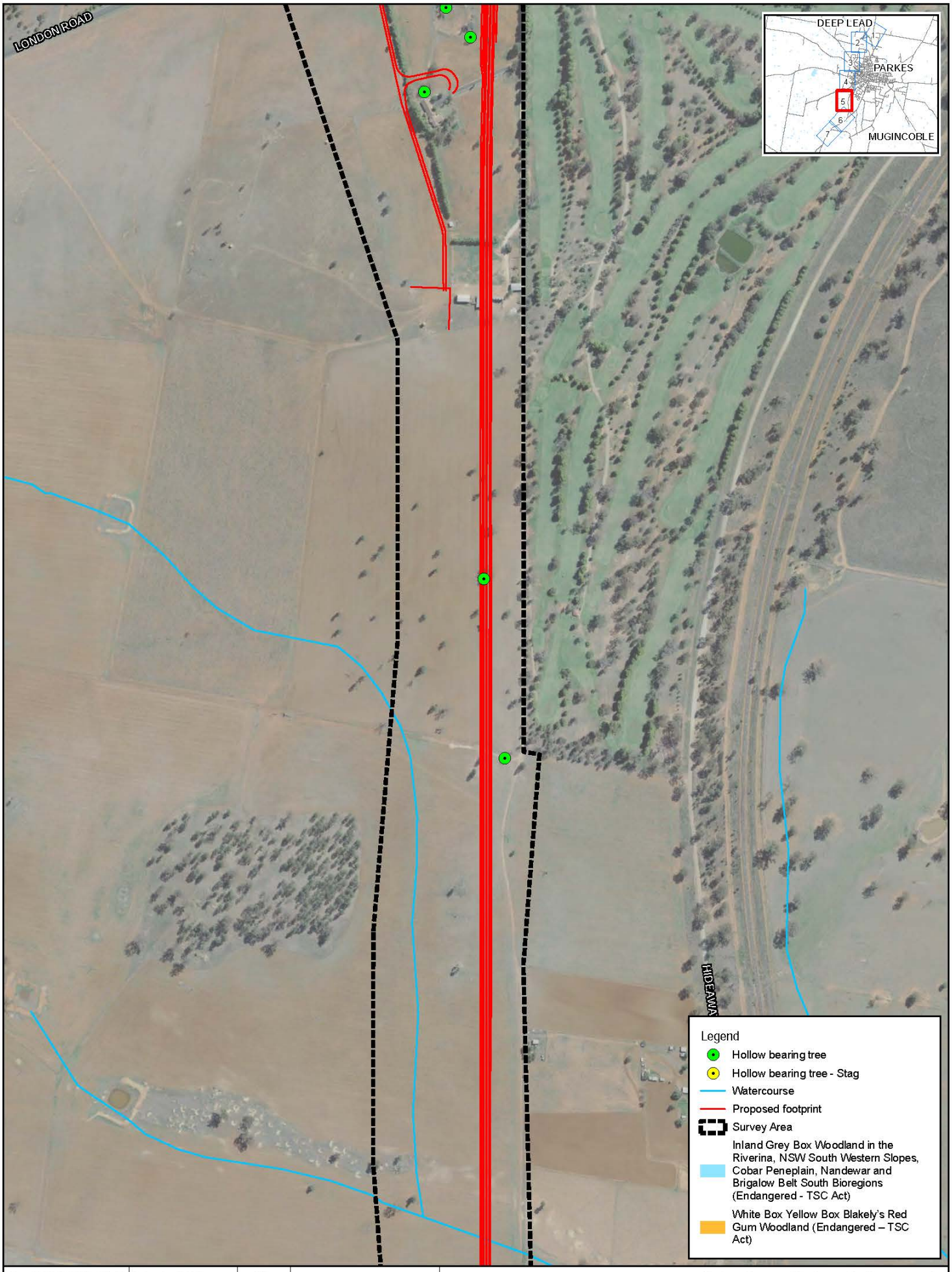

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Figure 3.3
Threatened species, communities and habitat features
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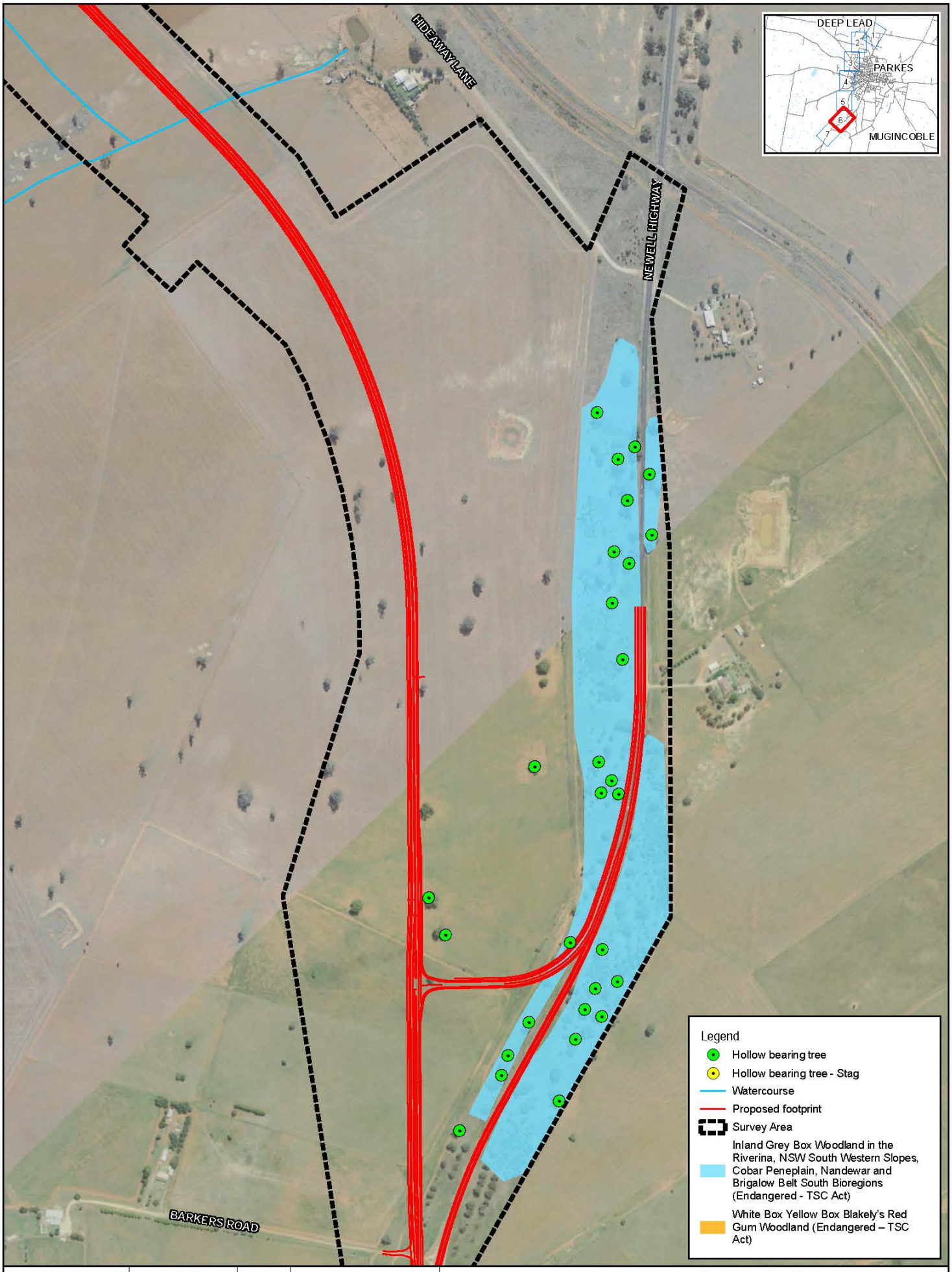

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Figure 3.3
Threatened species, communities and habitat features

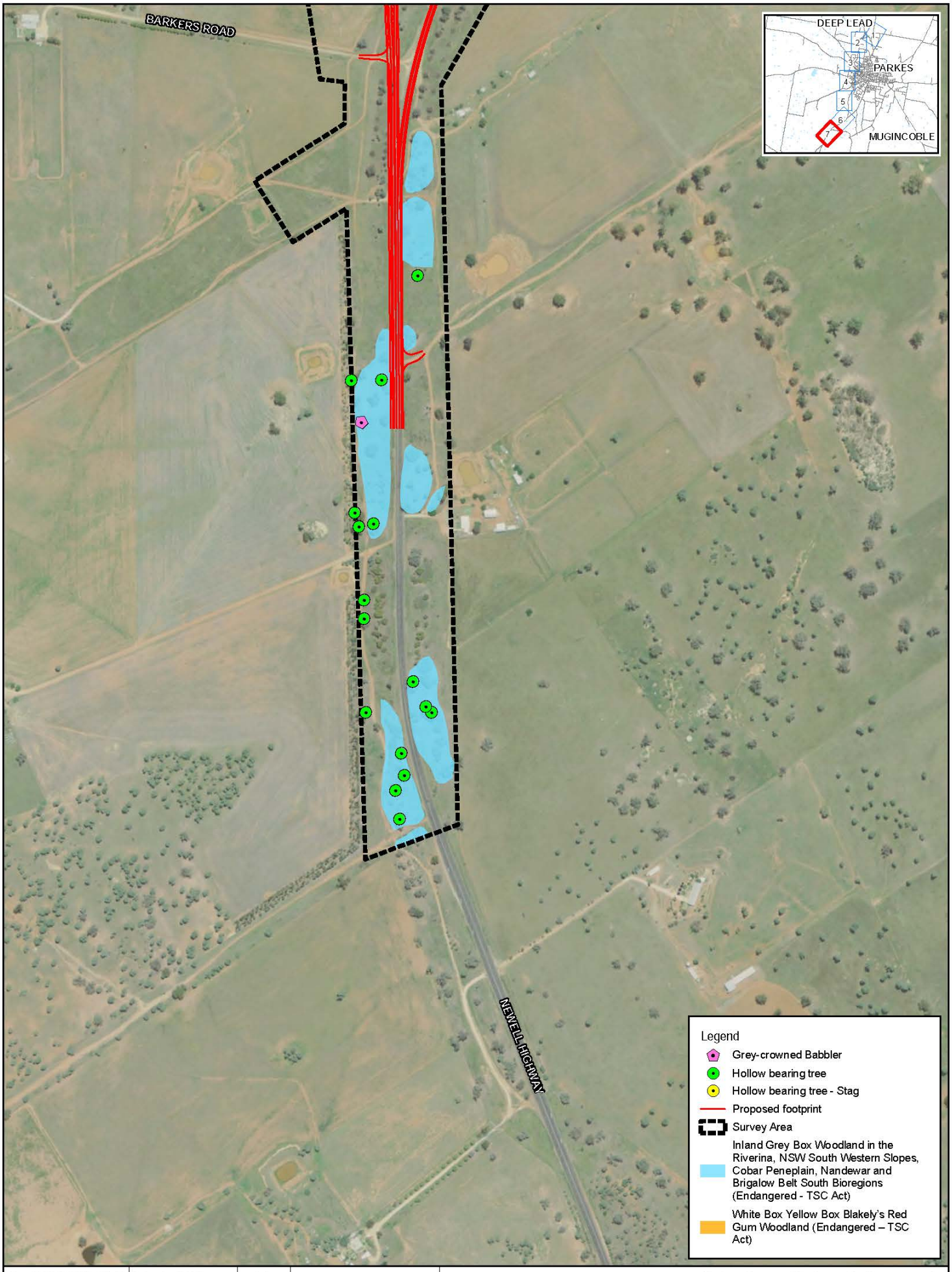

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Figure 3.3
Threatened species, communities and habitat features
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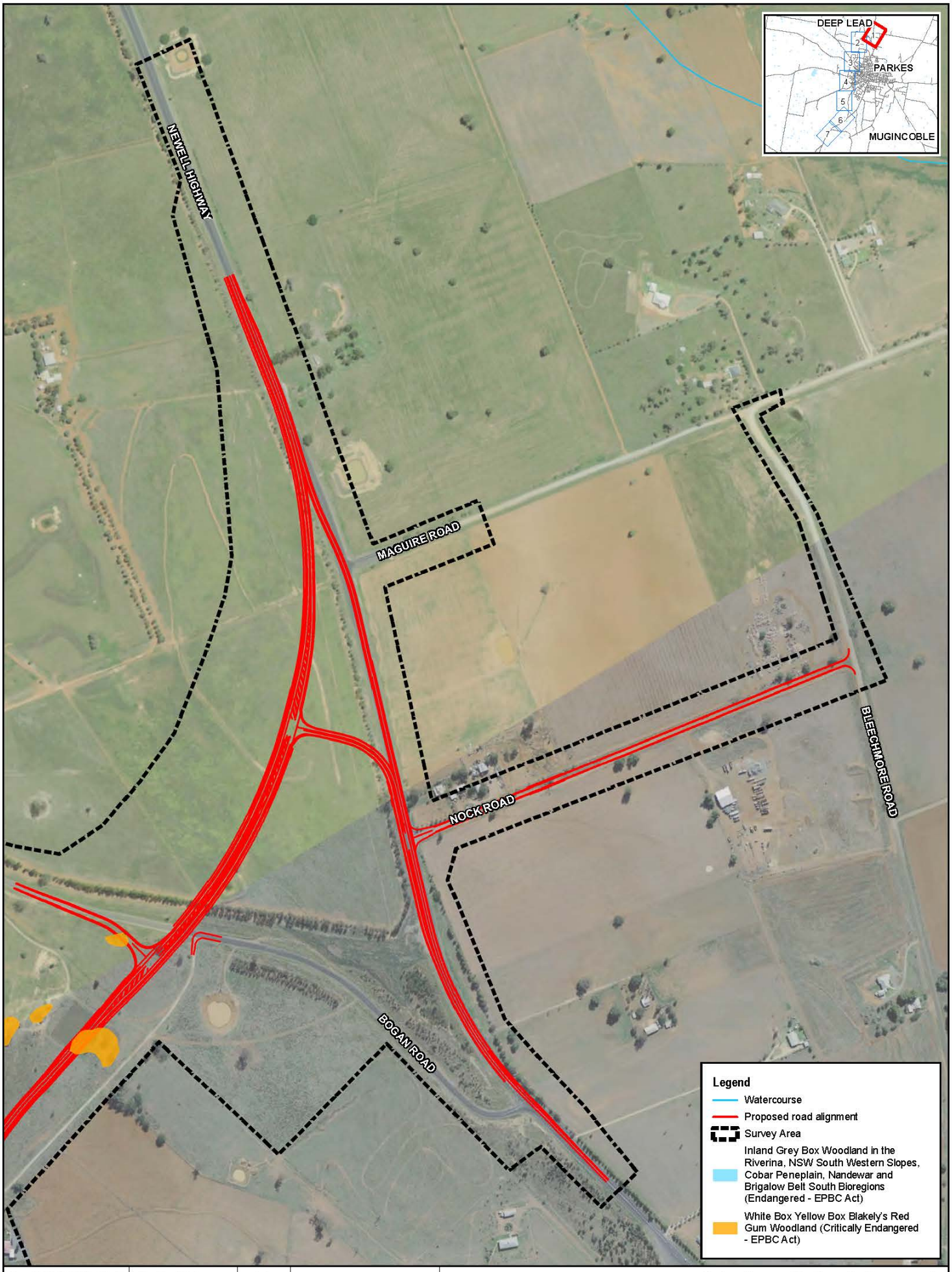

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Parkes Bypass Biodiversity Assessment
Figure 3.4
Matters of National Environmental Significance
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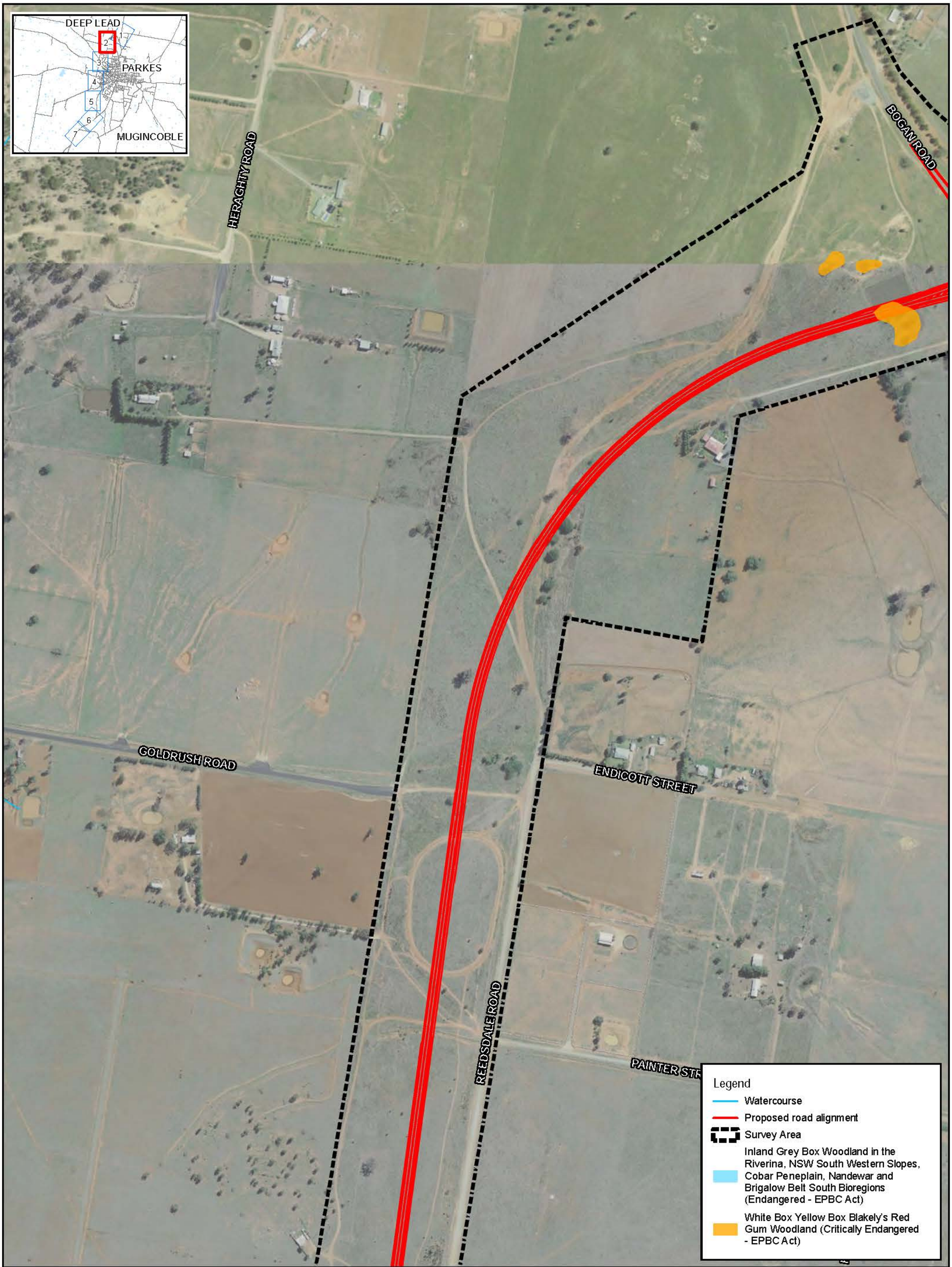

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Figure 3.4
Matters of National Environmental Significance
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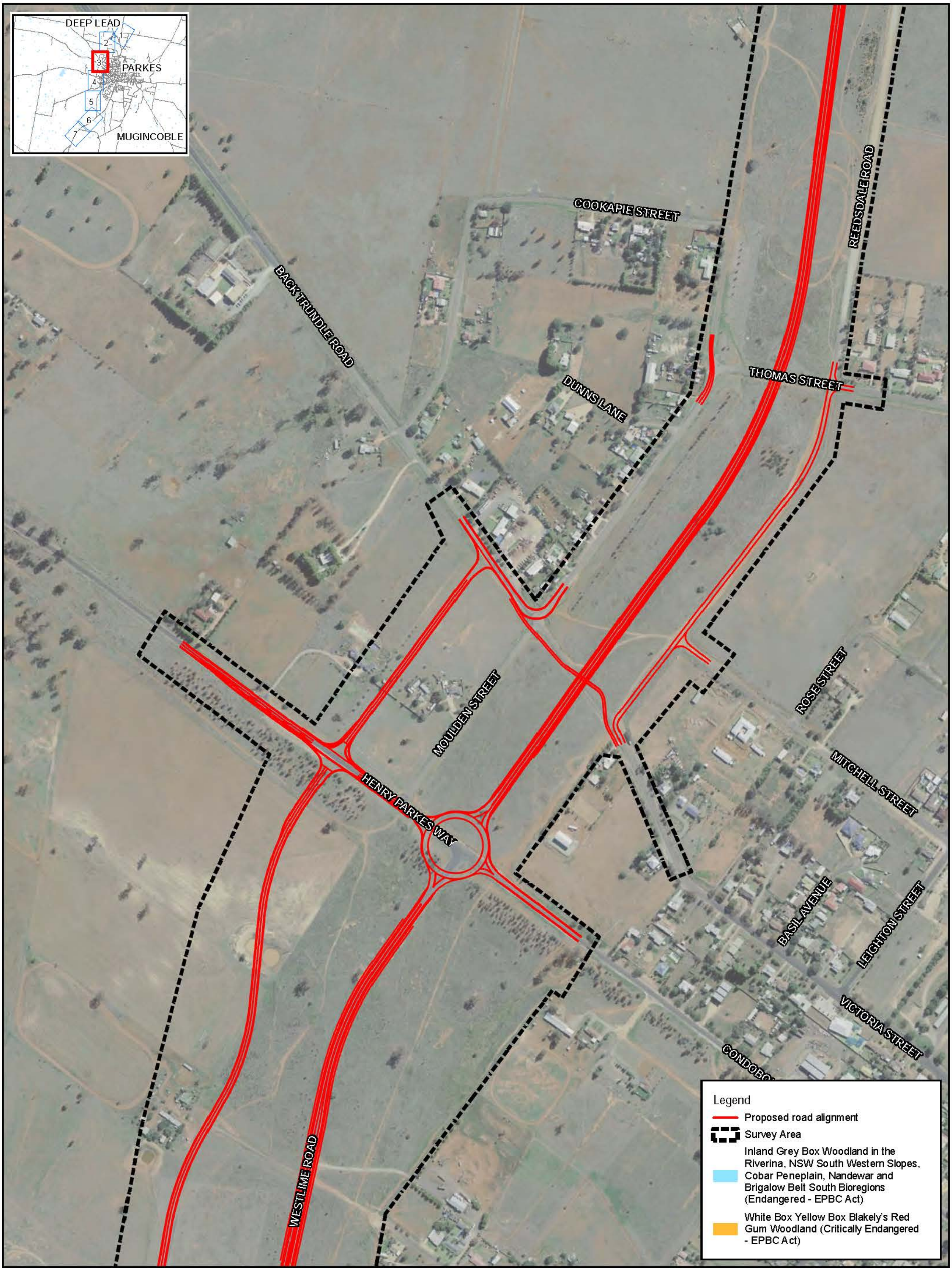

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Parkes Bypass Biodiversity Assessment

Figure 3.4

Matters of National Environmental Significance

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Parkes Bypass Biodiversity Assessment
Figure 3.4
Matters of National Environmental Significance
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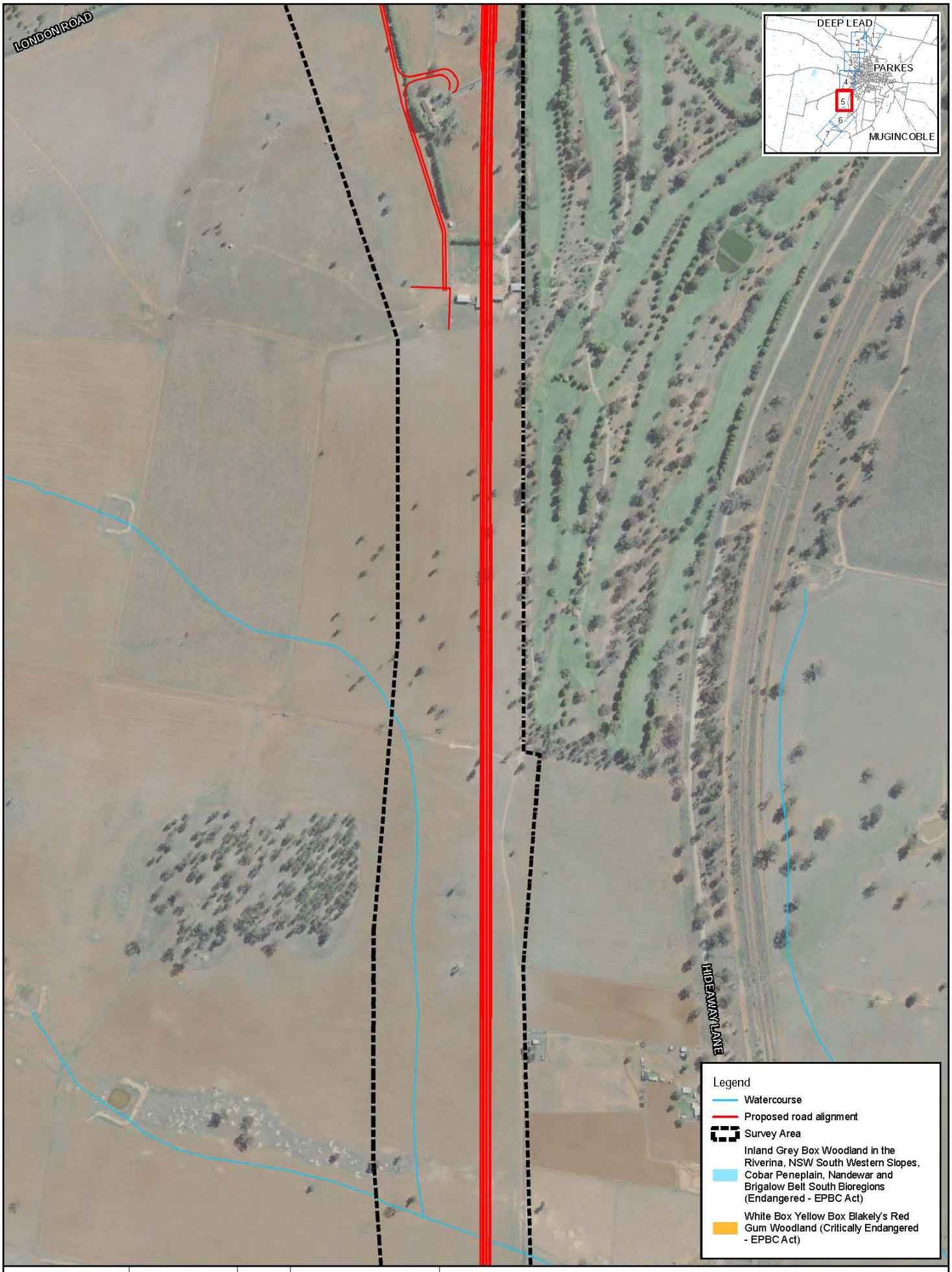

Map: 2270437A_GIS_015_A3	Author: David.Naiken
Date: 30/08/2018	Approved by: Isabella.See

Data source: © Department of Finance, Services & Innovation 2018, Land and Property Information 2017

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Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3

Parkes Bypass Biodiversity Assessment
Figure 3.4
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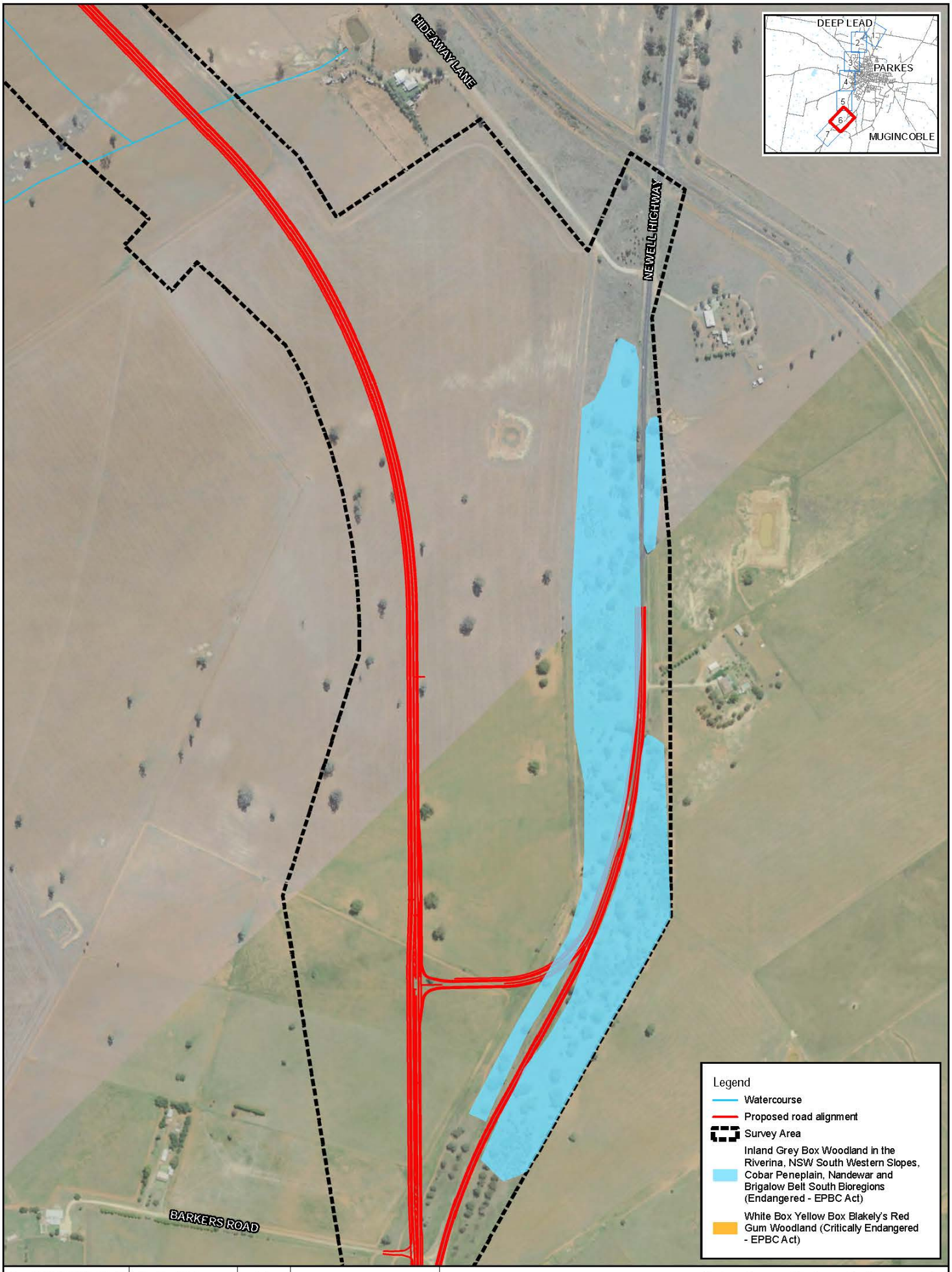

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Parkes Bypass Biodiversity Assessment
Figure 3.4
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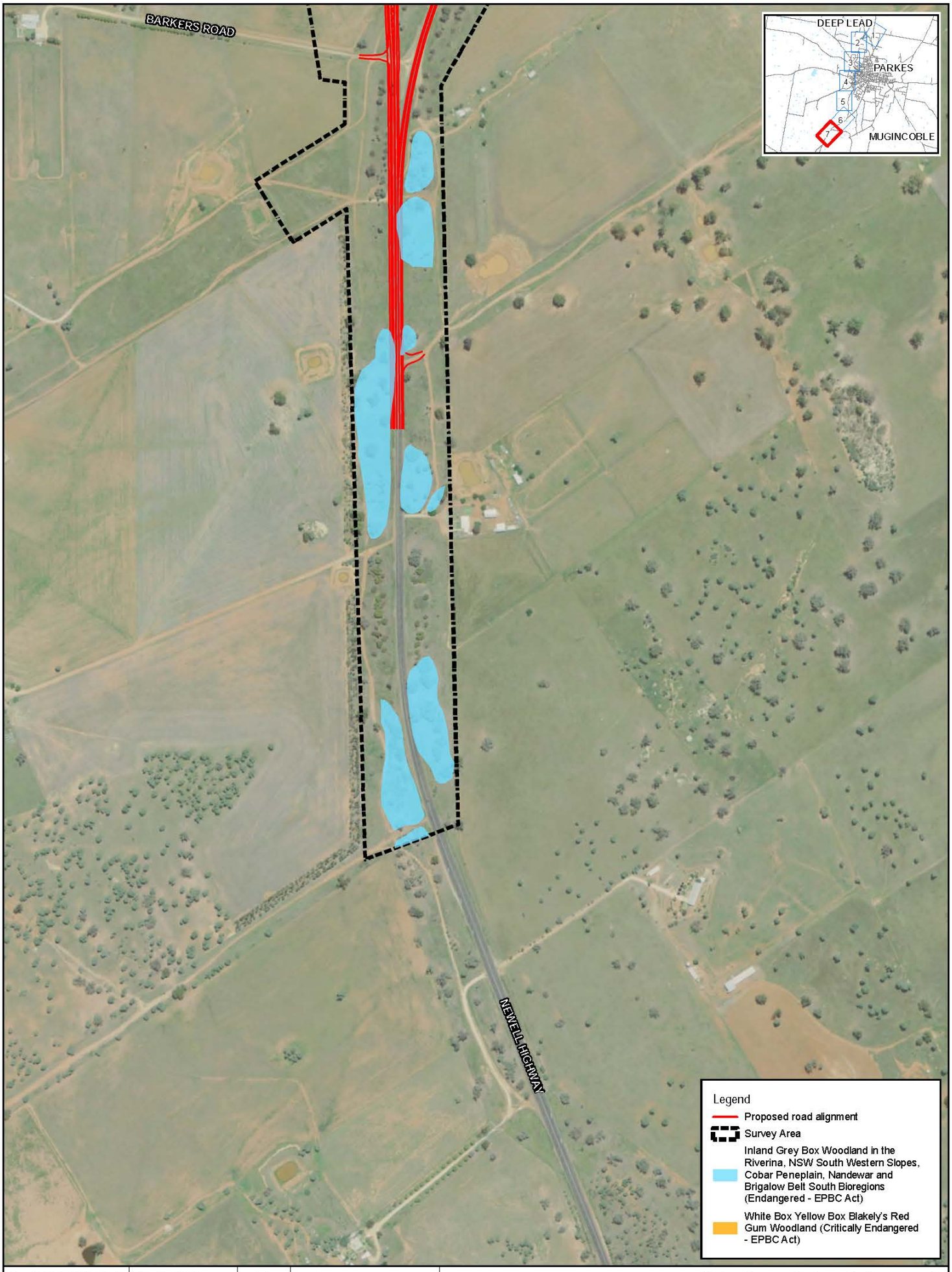

Map: 2270437A_GIS_015_A3 | Author: David.Naiken

Date: 30/08/2018 | Approved by: Isabella.See

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Parkes Bypass Biodiversity Assessment

Figure 3.4

Matters of National Environmental Significance

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4 Potential impacts

The section contains a description of the potential impact of the proposal on biodiversity. The impact are separated into direct, indirect and cumulative impact categories and include the following:

- Direct/construction impacts:
  - Removal of native vegetation
  - Removal of threatened fauna & flora species habitat
  - Changes to hydrology
  - Injury and mortality
- Indirect/operational impact:
  - Wildlife habitat fragmentation
  - Edge effects; including weed invasion, noise, light and vibration
  - Invasion and spread of pests
  - Invasion and spread of pathogens and disease
- Cumulative impact.

Where applicable, impact are also correlated with relevant key threatening processes. Impact evaluation, significance assessments and residual impact are discussed further in Section 6 and Appendix E.

4.1 Direct/construction impacts

4.1.1 Removal of native vegetation

The impact of the proposal on native vegetation is shown below. The area of each PCT to be impacted, its relative abundance and legislative status are shown in Table 4-1. Discussion of relevant key threatening processes related to direct impact on vegetation are shown in Table 4-2.

Table 4-1 Impact on vegetation

Plant community type (PCT)	Status		Percent cleared in CMA[1]	Proposal footprint[2] (hectares)
	BC Act	EPBC Act		
PCT 80/BVT LA153 – Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion	**Endangered:** Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions (BC Act)	**Endangered:** Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia	85%	0.84
PCT 70/BVT LA223 – White cypress pine woodland on sandy loams in central NSW wheat belt	Not listed	Not listed	60%	0.45
PCT 176/BVT LA148 – Green Mallee – White cypress pine very tall mallee woodland on gravel rises mainly in the Cobar Peneplain bioregion	Not listed	Not listed	20%	0.00

Plant community type (PCT)	Status		Percent cleared in CMA[1]	Proposal footprint[2] (hectares)
	BC Act	EPBC Act		
PCT 267/BVT LA218 – White Box – White Cypress Pine – Western Grey Box shrub/grass/forb woodland in the NSW south western slopes bioregion	**Endangered:** White Box Yellow Box Blakely's Red Gum Woodland	**Critically Endangered:** White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	90%	0.10
Total				**1.39**

Note:

1. Based on the VIS classification database.
2. Area to be cleared based on ground-truthed vegetation mapping within the survey area.

Table 4-2 Key threatening processes associated with removal of native vegetation

Key threatening processes	Legislation		Impact of the proposal
	BC Act	EPBC Act	
Clearing of native vegetation	✓	Not listed	The proposal will contribute to these processes through the clearing of four native vegetation communities as shown in Table 4-1
Land clearance	Not listed	✓	

4.1.2 Removal of threatened fauna species habitat

Impact on threatened fauna species, threatened populations and their habitat are discussed in this section. Key habitat features such as hollow-bearing trees which may constitute breeding habitat are discussed for relevant fauna groups.

Table 4-3 Impact on threatened fauna and their habitats

Species	Status		Habitat impacted by proposal	Estimated number of individuals removed or affected
	BC Act[1]	EPBC Act[2]		
Birds – small woodland birds				
Grey-Crowned Babbler	V	Not listed	3.32 ha of potential habitat to be impacted (all native vegetation communities and landscape plantings)	These species are only likely to use the habitats in the proposal footprint intermittently. The area of habitat to be removed would represent less than the home range of a single individual or breeding pair of any of these species.
Dusky Woodswallow	V	Not listed		
Varied Sittella	V	Not listed		
Flame Robin	V	Not listed		
Diamond Firetail	V	Not listed		
Black-chinned Honeyeater	V	Not listed		

Species	Status		Habitat impacted by proposal	Estimated number of individuals removed or affected
	BC Act[1]	EPBC Act[2]		
Birds – hollow-dependent				
Brown Treecreeper	V	Not listed	3.32 ha of potential habitat to be impacted (all native vegetation communities and landscape plantings) and 10 hollow bearing trees	These species are only likely to use the habitats in the proposal footprint intermittently. The area of habitat to be removed would represent less than the home range of a single individual or breeding pair of any of these species.
Superb Parrot	V	V		
Barking Owl	V	Not listed	61.44 ha of potential foraging habitat (1.39 ha of native vegetation communities and 60.05 ha of miscellaneous ecosystems)	
Birds – large predatory birds				
Spotted Harrier	V	Not listed	61.44 ha of potential foraging habitat (1.39 ha of native vegetation communities and 60.05 ha of miscellaneous ecosystems)	These species are only likely to use the habitats in the proposal footprint intermittently. The area of habitat to be removed would represent less than the home range of a single individual or breeding pair of any of these species.
Black Falcon	V	Not listed		
Little Eagle	V	Not listed		
Birds – blossom nomads				
Regent Honeyeater	CE	EM	3.32 ha of potential foraging habitat (all native vegetation communities and landscape plantings)	Possibly suitable albeit marginal habitat available. These species are only likely to use the habitats in the proposal footprint intermittently and are unlikely to breed in the locality.
Swift Parrot	E1	CE		
Little Lorikeet	V	Not listed		
Mammals – insectivorous bats – hollow dependent				
Little Pied Bat	V	Not listed	3.32 ha of potential foraging habitat (all native vegetation communities and landscape plantings) and 10 hollow bearing trees	These species may use the habitats in the proposal footprint on a continual basis or intermittently. The area of habitat to be removed would represent less than the home range of a single individual or breeding pair of any of these species.
South-eastern Long-eared Bat (Corben's Long-eared Bat & Greater Long-eared Bat)	V	V		
Yellow-bellied Sheathtail-bat	V	Not listed		

Note:

1. Vulnerable (V), Endangered (E1), Critically Endangered (CE) as listed on the BC Act
2. Vulnerable (V), Endangered (E), Critically Endangered (CE), Migratory (M) as listed on the EPBC Act

Key threatening processes associated with general habitat (native vegetation) removal are listed in Table 4-2. Key threatening processes associated with removal of key fauna habitat features are shown in Table 4-4 below.

Table 4-4 Key threatening processes associated with removal of fauna habitat features

Key threatening processes	Legislation		Impact of the proposal
	BC Act	EPBC Act	
Loss of hollow-bearing trees	✓	Not listed	10 live hollow-bearing trees will require removal from the proposal footprint
Removal of dead wood and dead trees	✓	Not listed	Dead wood on the ground and dead trees (1 stag), which is scattered through the proposal footprint at low densities would be removed

4.1.3 Removal of threatened plants

Impact on threatened plant species and their habitat are discussed in this section and Table 4-5.

Table 4-5 Impact on threatened plants

Species	Status		Habitat impacted by proposal	Estimated number of individuals removed or affected
	BC Act[1]	EPBC Act[2]		
Austrostipa wakoolica	E1	E	0.94 ha	Species not recorded. No individuals will be removed or affected by the proposal

Note:

1. Endangered (E1), as listed on the BC Act
2. Endangered (E), as listed on the EPBC Act

4.1.4 Changes to hydrology

The existing hydrological conditions of the proposal footprint are already affected by altered landform and altered stormwater runoff and velocity as a result of surrounding land uses. The proposal may result in further alteration to the hydrology of the proposal footprint due to changes in landform.

The proposal footprint does not contain any native vegetation communities (e.g. natural wetlands) which are likely to be reliant on surface water.

Given the already altered hydrological condition of the proposal footprint and the lack of natural ecosystems likely to be reliant on surface water, possible reductions in surface water accumulation as a result of the proposal are unlikely to have a significant impact on native vegetation communities. Increased surface water accumulation could adversely affect the PCT 80/BVT LA153 – Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion vegetation type however, it is recommended that the stormwater design for the proposal be done in accordance with '*Managing urban stormwater: Soils and construction, Volume 2D: Main Road Construction, Sydney'* (Blue Book) (Department of Environment & Climate Change, 2008) to avoid such potential impact.

Although a reduction in surface water accumulation is unlikely to impact native vegetation communities, a reduction in surface water through filling of dams and detention basins could result in loss of habitat for species which readily utilise artificial and highly disturbed water bodies. Whilst the current design generally avoids existing surface water detention basins, a number occur within close proximity to the proposal footprint area. A variety of common native species (e.g. frogs, tortoises) are likely to utilise this habitat.

4.1.5 Injury and mortality

Injury and mortality of fauna could occur during construction activities and during operation of the road and are discussed in this section. Injury and mortality may occur:

- During construction when vegetation and habitat is being cleared
- When machinery and plant is moved to, from and on site
- During public use of the road during the operational phase of the proposal (Table 4-6).

Table 4-6 Potential for injury and mortality of fauna as a result of the proposal

Activity with potential to cause mortality	Native animals with potential to be affected	Nature and magnitude of the impact of the proposal
Vegetation/habitat removal during construction: • Removal of mature trees with hollows and dead standing trees	• Hollow-dependent bats (including threatened species as listed in Table 4-3) • Hollow-nesting and canopy-nesting birds (including threatened species as listed in Table 4-3) • Arboreal mammals • Arboreal reptiles • Arboreal frogs.	Vegetation removal will be undertaken in accordance with Guide 4: Clearing of vegetation and removal of bushrock and Guide 9: Fauna handling of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA proposals (Roads and Traffic Authority, 2011). Implementation of these guidelines will minimise fauna injury and mortality during construction but is unlikely to eliminate the potential for it to occur. Mortality of smaller species of native (non-threatened) reptiles and frogs may be moderate. These smaller, non-threatened species are generally abundant and the mortality caused by the proposal is unlikely to have a substantial long-term impact on populations of these species. **Threatened birds and bats** The level of mortality and injury of both non-threatened and threatened species of birds, bats, arboreal mammals and larger reptiles is likely to be very low with the implementation of the guidelines.
• Removal of understorey, groundcover and topsoil	• Small woodland birds (species which nest in understorey vegetation and breed locally as listed in Table 4-3) • Ground-dwelling reptiles • Frogs.	
Machinery/plant and vehicle movements during construction (between locations within the proposal footprint)	• Terrestrial, semi-aquatic and arboreal reptiles, frogs and mammals • Birds.	Occasional mortality of native animals may occur during vehicle movements within the proposal footprint. With the implementation of speed limits and briefing of staff, the level of construction-phase mortality of native wildlife is likely to be negligible.

Activity with potential to cause mortality	Native animals with potential to be affected	Nature and magnitude of the impact of the proposal
Roadkill post-construction (including impact of consideration of new watering or feed sources or other artificial habitat adjacent to road)	• Terrestrial, semi-aquatic and arboreal reptiles, frogs and mammals. • Birds, especially waterbirds, owls (e.g. Barking Owl) and raptors (e.g. Little Eagle).	All roads have potential to result in the mortality (roadkill) of native animals. The risk of roadkill is higher where roads and/or associated landscaped areas: • Traverse areas of substantial animal habitat • Are located near natural or artificial water bodies • Contain food sources (e.g. mown grass verges, nectar-producing shrubs) which attract animals to the road edge • Have high speed limits • Provide poor visibility of wildlife (e.g. due to bends, crests and poor lighting). While it is not possible to eliminate the risk of roadkill occurring, it is possible to minimise roadkill through consideration of the above factors in the design of roads and associated landscaping and infrastructure. It is also possible to reduce roadkill risk by encouraging animals to cross roads more safely through provision of features such as: • Fauna fencing • Fauna underpasses • Fauna rope bridges • Landscaping which encourages birds and bats to fly higher over roads. The threatened animals likely to occur on the proposal footprint are at low risk of roadkill, since majority of threatened species are mobile (fly) and generally feed high in the canopy of vegetation. However, some species (i.e. raptors) would readily feed on roadkill and would be placed at some risk of road-strike mortality. Overall, with adequate consideration of factors associated with roadkill in preparation of the detailed design, the proposal is unlikely to result in significant levels of roadkill mortality of threatened species or the ecosystems of the proposal locality.

4.2 Indirect/operational impacts

4.2.1 Wildlife connectivity and habitat fragmentation

The impact of the proposal on wildlife habitat connectivity are discussed in this section. Habitat fragmentation is the division of a single area of habitat into two or more smaller areas, with the occurrence of a new habitat type in the area between the fragments. This new dividing habitat type is often artificial and inhospitable to the species remaining within the fragments. Although the newly created habitat is generally used by some species, those species are usually generalists and are often considered aggressive (Grey et al., 1998), further decreasing the population levels of the species remaining in the fragments. In addition to the loss of total habitat area, the process of fragmentation can impact on species within the newly created fragments in several ways, including barrier effects, genetic isolation, and edge effects.

Table 4-7 Potential impact of the proposal related to wildlife habitat connectivity and fragmentation

Impact of fragmentation	Biodiversity with potential to be affected	Nature and magnitude of the impact of the proposal	Duration of impact
Genetic isolation due to fragmentation of habitat and barrier effects	Native plants, including threatened species (Table 4-5).	The habitat of these plants is already fragmented and isolated by existing roadways and areas of residential land and agricultural use. While the proposal will result in a slight increase in the distance between the habitat of populations and sub-populations of these species, it is not likely to significantly alter the current extent of genetic mixing or to result in significantly increased genetic isolation.	Permanent
	Birds and bats	Birds and bats are unlikely to be genetically isolated by the proposal due to their ability to fly over the roadway.	Permanent
	Terrestrial and arboreal mammals, reptiles and frogs	These groups are likely to continue to cross the new roadway, although this is already severely limited due to current surrounding residential use and agricultural use. In the absence of fencing, all these animal groups are likely to cross the road at ground level and hence to be at risk of roadkill mortality.	Permanent

Impact of fragmentation	Biodiversity with potential to be affected	Nature and magnitude of the impact of the proposal	Duration of impact
Edge effects	Native plants, including threatened species (Table 4-5).	Habitat/vegetation fragmentation is likely to cause the following increased edge effects associated with the interface between the road and nearby areas of habitat: • Altered soil moisture conditions • Altered light conditions (shading, reduced-shading, artificial lighting) • Noise and vibration (construction and operation) • Weed invasion (associated with soil disturbance and roadside littering). These effects of fragmentation are likely to reduce the suitability of habitat next (generally within 20 metres) to the roadway. Most the vegetation affected is already subject to such edge effects and the increase in edge effects created by the proposal is unlikely to be significant.	Permanent
Indirect impact of increased fragmentation on threatened predators	Predatory birds	The marginal increase in fragmentation as a result of the proposal may have an indirect impact on predatory birds such as the Barking Owl and Little Eagle, due to marginal fragmentation impact on food items such as possums, gliders and reptiles which are food items for these species.	Permanent

4.2.2 Edge effects on nearby native vegetation and habitat

Habitat/vegetation fragmentation is likely to cause the following increased edge effects associated with the interface between the road and nearby areas of habitat:

- Altered soil moisture conditions
- Altered light conditions (shading, reduced-shading, artificial lighting)
- Noise and vibration (construction and operation)
- Weed invasion (associated with soil disturbance and roadside littering).

These effects of fragmentation are likely to reduce the suitability of habitat adjacent (generally within 20 metres) to the roadway. The majority of the vegetation affected is already subject to such edge effects and the increase in edge effects created by the proposal is unlikely to be significant.

Table 4-8 Potential impact of the proposal due to edge effects

Edge effects	Biodiversity with potential to be affected	Nature and magnitude of the impact of the proposal	Duration of impact
Soil moisture changes	Native plants, including threatened species (Table 4-5) Threatened ecological communities	A change in soil moisture can result in substantial changes in vegetation structure and composition. It can result in the loss of particular plant species and the proliferation of others, and in extreme cases, complete transformation of vegetation communities (e.g. from woodland to wetland or vice versa). This can, in turn, affect the suitability of vegetation as habitat for animals, including threatened species. There may be small scale changes in soil moisture conditions associated with increased interception of surface water flows by the roadway. However, with the implementation of a surface/storm water system associated with the roadway such changes are likely to occur over only very small areas and are unlikely to significantly affect biodiversity values.	Permanent
Shading	Native plants, including threatened species (Table 4-5) Threatened ecological communities	Shading can result in substantial changes in vegetation structure and composition. It can result in the loss of particular plant species and the proliferation of others. This can, in turn, affect the suitability of vegetation as habitat for animals, including threatened species. There may be small scale shading from elevated sections of the roadway. However, such changes are likely to occur over only very small areas immediately adjacent to the roadway and are unlikely to significantly affect biodiversity values.	Permanent
Light pollution	Bats, frogs and nocturnal birds and mammals	Artificial light that alters the natural patterns of light and dark in ecosystems is referred to as 'ecological light pollution' (Longcore and Rich, 2004). Types of ecological light pollution include chronic or periodically increased illumination, unexpected changes in illumination, and direct glare (Longcore and Rich, 2004). Impact of ecological light pollution on animals include increased orientation or disorientation from additional illumination and attraction or repulsion responses which may affect foraging, reproduction, communication, and other critical behaviours (Longcore and Rich, 2004). One of the most notable implications of light pollution is alteration of interspecific interactions (e.g. predator-prey and competitive interactions) (Longcore and Rich, 2004). Some species of insectivorous bats (chiefly fast-flying species e.g. *Tadarida* spp.) forage on insects attracted to lights while other slow-flying bat (e.g. some *Myotis* and *Rhinolophus* species) are thought to avoid lighted areas (Patriarca, 2010). Artificially illuminated habitat may be avoided by nocturnal animals if lighting is perceived to increase the risk of predation (Longcore and Rich, 2004).	Permanent

Edge effects	Biodiversity with potential to be affected	Nature and magnitude of the impact of the proposal	Duration of impact
		Under present conditions there is moderate light pollution in the larger areas of habitat within the proposal footprint. Light pollution is likely to be moderately higher during the operation of the proposal due to fixed street lighting and light from vehicles using the road. The proposed lighting for the roadway would also be designed to minimise light spill (as explained in the REF document), thereby minimising ecological light pollution impact and significant ecological light pollution impact on the survey area are unlikely.	
Noise and vibration	All animal species	Substantial variation has been shown in scientific studies in the responses of wildlife to human-generated noise and vibration, ranging from serious to non-existent in different species and situations. The risk of hearing damage in wildlife is probably greater from exposure to very loud noises at close proximity than from long-term exposure to lower noise levels. The presence or otherwise of direct physiological effects of noise on wildlife is poorly known (Larkin, 1996). The main impact on wildlife associated with noise are behavioural. Vehicle noise has been shown, particularly in some species of birds and frogs, to interfere with communication essential for reproduction; however pedestrian activity may cause stronger behavioural reactions than people in vehicles. Noise may affect behaviour by causing animals to retreat from favourable habitat near noise sources, reducing time spent feeding and resulting in energy depletion and lower likelihood of survival and reproduction (Larkin, 1996). Serious effects such as decreased reproductive success have been documented in some studies and documented to be lacking in other studies on other species (Larkin, 1996). Decreased responsiveness of wildlife after repeated noises is frequently observed and usually attributed to habituation (Larkin, 1996). The wildlife of the proposal footprint is likely to be habituated to frequent noise exposure from the surrounding residential properties and existing roadways around Parkes. While the construction phases of the proposal may cause temporary disturbance to animals, the impact from noise emissions are likely to be localised close to the proposal footprint (up to 100 m) and are not likely to have a significant, long-term, impact on wildlife populations. It is likely that most animal species within the proposal footprint and surrounds are already habituated to periodic noise disturbance from human activity and are also unlikely to be significantly affected by the proposal's operational noise.	Permanent

Edge effects	Biodiversity with potential to be affected	Nature and magnitude of the impact of the proposal	Duration of impact
Weed invasion	Native plants, including threatened species (Table 4-5).	Weed invasion density in the existing native vegetation that would be retained varies from very low to high. The most problematic weeds being various species of exotic perennial grasses such as *Eragrostis curvula* (African Love Grass) and *Hyparrhenia hirta* (Coolatai Grass) along with woody shrubs *Hypericum perforatum* (St John's Wort), *Lycium ferocissimum* (Africa Boxthorn) and *Solanum elaeagnifolium* (Silverleaf Nightshade). The proposal has the potential to further disperse weeds into nearby areas of native vegetation. The greatest potential for weed dispersal and establishment associated with the proposal would include earthworks, movement of soil and attachment of seed (and other propagules) to vehicles and machinery where these are utilised within or adjacent to retained vegetation. The proposal would also involve substantial weed control and native vegetation restoration work. With the weed management and vegetation restoration regime proposed, the overall impact of weed invasion on retained vegetation is likely to decrease in the medium to long term.	Short to Medium Term

4.2.3 Invasion and spread of pests

From a biodiversity conservation perspective, pest animals include all species that have a negative impact on the functioning of natural ecosystems and/or the conservation of threatened biodiversity. Pests therefore include both exotic and native species. Exotic pests present or likely to occur on within the proposal footprint include the Fox, Rabbit, Brown Hare, Cat, Common Myna, House Mouse, and Common Starling.

These species have the potential to affect uncommon or threatened indigenous biodiversity through predation (e.g. Black Rat, Cat, Fox), grazing (e.g. Rabbit, Brown Hare) and competition for breeding habitat (e.g. Common Myna and Common Starling).

The majority of known pest species in the locality are quite mobile in nature or prolific. There is therefore little potential for the proposal to introduce these species to any new location where it is currently absent.

The habitat that would be removed for the proposal is already affected by pest species. Removal of this habitat would result in a reduction in habitat available to these species. In the short term this may lead to increased competition for resources (e.g. tree hollows) and increased pressure on remaining habitats. The proposed installation of nest boxes prior to the commencement of construction (refer section 5.2) may reduce these short-term impact.

Many highly invasive and destructive pest species which are found overseas or interstate have not yet become established or presently have restricted distributions in NSW. Several such species are the subject of Key Threatening Process listings (e.g. Red Imported Fire Ant, Yellow Crazy Ant, Large Earth Bumblebee, Cane Toad). The primary risk associated with these species is the importation of goods or materials from interstate or overseas locations where populations of these species are well established. As the proposal does not involve importation of goods from overseas or interstate, it has low potential to bring novel species to the proposal footprint.

4.2.4 Invasion and spread of pathogens and disease

Plant and animal pathogens can affect threatened biodiversity through direct mortality and modification to vegetation structure and composition. The following pathogens are considered to have potential to affect the biodiversity within the proposal footprint and are the subject of Key Threatening Process listings:

- Amphibian Chytrid Fungus (Batrachochytrium dendrobatidis)
- Phytophthora Root Rot Fungus (*Phytophthora cinnamomi*).

These two pathogens have potential to occur within the survey area at present, or in the future. Although they are more regularly observed along coastal areas, they have been listed to occur throughout NSW other than arid zones. The main way in which Phytophthora Root Rot Fungus may be spread is through the movement of infected plant material and/or soil.

The construction and operation of the proposal may increase the risk of disturbing and spreading these pathogens. With the implementation of hygiene procedures for the use of vehicles and the importation of materials to the proposal footprint, the risk of introducing these pathogens would, however, be low. Preferential use of plant materials sourced on-site (e.g. mulch, seeds) used for vegetation restoration would also help to minimise this risk.

Amphibian Chytrid Fungus can be spread through the movement of infected animals or water (including mud or moist soil) from infected areas. With the implementation of hygiene procedures for the use of vehicles and the importation of materials to the proposal footprint, the risk of introducing this pathogen to uninfected areas is low.

4.3 Cumulative impact

The potential cumulative biodiversity impact as a consequence of the construction and operation of the proposal are discussed here within the context of the existing environment, present and likely future impact.

Agricultural, residential and infrastructure development in the locality in historic and recent times has led to extensive vegetation clearing in the locality and at the catchment scale. Remaining remnant vegetation/habitat has also been affected by a variety of disturbance mechanisms, including clearing of undergrowth, grazing by domestic animals, altered fire regimes, feral animals and weed invasion. This habitat loss and disturbance has resulted in the local extinction of several species which are less tolerant of habitat loss and disturbance (e.g. woodland birds and small mammals) and an increased risk of extinction to a number of vegetation communities.

Isolated remnant populations of disturbance-sensitive threatened species in such a landscape may be susceptible to local extinction due to seemingly small reductions in habitat area or quality, if the habitat is near the lower limit in size or quality necessary to support a viable population and a critical threshold is reached.

In assessing the cumulative impact of a proposal, it is important to consider whether the additive effects of multiple proposals may cause such a critical threshold to be reached for any threatened biodiversity affected.

Several developments are underway or planned in the locality, that also impact on biodiversity values that are likely to be impacted by the current proposal. Cumulative impact in relation to other proposal and developments within the locality is highlighted in Section 6 of the REF.

5 Avoid, minimise and mitigate impact

This section outlines the impact mitigation measures and safeguards recommended for the proposal. These measures would be refined during the detailed design phase of the proposal and included in a project construction biodiversity management sub-plan of the construction environment management plan (CEMP).

A general principle of environmental management is to, in order of preference:

- Avoid environmental impact
- Reduce impact
- Mitigate the impact
- As a last resort, once the above options have been investigated, compensate for the residual impact (offset).

5.1 Avoidance and minimisation

As the proposal involves construction of a new highway which is adjacent to areas of native vegetation and linking it to other existing roads, complete avoidance of biodiversity impact is not practicable.

The road design would include several areas where cut and fill and batter slopes would be required to allow for changes in road height compared to natural ground level (refer to Section 3 of the REF). Wherever possible, the proposal footprint has also been restricted to the minimum practicable working width in areas adjacent to:

- Endangered ecological communities (EECs) and critically endangered ecological communities (CEECs) in moderate and high condition
- Areas that contain known threatened species populations
- Areas containing known threatened species habitat.

5.2 Mitigation measures

The following best practice management guidelines were considered in the identification of appropriate mitigation measures:

- Roads and Maritime Services' Biodiversity Guidelines: *Protecting and managing biodiversity on RTA projects* (Roads and Traffic Authority, 2011).
- Wildlife Connectivity Guidelines for Road Projects (Roads and Maritime, in prep)
- NSW DPI (Fisheries) document P*olicy and Guidelines for fish habitat conservation and management* (Department of Primary Industries, 2013).
- *Recovering bushland on the Cumberland Plain: best practice guidelines for the management and restoration of bushland* (Department of Environment and Conservation, 2005).
- *Reducing the impact of road crossings on aquatic habitat in coastal waterways – Hawkesbury-Nepean, NSW* (NSW Department of Primary Industries, 2006).

Management measures were developed in consultation with Roads and Maritime.

Roads and Maritime's standard biodiversity impact mitigation measures and the likely biodiversity impact of the project is shown in Table 5-1 with emphasis on threatened species, populations and ecological communities. Additional recommended species-specific and site-specific measures are also described.

Table 5-1 Mitigation measures

Impact	Mitigation measures	Timing and duration	Likely efficacy of mitigation	Residual impact anticipated	Responsible
Removal of native vegetation	Native vegetation removal will be minimised through detailed design.	Detailed design	Effective	Loss of native vegetation	RMS Proposal Design Engineer
	Determine appropriate exclusion zones during pre-clearing surveys to minimise clearing of native vegetation. Pre-clearing surveys will be undertaken in accordance with Guide 1: Pre-clearing process of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (Roads and Traffic Authority, 2011).	Prior to construction	Effective		RMS Proposal Environment Officer
	Exclusion zones will be set up at the limit of clearing in accordance with Guide 2: Exclusion zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (Roads and Traffic Authority, 2011).	Detailed design	Effective		Contractor Proposal Environment Officer
	Wherever practicable, within road safety limitations and provisions for utilities, native vegetation will be restored in areas along the existing road corridors with canopy and shrub species that are indigenous to the local region. Native vegetation will be re-established in accordance with Guide 3: Re-establishment of native vegetation of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (Roads and Traffic Authority, 2011).	Post construction	Effective		RMS Proposal Design Engineer Contractor Proposal Environment Officer
	The unexpected species find procedure is to be followed under Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects(Roads and Traffic Authority, 2011) if threatened ecological communities, not assessed in the biodiversity assessment, are identified in the proposal footprint.	During construction	Proven		Contractor Proposal Environment Officer

Impact	Mitigation measures	Timing and duration	Likely efficacy of mitigation	Residual impact anticipated	Responsible
Removal of threatened species habitat and habitat features	Habitat removal will be minimised through detailed design.	Detailed design	Effective	Residual loss of threatened fauna habitat	RMS Proposal Design Engineer
	Exclusion zones will be set up at the limit of clearing in accordance with Guide 2: Exclusion zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (Roads and Traffic Authority, 2011).	During construction	Effective		Contractor Proposal Environment Officer
	Habitat will be replaced or re-instated in accordance with Guide 5: Re-use of woody debris and bushrock and Guide 8: Nest boxes of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (Roads and Traffic Authority, 2011).	During construction	Proven		Contractor Proposal Environment Officer
	The unexpected species find procedure is to be followed under Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (Roads and Traffic Authority, 2011) if threatened fauna, not assessed in the biodiversity assessment, are identified in the proposal footprint.	During construction	Proven		Contractor Proposal Environment Officer
Threatened plants	The unexpected species find procedure is to be followed under Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (Roads and Traffic Authority, 2011) if threatened flora species, not assessed in the biodiversity assessment, are identified in the proposal footprint.	During construction	Proven	Loss of threatened plants	Contractor Proposal Environment Officer
Changes to hydrology	Changes to existing surface water flows will be minimised through detailed design.	Detailed design	Effective	Minor alteration to surface water flows.	RMS Proposal Design Engineer

Impact	Mitigation measures	Timing and duration	Likely efficacy of mitigation	Residual impact anticipated	Responsible
Injury and mortality of fauna	Fauna will be managed in accordance with Guide 9: Fauna handling of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects(Roads and Traffic Authority, 2011).	During construction	Effective	While the measures described are effective in minimising fauna injury and mortality, they are unlikely to completely prevent it. Some loss of individuals of native animal species is likely to occur during construction and operation of the road. However, the potential mortality of fauna is unlikely to significantly impact local native animal populations.	Contractor Proposal Environment Officer
	Habitat removal will be undertaken in accordance with Guide 4: Clearing of vegetation and removal of bushrock of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (Roads and Traffic Authority, 2011).	During construction	Effective		Contractor Proposal Environment Officer
	The unexpected species find procedure is to be followed under Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (Roads and Traffic Authority, 2011) if threatened fauna, not assessed in the biodiversity assessment, are identified in the proposal footprint.	During construction	Proven		Contractor Proposal Environment Officer
	Minimising road-kill will be considered in the detailed design of the road and associated infrastructure (e.g. culverts, fencing) and landscaping.	Detailed design	Effective		RMS Proposal Design Engineer
Edge effects – Soil moisture changes	Changes to existing surface water flows will be minimal due to well-drained soil, any potential changes will be minimised through detailed design.	Detailed design	Effective	Minor alteration to soil moisture conditions and reduction in habitat suitability for dryland plant species adjacent to the upgraded road. Minor alteration to fauna habitat characteristics are unlikely to substantially affect any species.	Proposal Design Engineer

Impact	Mitigation measures	Timing and duration	Likely efficacy of mitigation	Residual impact anticipated	Responsible
Edge effects – Weed invasion	Weed species will be managed in accordance with Guide 6: Weed management of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (Roads and Traffic Authority, 2011).	During construction	Effective	Minor proliferation of less problematic (non-noxious) weeds (e.g. annual weeds) may occur at edges of proposal footprint but these species are unlikely to invade undisturbed areas or prevent the reestablishment of native vegetation.	Proposal Environment Officer
Invasion and spread of pathogens and disease	Implement hygiene procedures for the use of vehicles and the importation of materials to the proposal footprint in accordance with Guide 7: Pathogen management of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (Roads and Traffic Authority, 2011).	During construction	Effective	Minimal. With the implementation of these procedures, the risk of introducing pathogens would be low.	Proposal Manager

6 Assessments of significance

Assessments of significance have been conducted for each threatened species, population or ecological community recorded in the survey area or considered to have a moderate to high likelihood of occurrence (see section 3.8). Combined assessments of significance have been conducted for groups of species that have similar life history and habitat requirements; e.g. threatened woodland birds, hollow-dependent microbats.

Assessments of significance have been undertaken in accordance with the following published guidelines:

- Threatened species assessment guidelines – test of significance is set out in s.7.3 of the *Biodiversity Conservation Act 2016.*
- Significant Impact Guidelines 1.1 – Matters of National Environmental Significance for EPBC Act listed biodiversity (Department of the Environment, 2013b)
- Referral guidelines for species listed under the EPBC Act (Department of the Environment and Energy, 2017b).

The results of the significance assessments are summarised in Table 6-1 and Table 6-2.

Table 6-1 Summary of the findings of BC Act significance assessments

Threatened species, populations and communities	Significance assessment factor[1] and intensity of impact[2]							Likely significant impact?
	(a) life cycle – species	(b) life cycle pop.	(c) tec risk of extinction	(d) habitat all taxa	(e) critical habitat	(f) recovery and threat abatement	(g) key threatening processes	
Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions	N/A	N/A	NS	NS	N/A	NS	NS	No
White Box Yellow Box Blakely's Red Gum Woodland	N/A	N/A	NS	NS	N/A	NS	NS	No
Austrostipa wakoolica	NS	N/A	N/A	NS	NS	NS	NS	No
Small threatened woodland birds: • Grey-crowned Babbler • Dusky Woodswallow • Varied Sittella • Flame Robin • Diamond Firetail • Black-chinned Honeyeater	NS	N/A	N/A	NS	NS	NS	NS	No
Hollow-dependent birds: • Brown Treecreeper • Superb Parrot	NS	N/A	N/A	NS	N/A	NS	NS	No
Barking Owl	NS	N/A	N/A	NS	N/A	NS	NS	No

Threatened species, populations and communities	Significance assessment factor[1] and intensity of impact[2]							Likely significant impact?
	(a) life cycle – species	(b) life cycle pop.	(c) tec risk of extinction	(d) habitat all taxa	(e) critical habitat	(f) recovery and threat abatement	(g) key threatening processes	
Predatory birds: • Spotted Harrier • Black Falcon • Little Eagle	NS	N/A	N/A	NS	X	NS	NS	No
Blossom nomads: • Regent Honeyeater • Swift Parrot • Little Lorikeet	NS	N/A	N/A	NS	X	NS	NS	No
Insectivorous bats – hollow-dependent: • Little Pied Bat • South-eastern Long-eared Bat • Yellow-bellied Sheathtail-bat	NS	N/A	N/A	NS	X	NS	NS	No

Notes:

1. Significance assessment factors as set out in the Threatened Species Conservation Act 1995/ Environmental Planning and Assessment Act 1979.
2. Assessment S= Significant negative impact, NS = negative but non-significant impact, P= Possible slightly positive impact, X = minimal or no impact, N/A = not applicable

Table 6-2 Summary of the findings of EPBC Act significance assessments

Threatened species, populations and communities	EPBC Act status[1]	Important population[2]	Likely significant impact?
Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia	E	N/A	No
Austrostipa wakoolica	E	N/A	No
Superb Parrot	V	N/A	No
South-eastern Long-eared Bat	V	N/A	No
Migratory and/or nomadic blossom-feeding birds:			No
Regent Honeyeater	CE	N/A	
Swift Parrot	E	N/A	

Note:

1. Vulnerable (V), Endangered (E), Critically Endangered (CE) as listed on the EPBC Act
2. Important Population as determined by the Environment Protection and Biodiversity Conservation Act 1999, is one that for a vulnerable species:
   (a) Is likely to be key source populations either for breeding or dispersal
   (b) Is likely to be necessary for maintaining genetic diversity
   (c) Is at or near the limit of the species range.

6.1 Impact summary

A summary of the impact considered in the assessment are shown in Table 6-3 along with a summary of the impact assessment and residual impact require offsetting.

Table 6-3 Summary of impact

Impact	Key biodiversity values affected (threatened species, populations and ecological communities)	Nature of impact	Extent (scale) of impact	Duration of impact	Key threatening process of relevance to species and impact	Confidence in assessment
Removal of native vegetation (comprising TECs)	• Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions • White Box Yellow Box Blakely's Red Gum Woodland	Direct	Site based	**Long term**: within operational area of the road and associated infrastructure. **Short term to medium-term**: in other areas of construction footprint.	Clearing of native vegetation (BCAct) Land clearance (EPBC Act)	High
General threatened fauna habitat removal and/or modification	Migratory and/or nomadic blossom-feeding birds including: • Regent Honeyeater • Swift Parrot • Little Lorikeet Hollow-dependent birds: • Superb Parrot • Brown Treecreeper Small woodland birds including: • Grey-crowned Babbler • Dusky Woodswallow • Varied Sittella • Flame Robin • Diamond Firetail • Black-chinned Honeyeater Large predatory birds with extensive home ranges including: • Spotted Harrier • Black Falcon • Little Eagle • Barking Owl	Direct	Site based	**Long term**: within operational area of the road and associated infrastructure. **Short term to medium-term**: in other areas of construction footprint.	Clearing of native vegetation (BC Act) Land clearance (EPBC Act)	High

Impact	Key biodiversity values affected (threatened species, populations and ecological communities)	Nature of impact	Extent (scale) of impact	Duration of impact	Key threatening process of relevance to species and impact	Confidence in assessment
	Insectivorous bats including: • Little Pied Bat • South-eastern Long-eared Bat • Yellow-bellied Sheathtail-bat					
Removal of threatened fauna micro-habitat features	Barking Owl Hollow-dependent birds: • Superb Parrot • Brown Treecreeper Small woodland birds including: • Grey-crowned Babbler • Varied Sittella • Flame Robin • Diamond Firetail Insectivorous bats including: • Little Pied Bat • South-eastern Long-eared Bat • Yellow-bellied Sheathtail-bat	Direct	Site based	Long term	Removal of dead wood and dead trees Loss of Hollow-bearing Trees	High
Edge effects on adjacent native vegetation and habitat including: • noise and vibration (construction and operation) • altered light conditions (artificial lighting)	Small woodland birds including: • Grey-crowned Babbler • Dusky Woodswallow • Varied Sittella • Flame Robin • Diamond Firetail • Brown Treecreeper • Black-chinned Honeyeater Insectivorous bats including: • Little Pied Bat • South-eastern Long-eared Bat • Yellow-bellied Sheathtail-bat	Indirect	Site based	Short-term (associated with construction) Long-term Short-term (associated with operation)	None	High

Impact	Key biodiversity values affected (threatened species, populations and ecological communities)	Nature of impact	Extent (scale) of impact	Duration of impact	Key threatening process of relevance to species and impact	Confidence in assessment
Injury and mortality of fauna – during construction	Hollow-dependent birds: • Superb Parrot • Brown Treecreeper Small woodland birds including: • Grey-crowned Babbler • Varied Sittella Barking Owl Insectivorous bats including: • Little Pied Bat • South-eastern Long-eared Bat • Yellow-bellied Sheathtail-bat	Direct	Site-based Local (other species)	Short-term	None	High
Injury and mortality of fauna – during operation	Small woodland birds including: • Grey-crowned Babbler • Varied Sittella • Flame Robin • Diamond Firetail Large predatory birds with extensive home ranges including: • Spotted Harrier • Black Falcon • Little Eagle Barking Owl Insectivorous bats including: • Little Pied Bat • South-eastern Long-eared Bat • Yellow-bellied Sheathtail-bat	Indirect	Regional Local (other species)	Long-term	None	High

6.2 Residual impact and offsets

Roads and Maritime provide biodiversity offsets in accordance with the Guideline for Biodiversity Offsets (RMS 2016).

Table 6-4 provides guidance to determine if offsets should be considered for a proposal assessed in accordance with the Guideline for Biodiversity Offsets (2016).

Table 6-4 When should Biodiversity Offsets be considered?

Description of applicable activity or impact (RMS 2016)	Consideration of offsets recommended by guideline? (RMS 2016)	Relevant to proposal	Offsets recommended for this proposal
1. Activities in accordance with Roads and Maritime Services Environmental assessment procedure: Routine and Minor Works (RTA 2011).	No	No	No
2. Work on cleared land, plantations, exotic vegetation where there are no threatened species or habitat present.	No	No	No
3. Work involving the clearing of vegetation planted as part of a road corridor landscaping program (this includes where threatened species or species comprising listed ecological communities have been used for landscaping purposes)	No	No	No
4. Works involving clearing of nationally listed threatened ecological community (TEC) or nationally listed threatened species habitat.	Where clearing area > 1 ha of a TEC or habitat in moderate to good condition	- PCT 80/BVT LA153 – Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW	No

Description of applicable activity or impact (RMS 2016)	Consideration of offsets recommended by guideline? (RMS 2016)	Relevant to proposal	Offsets recommended for this proposal
5. Works involving clearing of NSW endangered or vulnerable ecological community	Where clearing > 5 ha or where the ecological community is subject to an SIS	South Western Slopes Bioregion and Riverina Bioregion (85%) - PCT 267/BVT LA218 White Box White Cypress Pine Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion LA218 (90%) **No** – Clearing < 1 ha (LA153 – 0.84 ha), (LA218 – 0.10 ha)	No
6. Works involving clearing of NSW listed threatened species habitat where the species is a species credit species as defined in the OEH Threatened Species Profile Database (TSPD)	Where clearing > 1 ha or where the species is subject of an SIS	No – significant impact assessment undertaken for threatened species	No.
7. Works involving clearing of NSW listed threatened species habitat and the species is an ecosystem credit species as defined in OEH's Threatened Species Profile Database (TSPD)	Where clearing > 5 ha or where the species is subject of an SIS	No – significant impact assessment undertaken for threatened species	No
8. Type 1 or Type 2 key fish habitats (as defined by NSW Fisheries)	Where there is any net loss habitat	No – Type 1 or Type 2 sensitive key fish habitat will not be impacted by the proposal	No

7 Conclusion

The proposal footprint occurs primarily on a travelling stock route that contains discrete patches of remnant native vegetation within large patch areas of pasture grassland and cropping paddocks.

The general land use in the area includes residential, agricultural use and roadways. The proposal footprint occurs approximately 600 m to the west of the existing road corridor of Newell Highway with much of the proposal within disturbed land.

Four native plant community types were recorded within the survey area of which two are listed as threatened ecological communities:

- PCT80/BVT LA153 – Western Grey Box – White Cypress Pine Tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion – Endangered under BC Act & EPBC Act
- PCT 267/BVT LA218 White Box – White Cypress Pine – Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion – Endangered under BC Act (this community does not meet EPBC Act condition threshold criteria).

One threatened species of animal was recorded:

- Grey-crowned Babbler (*Pomatostomus temporalis temporalis*); listed as Vulnerable under the BC Act.

Based on the habitat characteristics of the survey area a further 18 threatened species are considered to have a moderate or high likelihood of occurrence, which include:

- 17 threatened species of animal
- One threatened species of plant.

The proposal would require the removal of about 61.44 ha of vegetation, of which 1.39 ha is native vegetation and 60.05 ha is miscellaneous ecosystems predominately made up of pasture grassland, cropping, landscape plantings. Of the vegetation to be cleared, about 0.94 ha is consistent with a threatened ecological community. Vegetation to be cleared provides habitat for threatened species and the vegetation clearing and loss of habitat is the main impact of the proposal.

Assessments of impact significance were conducted for all threatened species, populations and ecological communities considered likely to be affected by the proposal. Through these assessments, it was concluded that the proposal is unlikely to have a significant impact on any threatened species, population or ecological community.

The standard biodiversity mitigation measures implemented by Roads and Maritime will be implemented to avoid and minimise the main potential impact of the proposal. Additional mitigation measures should be implemented to address potential impact associated the loss of hollow-bearing trees. With the implementation of recommended mitigation measures proposed it is unlikely that residual impact of the proposal will result in significant impact to biodiversity within the locality.

Based on an assessment of the proposal impact against the Guideline for Biodiversity Offsets (RMS 2016) an offset for this proposal is not required.

Given the proposal is not considered likely to lead to a significant impact on threatened species, populations, ecological communities or their habitats, a Species Impact Statement (SIS) is not required to support this proposal. In respect to MNES matters, a referral of this proposal for consideration as a controlled action under the EPBC Act is not required to support this proposal.

8 References

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Appendix A

Flora recorded during site surveys

Flora recorded during site surveys

Family name	Scientific name	Common name	BC Act status[1]	EPBC Act status[2]	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Adiantaceae	*Cheilanthes tenuifolia**						0.4/20					
Amaranthaceae	*Ptilotus exaltatus var. semilanatus**	Lamb Tails			0.4/3							
Asclepiadaceae	*Gomphocarpus fruticosus**	Narrow-leaved Cotton Bush								0.4/3		0.4/5
Asteraceae	*Arctotheca calendula**	Capeweed				0.4/5		0.4/5				0.4/10
Asteraceae	*Calotis cuneata**	Mountain Burr-Daisy			0.4/10							
Asteraceae	*Calotis lappulacea**	Yellow Burr-daisy			2/50		3/50	2/50				0.4/3
Asteraceae	*Calotis sp.**							1/20				
Asteraceae	*Carthamus lanatus**	Saffron Thistle			0.4/2				0.4/10			
Asteraceae	*Chondrilla juncea**	Skeleton Weed										0.4/10
Asteraceae	*Hypochaeris radicata**	Catsear					0.4/5	2/50	1/20	0.4/10		
Asteraceae	*Lactuca serriola**	Prickly Lettuce			1/20	0.4/5		0.4/5	0.4/5	1/50	0.4/10	
Asteraceae	*Minuria leptophylla**	Minnie Daisy			0.4/5							
Asteraceae	*Sonchus oleraceus**	Common Sowthistle			0.4/10	0.4/10	1/20	2/20	0.4/5	1/50	1/20	1/20

Family name	Scientific name	Common name	BC Act status[1]	EPBC Act status[2]	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Asteraceae	*Vittadinia cervicularis*	Annual New Holland Daisy				1/20						
Asteraceae	*Vittadinia cervicularis var. subcervicularis*	Annual New Holland Daisy				0.4/5					0.4/10	0.4/5
Asteraceae	*Vittadinia cuneata*	Fuzzweed								0.4/5		
Asteraceae	*Vittadinia muelleri*	Narrow-leaf New Holland Daisy			2/50							0.4/10
Boraginaceae	*Echium plantagineum**	Pattersons Curse			1/20	10/50		1/10	0.4/10	10/500	1/20	5/100
Brassicaceae	*Lepidium africanum**	Common Peppercress			0.4/10							
Brassicaceae	*Rapistrum rugosum**	Turnip Weed			5/100	1/5						2/20
Brassicaceae	*Sisymbrium officinale**	Hedge Mustard								1/20		
Campanulaceae	*Wahlenbergia communis*	Tufted Bluebell				0.4/10		2/50				
Campanulaceae	*Wahlenbergia luteola*	Bronze Bluebell			5/100	1/50	5/100	0.4/10	1/20			0.4/2
Campanulaceae	*Wahlenbergia sp.*	Bluebell					2/50		0.4/1	0.4/10	0.4/10	
Caryophyllaceae	*Petrorhagia nanteuilii**	Childling Pink			0.4/20							
Chenopodiaceae	*Atriplex semibaccata*	Creeping Saltbush			0.4/10							

Family name	Scientific name	Common name	BC Act status[1]	EPBC Act status[2]	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Chenopodiaceae	*Einadia nutans subsp. nutans*				1/20	5/50	5/50	2/50	2/50	0.4/2		
Chenopodiaceae	*Maireana enchylaenoides*	Wingless Bluebush			3/50	0.4/10						
Chenopodiaceae	*Maireana microphylla*	Small-leaf Bluebush			1/3	2/20						
Chenopodiaceae	*Sclerolaena muricata var. semiglabra*	Dark Roly-poly			0.4/5							
Crassulaceae	*Crassula colorata var. acuminata*	Dense Crassula					0.4/1					
Cupressaceae	*Callitris glaucophylla*	White Cypress Pine			15/20		10/50	35/50	35/100		40/20	
Cyperaceae	*Cyperus sp.*							0.4/5		0.4/14		
Fabaceae (Caesalpinioideae)	*Senna artemisioides subsp. zygophylla*				0.1/1	0.4/2						
Fabaceae (Caesalpinioideae)	*Senna sp.*								5-Feb			
Fabaceae (Faboideae)	*Glycine tabacina*				0.4/10					2/50		
Fabaceae (Faboideae)	*Medicago polymorpha**	Burr Medic				5/100	1/10			15/500	0.4/20	15/100
Fabaceae (Faboideae)	*Medicago sp.**								0.4/5			0.4/10
Fabaceae (Faboideae)	*Medicago truncatula**	Barrel Medic			10/1000			3/100	2/50			

Family name	Scientific name	Common name	BC Act status[1]	EPBC Act status[2]	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Fabaceae (Faboideae)	*Trifolium angustifolium**	Narrow-leaved Clover						1/20	1/10	0.4/10	0.4/10	1/25
Fabaceae (Faboideae)	*Trifolium arvense**	Haresfoot Clover			2/50		1/20	1/20	1/10	5/100	15/1000	2/50
Fabaceae (Faboideae)	*Trifolium campestre**	Hop Clover			2/50							
Fabaceae (Faboideae)	*Trifolium pratense**	Red Clover									0.5/10	
Fabaceae (Faboideae)	*Trifolium sp.**						1/20					0.4/5
Fabaceae (Mimosoideae)	*Acacia decora*	Western Golden Wattle			1/2							
Fabaceae (Mimosoideae)	*Acacia mollifolia*					1/1						
Fabaceae (Mimosoideae)	*Acacia parvipinnula*	Silver-stemmed Wattle										0.4/1
Fabaceae (Mimosoideae)	*Acacia salicina*	Cooba			1/1	2/3						
Geraniaceae	*Geranium homeanum*	Rainforest Cranes-bill								0.4/1		
Goodeniaceae	*Goodenia pinnatifida*	Cut-leaf Goodenia					0.4/1	1/50	0.4/10			0.4/5
Hypericaceae	*Hypericum perforatum**	St. John's Wort										
Iridaceae	*Romulea rosea**	Onion Grass			0.4/20							
Juncaceae	*Juncus sp.*										0.4/3	

Family name	Scientific name	Common name	BC Act status[1]	EPBC Act status[2]	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Lamiaceae	*Marrubium vulgare**	Horehound				2/10		5/50		0.4/5		2/50
Lamiaceae	*Salvia verbenaca**	Wild Sage				1/10						
Lomandraceae	*Lomandra filiformis subsp. filiformis*				1/20							
Lomandraceae	*Lomandra leucocephala*	Woolly Mat-rush			1/10							
Lomandraceae	*Lomandra multiflora*								0.4/1			0.4/10
Malvaceae	*Malva parviflora**	Small-flowered Mallow			0.4/5					0.4/5		0.4/20
Malvaceae	*Sida corrugata*	Corrugated Sida, Variable Sida			2/50	0.4/10	2/20	3/50	2/50			
Myrtaceae	*Eucalyptus albens*	White Box			5/1							15/3
Myrtaceae	*Eucalyptus microcarpa*	Western Grey Box			20/6	1/1	30/20		30/2	25/2		
Myrtaceae	*Eucalyptus viridis*	Green Mallee				15/4						
Oxalidaceae	*Oxalis perennans*	Grassland Wood-sorrel			1/50	0.4/5	0.4/10	1/20	1/20	0.4/20		0.4/10
Plantaginaceae	*Plantago lanceolata**	Lambs Tongues										1/20
Poaceae	*Aristida personata**	Purple Wire-grass					0.4/10					
	Aristida sp.								0.4/10			
Poaceae	*Austrostipa blackii*	Crested Spear-grass				0.4/20						

Family name	Scientific name	Common name	BC Act status[1]	EPBC Act status[2]	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Poaceae	*Austrostipa scabra*	Speargrass			3/50						1/50	1/50
Poaceae	*Austrostipa sp.*						10/100	10/500		3/100		
Poaceae	*Austrostipa verticillata*											2/50
Poaceae	*Avena barbata**	Bearded Oats			20/1000	45/1000	5/100	10/100		15/500		15/500
Poaceae	*Avena fatua**	Wild Oats							0.4/10		25/1000	
Poaceae	*Bromus diandrus**	Great Brome			5/100	10/500	1/20	10/500		10/500	10/500	1/50
Poaceae	*Bromus hordeaceus**						1/20	2/50	1/20	5/100		0.4/10
Poaceae	*Bromus madritensis*	Madrid Brome			0.4/10							
Poaceae	*Bromus molliformis**				1/20							
Poaceae	*Dichanthium sericeum*	Queensland Bluegrass					3/50	5/100				
Poaceae	*Enteropogon acicularis*	Spider Grass					0.4/5					
Poaceae	*Eragrostis curvula**	African Lovegrass										0.4/10
Poaceae	*Hordeum leporinum**	Barley Grass			0.4/10	3/50			0.4/5	0.4/20		20/1000
Poaceae	*Hyparrhenia hirta**	Coolatai Grass										
Poaceae	*Lolium perenne**	Perennial Ryegrass										5/50
Poaceae	*Lolium rigidum**	Wimmera Ryegrass			15/500	5/50	5/100		5/100	20/1000	10/500	20/1000

Family name	Scientific name	Common name	BC Act status[1]	EPBC Act status[2]	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Poaceae	*Rytidosperma caespitosum*	Ringed Wallaby Grass				1/50	5/100		5/100			
Poaceae	*Rytidosperma sp.*						3/50	5/100		1/50	0.4/10	1/50
Poaceae	*Vulpia myuros**	Rats Tail Fescue					1/20	15/1000	5/100		5/500	
Polygonaceae	*Rumex sp.*						0.4/2	1/20				
Sapindaceae	*Dodonaea viscosa*	Sticky Hop-bush					5/6					
Solanaceae	*Lycium ferocissimum**	African Boxthorn					0.4/5				2/5	
Solanaceae	*Solanum elaeagnifolium**	Silver-leaved Nightshade										2/50

1. As listed on the *Biodiversity Conservation Act 2016.*
2. As listed on the Environment Protection and Biodiversity Conservation Act 1999.

* denotes exotic species

Cover and abundance of species in each plot was recorded in the following format, cover/abundance e.g. 0.4/7

Appendix B

Threatened flora likelihood of occurrence

Threatened flora likelihood of occurrence

Family name	Species name	Common name	BC Act status[1]	EPBC Act status[2]	Habitat	Data source	Likelihood of occurrence
Asclepiadaceae	*Tylophora linearis*		V	E	Majority of records occur in the central western region. Records from Goonoo, Pillaga West, Pillaga East, Bibblewindi, Cumbil and Eura State Forests, Coolbaggie NR, Goobang NP and Beni SCA. Also has been recorded Hiawatha State Forest near West Wyalong in the south and there are old records as far north as Crow Mountain near Barraba and near Glenmorgan in the western Darling Downs. Grows in dry scrub and open forest. Recorded from low-altitude sedimentary flats in dry woodlands of *Eucalyptus fibrosa, Eucalyptus sideroxylon, Eucalyptus albens, Callitris endlicheri, Callitris glaucophylla* and *Allocasuarina luehmannii*. Also grows in association with *Acacia hakeoides, Acacia lineata, Melaleuca uncinata,* Myoporum species and Casuarina species. Flowers in spring, with flowers recorded in November or May with fruiting probably 2 to 3 months later (Office of Environment & Heritage, 2015b).	PMST	Low. One vegetation type (LA223) provides potential habitat within the survey area. There are no records of this species within 10 km of the survey area. No individuals of this species were recorded during field surveys.

Family name	Species name	Common name	BC Act status[1]	EPBC Act status[2]	Habitat	Data source	Likelihood of occurrence
Fabaceae (Faboideae)	*Swainsona murrayana*	Slender Darling Pea	V	V	Found throughout NSW, it has been recorded in the Jerilderie and Deniliquin areas of the southern riverine plain, the Hay plain as far north as Willandra National Park, near Broken Hill and in various localities between Dubbo and Moree. The species has been collected from clay-based soils, ranging from grey, red and brown cracking clays to red-brown earths and loams. 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. The species may require some disturbance and has been known to occur in paddocks that have been moderately grazed or occasionally cultivated. (Office of Environment & Heritage, 2014a).	PMST	Low. One vegetation type (LA153) provides potential habitat within the survey area. There are no records of this species within 10 km of the survey area. Though surveys were undertaken during flowering season, no individuals of this species were recorded.

Family name	Species name	Common name	BC Act status[1]	EPBC Act status[2]	Habitat	Data source	Likelihood of occurrence
Fabaceae (Faboideae)	*Swainsona sericea*	Silky Swainson-pea	V		Grows in grassland and eucalypt woodland (Royal Botanic Gardens, 2008). Found in Natural Temperate Grassland and Snow Gum Eucalyptus pauciflora Woodland on the Monaro. Found in Box-Gum Woodland in the Southern Tablelands and South West Slopes. Sometimes found in association with cypress-pines Callitris spp. Habitat on plains unknown (Department of Environment and Climate Change, 2008).	BioNet	Low. Two vegetation types (LA153 & LA223) provides potential habitat within the survey area. There is one record of this species within 1 km of the survey area although this record is historic and dated 1947. There are no recent records on BioNet of this species within the locality. This species was not recorded during field surveys.

Family name	Species name	Common name	BC Act status[1]	EPBC Act status[2]	Habitat	Data source	Likelihood of occurrence
Orchidaceae	*Prasophyllum petilum*		E1	E	Natural populations are known from a total of five sites in NSW. These area at Boorowa, Captains Flat, Ilford, Delegate and a newly recognised population c.10 k SE of Muswellbrook. It also occurs at Hall in the Australian Capital Territory. Grows in open sites within Natural Temperate Grassland at the Boorowa and Delegate sites. Also grows in grassy woodland in association with River Tussock *Poa labillardieri*, Black Gum *Eucalyptus aggregata* and tea-trees Leptospermum spp. at Captains Flat and within the grassy groundlayer dominated by Kanagroo Grass under Box-Gum Woodland at Ilford (and Hall, ACT). Highly susceptible to grazing, being retained only at little-grazed travelling stock reserves (Boorowa & Delegate) and in cemeteries (Captains Flat, Ilford and Hall) (Office of Environment & Heritage, 2015a) (Department of the Environment, 2016).	PMST	Low. Though some elements of the preferred habitat is present within the survey area, this species has not been recorded within locality and wasn't recorded during field surveys.

Family name	Species name	Common name	BC Act status[1]	EPBC Act status[2]	Habitat	Data source	Likelihood of occurrence
Orchidaceae	*Prasophyllum sp. Wybong*	Leek orchid		CE	Prasophyllum sp. Wybong (C. Phelps ORG 5269) is known from seven populations in open eucalypt woodland and grassland in NSW. The species' area of occupancy is estimated to be 1.5 km^2 with an estimated population size based on surveys in 2006 of 460 mature individuals. This species occurs within the Sydney Basin, New England Tablelands, Brigalow Belt South and NSW South Western Slopes IBRA Bioregions and the Border Rivers-Gwydir, Namoi, Hunter-Central Rivers and Central West Natural Resource Management Regions. The distribution of this species overlaps with the White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland EPBC Act-listed threatened ecological community(Department of Sustainability Environment Water Population and Communities, 2011)	PMST	Low Not known to occur within the locality.

Family name	Species name	Common name	BC Act status[1]	EPBC Act status[2]	Habitat	Data source	Likelihood of occurrence
Poaceae	*Austrostipa metatoris*		V	V	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. Associated species include *Callitris glaucophylla, Eucalyptus microcarpa, E. populnea, Austrostipa eremophila, A. drummondii, Austrodanthonia eriantha* and *Einadia nutans*. Flowers from October to December, mainly in response to rain. Seed dispersal is mainly by wind, rain and flood events; the awn and sharp point of the floret appear to be an adaptation for burying the seed into the soil; grass seed is traditionally believed to be viable for three to five years, so a long-lived seed bank is considered unlikely for this species. Recorded as common in the Mairjimmy State Forest population (Harden, 1993).	PMST	Low. One vegetation type (LA223) provides potential habitat within the survey area. There are no records of this species within 10 km of the survey area. Though surveys were undertaken during flowering season, no individuals of this species were recorded.

Family name	Species name	Common name	BC Act status[1]	EPBC Act status[2]	Habitat	Data source	Likelihood of occurrence
Poaceae	*Austrostipa wakoolica*		E1	E	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. Associated species include *Callitris glaucophylla, Eucalyptus microcarpa, E. populnea, Austrostipa eremophila, A. drummondii, Austrodanthonia eriantha* and *Einadia nutans*. Flowers from October to December, mainly in response to rain (Office of Environment & Heritage, 2014b).	Bionet, PMST	Moderate. Within the Lachlan major catchment a total of 22 vegetation types are identified to provided potential habitat for this species (Office of Environment & Heritage 2017). Of these, LA153 and LA223 have been recorded within the survey area and collectively provided approximately 21 hectares of habitat for this species. Records within locality of are dated between 1991 and 1992 with the closest record being approximately 11 km to the west of the survey area. No individuals of this species were recorded during field surveys.

Note:

1. Vulnerable (V), Endangered (E1), as listed on the *Biodiversity Conservation Act 2016.*
2. Endangered (E), Critically Endangered (CE) as listed on the *Environment Protection and Biodiversity Conservation Act 1999.*

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Appendix C

Fauna recorded during site surveys

Fauna recorded during site surveys

Scientific name	Common name	BC Act[1]	EPBC Act[2]
Amphibian			
Litoria peronii	Peron's Tree Frog		
Uperoleia laevigata	Smooth Toadlet		
Birds			
Milvus migrans	Black Kite		
Anas superciliosa	Pacific Black Duck		
Ardea pacifica	White-necked Heron		
Egretta novaehollandiae	White-faced Heron		
Cracticus nigrogularis	Pied Butcherbird		
Cracticus tibicen	Australian Magpie		
Cacatua galerita	Sulphur-crested Cockatoo		
Cacatua roseicapilla	Galah		
Coracina novaehollandiae	Black-faced Cuckoo-shrike		
Ocyphaps lophotes	Crested Pigeon		
Corcorax melanorhamphos	White-winged Chough		
Struthidea cinerea	Apostlebird		
Corvus coronoides	Australian Raven		
Grallina cyanoleuca	Magpie-lark		
Rhipidura fuliginosa	Grey Fantail		
Rhipidura leucophrys	Willie Wagtail		
Malurus cyaneus	Superb Fairy-wren		
Malurus lamberti	Variegated Fairy-wren		
Acanthagenys rufogularis	Spiny-cheeked Honeyeater		
Manorina flavigula	Yellow-throated Miner		
Pachycephala rufiventris	Rufous Whistler		
Acanthiza chrysorrhoa	Yellow-rumped Thornbill		
Acanthiza nana	Yellow Thornbill		
Pardalotus striatus	Striated Pardalote		
Phalacrocorax varius	Pied Cormorant		
Pomatostomus temporalis temporalis	Grey-Crowned Babbler (Eastern subspecies)	V	
Northiella haematogaster	Blue Bonnet		
Platycercus eximius	Eastern Rosella		

Scientific name	Common name	BC Act[1]	EPBC Act[2]
Psephotus haematonotus	Red-rumped Parrot		
*Acridotheres tristis**	Common Myna*		
*Sturnus vulgaris**	Common Starling*		
Mammals			
Trichosurus vulpecula	Common Brushtail Possum		
Macropus giganteus	Eastern Grey Kangaroo		
*Vulpes vulpes**	Fox*		
Chalinobolus gouldii	Gould's Wattled Bat		
Scotorepens balstoni	Inland Broad-nosed Bat		
Vespadelus vulturnus	Little Forest Bat		
*Oryctolagus cuniculus**	Rabbit*		
Austronomus australis	White-striped Free-tail-bat		

Note:

1. Vulnerable (V) as listed on the *Biodiversity Conservation Act 2016.*
2. As listed on the *Environment Protection and Biodiversity Conservation Act 1999.*

* Exotic species

Appendix D

Threatened fauna likelihood of occurrence

Threatened fauna likelihood of occurrence

Scientific name	Common name	BC Act[1]	EPBC Status[2]	Habitat	Data source[3]	Likelihood of occurrence
Birds						
Anthochaera phrygia (syn. Xanthomyza phrygia)	Regent Honeyeater	CE	EM	Occurs mostly in box-ironbark forests and woodland and prefers wet, fertile sites such as along creek flats, broad river valleys and foothills. Riparian forests with Casuarina cunninghamiana and Amyema cambagei are important for feeding and breeding. Spotted Gum and Swamp Mahogany forests are also important feeding areas in coastal areas. Important food trees include *Eucalyptus sideroxylon* (Mugga Ironbark), *E. albens* (White Box), *E. melliodora* (Yellow Box) and *E. leucoxylon* (Yellow Gum) (Garnett and Crowley, 2000).	EPBC	Moderate No nearby records and the survey area contains no high-quality habitat. May occur within survey area during seasonal movements and utilise blossoming eucalypts. Rare occurrences cannot be entirely discounted.
Apus pacificus	Fork-tailed Swift		M	Breeds in the northern hemisphere, wintering south to Australia. It is almost exclusively aerial, flying from less than 1 m to at least 300 m above ground. It mostly occurs over inland plains but sometimes above foothills or in coastal areas over cliffs, beaches, islands and well out to sea. It also occurs over towns and cities. It mostly occurs over dry and/or open habitats, including riparian woodland and tea-tree swamps, low scrub, heathland or saltmarsh, grassland, spinifex sandplains, farmland and sand-dunes. It sometimes occurs above forests. It probably roosts aerially, but has occasionally been observed to land (Higgins, 1999).	EPBC	Moderate. Potential aerial foraging habitat available, but no suitable terrestrial habitat. May occur intermittently over the survey area during seasonal movements.

Scientific name	Common name	BC Act[1]	EPBC Status[2]	Habitat	Data source[3]	Likelihood of occurrence
Ardea (Bulbulcus) ibis	Cattle Egret		M	Widespread and common according to migration movements and breeding localities surveys. Breeds in colonies, either mono-specific or with other Egrets/Herons. In Australia the principal breeding sites are the central east coast from about Newcastle to Bundaberg. It also breeds in major inland wetlands in north NSW (notably the Macquarie Marshes). Occurs in tropical and temperate grasslands, wooded lands and terrestrial wetlands. It has occasionally been seen in arid and semi-arid regions however this is extremely rare. High numbers have been observed in moist, low-lying poorly drained pastures with an abundance of high grass; it avoids low grass pastures. It has been recorded on earthen dam walls and ploughed fields. It is commonly associated with the habitats of farm animals, particularly cattle, but also pigs, sheep, horses and deer. The Cattle Egret is known to follow earth-moving machinery and has been located at rubbish tips. It uses predominately shallow, open and fresh wetlands including meadows and swamps with low emergent vegetation and abundant aquatic flora. They have sometimes been observed in swamps with tall emergent vegetation (Department of the Environment, 2016a).	EPBC	Moderate. Potential foraging habitat available. May occur intermittently within agricultural land during seasonal movements.

Scientific name	Common name	BC Act[1]	EPBC Status[2]	Habitat	Data source[3]	Likelihood of occurrence
Artamus cyanopterus	Dusky Woodswallow	V		The Dusky Woodswallow is widespread in eastern, southern and southwestern Australia. In New South Wales it is widespread from coast to inland, including the western slopes of the Great Dividing Range and farther west. It is sparsely scattered in, or largely absent from, much of the Upper Western region (Higgins and Peter, 2002). Often reported in woodlands and dry open sclerophyll forests, usually dominated by eucalypts, including mallee associations. It has also been recorded in shrublands and heathlands and various modified habitats, including regenerating forests; very occasionally in moist forests or rainforests (Higgins and Peter, 2002). At sites where Dusky Woodswallows are recorded the understorey is typically open with sparse eucalypt saplings, acacias and other shrubs, including heath(Higgins and Peter, 2002).The ground cover may consist of grasses, sedges or open ground, often with coarse woody debris(Higgins and Peter, 2002). Birds are also often observed in farm land, usually at the edges of forest or woodland or in roadside remnants or wind breaks with dead timber (Higgins and Peter, 2002).In western New South Wales this species is primarily associated with River Red Gum/Black Box/Coolibah open forest/woodland associated with larger river/creek systems and is less common and far more patchily distributed in other communities such as mallee and cypress-pine woodland(Higgins and Peter, 2002).	Bionet	Moderate. Potential foraging habitat in survey area in associated with remnant vegetation and roadside remnants.
Botaurus poiciloptilus	Australasian Bittern	E1	E	Occurs in shallow, vegetated freshwater or brackish swamps. Requires permanent wetlands with tall dense vegetation, particularly bulrushes and spikerushes. When breeding, pairs are found in areas with a mixture of tall and short sedges but will also feed in more open territory. (Garnett and Crowley, 2000, NSW National Parks and Wildlife Service, 2002).	EPBC	Low. No available habitat in survey area.
Calidris acuminata	Sharp-tailed Sandpiper		M	Occurs in a variety of habitats: tidal mudflat, mangrove swamps, saltmarshes, shallow fresh, brackish, salt inland swamps and lakes; flooded and irrigated paddocks, sewage farms and commercial saltfields (Pizzey and Knight, 2007).	Bionet	Low. Marginal habitat in study, may occur on rare occasions in artificial dams during seasonal movements.

Scientific name	Common name	BC Act[1]	EPBC Status[2]	Habitat	Data source[3]	Likelihood of occurrence
Calidris ferruginea	Curlew Sandpiper	E1	M	Occurs in inter-tidal mudflats of estuaries, lagoons, mangrove channels and also around lakes, dams, floodwaters and flooded saltbush surrounding inland lakes (Morcombe, 2003).	Bionet, EPBC	Low. Marginal habitat in study, may occur on rare occasions in artificial dams during seasonal movements.
Calidris ruficollis	Red-necked Stint		M	Mostly found in coastal areas, including sheltered inlets, bays lagoons and estuaries. They also occur in shallow wetlands near the coast or inland, including lakes, waterholes and dams (Higgins and Davies, 1996). They forage in mudflats, shallow water, sandy open beaches, flooded paddocks and in samphire feeding along the edges. The species roosts on sheltered beaches, spits, banks or islets, of sand, mud, coral or shingle. Occasionally they roost on exposed reefs or shoals (Higgins and Davies, 1996) and amongst seaweed, mud and cow-pats (Hobbs, 1961). During high tides they may also use sand dunes and claypans.	Bionet	Low. Marginal habitat in study, may occur on rare occasions in artificial dams during seasonal movements.
Chthonicola sagittata (syn. Pyrrholaemus sagittatus)	Speckled Warbler	V		Occurs in a wide range of eucalypt dominated vegetation with a grassy understorey and is often found on rocky ridges or in gullies. It feeds on seeds and insects and builds domed nests on the ground (Garnett and Crowley, 2000). The species has been shown to decrease in abundance as woodland area decreased, and it appears to be extinct in districts where no fragments larger than 100ha remain (Barrett et al., 1994). Isolation of Speckled Warbler populations in small remnants increases their vulnerability to local extinction as a result of stochastic events and decreases their genetic viability in the long term (NSW Scientific Committee, 2001b).	Bionet	Low. Marginal habitat available, no large remnant vegetation patches occur in survey area.
Circus assimilis	Spotted Harrier	V		Occurs throughout the Australian mainland, except in densely forested or wooded habitats of the coast, escarpment and ranges, and rarely in Tasmania. Occurs in grassy open woodland including Acacia and mallee remnants, inland riparian woodland, grassland and shrub steppe. It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands. Preys on terrestrial mammals (e.g. bandicoots, bettongs, and rodents), birds and reptile, occasionally insects and rarely carrion. (Office of Environment & Heritage, 2012b)	Bionet	Moderate Local records occur and potential foraging habitat within survey area.

Scientific name	Common name	BC Act[1]	EPBC Status[2]	Habitat	Data source[3]	Likelihood of occurrence
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	V		The Brown Treecreeper is endemic to eastern Australia and occurs in eucalypt forests and woodlands of inland plains and slopes of the Great Dividing Range. It is less commonly found on coastal plains and ranges. The western boundary of the range of Climacteris picumnus victoriae runs approximately through Corowa, Wagga Wagga, Temora, Forbes, Dubbo and Inverell and along this line the subspecies intergrades with the arid zone subspecies of Brown Treecreeper (*Climacteris picumnus picumnus*) which then occupies the remaining parts of the state. The eastern subspecies lives in eastern NSW in eucalypt woodlands through central NSW and in coastal areas with drier open woodlands such as the Snowy River Valley, Cumberland Plains, Hunter Valley and parts of the Richmond and Clarence Valleys. Mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species; also found in mallee and River Red Gum (Eucalyptus camaldulensis) Forest bordering wetlands with an open understorey of acacias, saltbush, lignum, cumbungi and grasses; usually not found in woodlands with a dense shrub layer; fallen timber is an important habitat component for foraging; also recorded, though less commonly, in similar woodland habitats on the coastal ranges and plains. Hollows in standing dead or live trees and tree stumps are essential for nesting (Office of Environment & Heritage, 2014a).	Bionet	Moderate. Local records occur, and potential habitat within remnant vegetation.
Daphoenositta chrysoptera	Varied Sittella	V		The Varied Sittella inhabits most of mainland Australia except the treeless deserts and open grasslands. It inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. The Varied Sittella feeds on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees, and from small branches and twigs in the tree canopy. It builds a cup-shaped nest of plant fibres and cobwebs in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years (Office of Environment & Heritage, 2016b).	Bionet	Moderate. Local records and potential foraging habitat within remnant vegetation.

Scientific name	Common name	BC Act[1]	EPBC Status[2]	Habitat	Data source[3]	Likelihood of occurrence
Epthianura albifrons	White-fronted Chat	E2		The White-fronted Chat occupies foothills and lowlands below 1000 m above sea level (North 1904; Higgins et al. 2001; Barrett et al. 2003). In New South Wales the White-fronted Chat occurs mostly in the southern half of the state, occurring in damp open habitats along the coast, and near waterways in the western part of the state (Higgins et al. 2001). Along the coastline, White-fronted Chats are found predominantly in saltmarsh vegetation although they are also observed in open grasslands and sometimes in low shrubs bordering wetland areas. (North 1904; Higgins et al. 2001; Barrett et al. 2003). The population in the Sydney Metropolitan Catchment Management Authority region is listed as Endangered (Office of Environment and Heritage, 2012).	Bionet	Low. A low number of local records with marginal habitat in survey area.
Falco hypoleucos	Grey Falcon	E1		Generally centred on inland drainage systems where the average rainfall is less than 500 millimetres. It is found in timbered lowland plains that are crossed by tree-lined water courses. Nests in the old nests of other birds, particularly raptors (Garnett and Crowley, 2000).	Bionet	Low. Marginal habitat available, inhabits woodlands in arid and semi-arid zones. May occur intermittently under extended dry inland conditions.
Falco subniger	Black Falcon	V		Widely, but sparsely, distributed in New South Wales, mostly occurring woodland, shrubland and grassland in the arid and semi-arid zones, especially wooded watercourses and agricultural land with scattered remnant trees. It is usually associated with streams or wetlands, visiting them in search of prey and often using standing dead trees as lookout posts. Habitat selection is generally influenced more by prey densities than by specific aspects of habitat floristics or condition, although in agricultural landscapes it tends to nest in healthy, riparian woodland remnants with a diverse avi-fauna (NSW Scientific Committee, 2013).	Bionet	Moderate. Potential foraging habitat within survey area.
Gallinago hardwickii	Latham's Snipe		M	Occurs in freshwater or brackish wetlands generally near protective vegetation cover. This species feeds on small invertebrates, seeds and vegetation. It migrates to the northern hemisphere to breed (Garnett and Crowley, 2000).	Bionet, EPBC	Low. Occurs intermittently locally during seasonal movements, however marginal habitat within survey area.

Scientific name	Common name	BC Act[1]	EPBC Status[2]	Habitat	Data source[3]	Likelihood of occurrence
Gelochelidon nilotica (syn Sterna nilotica)	Gull-billed Tern		M	Prefer shallow, often ephemeral, terrestrial wetlands, either fresh or saline, especially lakes, swamps and lagoons, particularly those with mudflats; sometimes on inundated ground, including saltpans, claypans and saltmarsh or watercourses and associated floodplains. Also occur in sheltered coastal embayments, estuaries and river deltas with tidal sandflats, mudflats or beaches. Inland, often occur well away from water, on dry samphire, grassy plains or even gibber. Usually breed on large, often ephemeral, inland lakes and swamps, on low exposed islands, banks, flats or spits of dry mud, sand or, occasionally, rocks; either bare or vegetated with sparse dry grass, reeds and rushes or scattered samphire (Higgins and Davies, 1997).	Bionet	Low. One local record but no available habitat within survey area.
Glareola maldivarum	Oriental Pratincole		M	Within Australia the Oriental Pratincole is widespread in northern areas, especially along the coasts of the Pilbara Region and the Kimberley Division in Western Australia, the Top End of the Northern Territory, and parts of the Gulf of Carpentaria. It is also widespread but scattered inland, mostly north of 20° S. There are occasional records in southern Australia, at sparsely scattered sites, with records in all states.	Bionet	Low. May occur as a rare vagrant during seasonal movements.
Glossopsitta pusilla	Little Lorikeet	V		The Little Lorikeet is a small green lorikeet with black bill and red patch on forehead and throat. The underside is yellow-green. Immatures are duller with less red on face and brown bill. Found in forests, woodland, treed areas along watercourses and roads. Forages mainly on flowers, nectar and fruit. Found along coastal east Australia from Cape York in Queensland down east coast and round to South Australia. Uncommon in southern Victoria (Higgins, 1999).	Bionet	Moderate. Potential foraging habitat within remnant vegetation.
Grantiella picta	Painted Honeyeater	V	V	Lives in dry forests and woodlands. Primary food is the mistletoes in the genus Amyema, though it will take some nectar and insects. Its breeding distribution is dictated by presence of mistletoes which are largely restricted to older trees. Less likely to be found in in strips of remnant box-ironbark woodlands, such as occur along roadsides and in windbreaks, than in wider blocks (Garnett and Crowley, 2000).	EPBC	Low. No local records and marginal foraging habitat within remnant vegetation. A specialist feeder on mistletoes (*Amyema*) which did not occur in high densities.

Scientific name	Common name	BC Act[1]	EPBC Status[2]	Habitat	Data source[3]	Likelihood of occurrence
Haliaeetus leucogaster	White-bellied Sea-Eagle		M	Occurs in coastal areas including islands, estuaries, inlets, large rivers, inland lakes and reservoirs. Builds a huge nest of sticks in tall trees near water, on the ground on islands or on remote coastal cliffs (Pizzey and Knight, 2007).	EPBC	Low. A low number of local records, but no available habitat within survey area.
Hieraaetus morphnoides	Little Eagle	V		The Little Eagle is distributed throughout the Australian mainland occupying habitats rich in prey within open eucalypt forest, woodland or open woodland. Sheoak or acacia woodlands and riparian woodlands of interior NSW are also used. For nest sites it requires a tall living tree within a remnant patch, where pairs build a large stick nest in winter and lay in early spring. Prey includes birds, reptiles and mammals, with the occasional large insect and carrion. Preys on birds, reptiles and mammals, occasionally adding large insects and carrion. Most of its former native mammalian prey species in inland NSW are extinct and rabbits now form a major part of the diet (Marchant and Higgins, 1993, Office of Environment & Heritage, 2015d).	Bionet	Moderate. Local records and potential foraging habitat within survey area.
Hirundapus caudacutus	White-throated Needletail		M	Occurs in airspace over forests, woodlands, farmlands, plains, lakes, coasts and towns. Breeds in the northern hemisphere and migrates to Australia in October-April (Pizzey and Knight, 2007).	Bionet	Moderate. May occur over survey area during seasonal movements, but no suitable terrestrial habitat in survey area.

Scientific name	Common name	BC Act[1]	EPBC Status[2]	Habitat	Data source[3]	Likelihood of occurrence
Lathamus discolor	Swift Parrot	E1	CE	Breeding occurs in Tasmania, majority migrates to mainland Australia in autumn, over-wintering, particularly in Victoria and central and eastern NSW, but also south-eastern Queensland as far north as Duaringa. Until recently it was believed that in New South Wales, swift parrots forage mostly in the western slopes region along the inland slopes of the Great Dividing Range but are patchily distributed along the north and south coasts including the Sydney region, but new evidence indicates that the forests on the coastal plains from southern to northern NSW are also extremely important. In mainland Australia it is semi-nomadic, foraging in flowering eucalypts in eucalypt associations, particularly box-ironbark forests and woodlands. Preference for sites with highly fertile soils where large trees have high nectar production, including along drainage lines and isolated rural or urban remnants, and for sites with flowering Acacia pycnantha, is indicated. Sites used vary from year to year. (Garnett and Crowley, 2000),(Swift Parrot Recovery Team, 2001).	Bionet, EPBC	Moderate. Low number of local records, but may occur within survey area during seasonal movements and utilise blossoming eucalypts.
Leipoa ocellata	Malleefowl	E1	VM	Ground-dwelling bird found in mallee woodland and other dry scrub in the semi-arid zone of inland Australia. Restricted to semi-arid rangelands and small habitat remnants in the dryland cropping zone of the southwest and centre of NSW. Prefers well drained, light sandy or loamy soils. Habitat usually contains dense but discontinuous canopy which provides abundant leaf litter and dense, varied shrub and herb layers containing food plants, particularly Acacia, Cassia, Bossiaea, Beyeria and some open ground for ease of movement (NSW National Parks and Wildlife Service, 1999b).	EPBC	Low. No available habitat within survey area.
Limosa limosa	Black-tailed Godwit	V	M	A coastal species found on tidal mudflats, swamps, shallow river margins and sewage farms. Also found inland on larger shallow fresh or brackish waters. A migratory species visiting Australia between September and May (Pizzey and Knight, 2007).	Bionet	Low. Local records at the Parkes Sewerage Treatment Plant, but no available habitat within survey area.

Scientific name	Common name	BC Act[1]	EPBC Status[2]	Habitat	Data source[3]	Likelihood of occurrence
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	V		Occurs within areas of annual rainfall between 400-700 mm. Feed on insects, nectar and lerps (Garnett and Crowley, 2000). Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark (*Eucalyptus sideroxylon*), White Box (*E. albens*), Inland Grey Box (*E. microcarpa*), Yellow Box (*E. melliodora*), Blakely's Red Gum (*E. blakelyi*) and Forest Red Gum (*E. tereticornis*). Also inhabits open forests of smooth-barked gums, stringybarks, ironbarks, river sheoaks (nesting habitat) and tea-trees. Feeding territories are large making the species locally nomadic. It tends to occur in the largest woodland patches in the landscape as birds forage over large home ranges of at least 5 hectares(Office of Environment & Heritage, 2015a).	Bionet	Low. No available habitat within survey area.
Merops ornatus	Rainbow Bee-eater		M	Usually occur in open or lightly timbered areas, often near water. Breed in open areas with friable, often sandy soil, good visibility, convenient perches and often near wetlands. Nests in embankments including creeks, rivers and sand dunes. Insectivorous, most foraging is aerial, in clearings (Higgins, 1999).	Bionet	Moderate. Potential to occur within remnant vegetation during seasonal movements.
Motacilla flava	Yellow Wagtail		M	This species occurs in a range of habitats including estuarine habitats such as sand dunes, mangrove forests and coastal saltmarshes. This species also occurs in open grassy areas including disturbed sites such as sports grounds and has been recorded on the edges of wetlands, swamps, lakes and farm dams. This species migrates from Asia to Australia in spring-summer. It has been recorded in the estuarine areas of the Hunter River in Newcastle NSW and in QLD and the north of NT and WA (Higgins et al., 2006).	EPBC	Low. No available habitat within survey area.

Scientific name	Common name	BC Act[1]	EPBC Status[2]	Habitat	Data source[3]	Likelihood of occurrence
Myiagra cyanoleuca	Satin Flycatcher		M	Widespread in eastern Australia. In Queensland, it is widespread but scattered in the east. In NSW, they are widespread on and east of the Great Divide and sparsely scattered on the western slopes, with very occasional records on the western plains. In Victoria, the species is widespread in the south and east, in the area south of a line joining Numurkah, Maldon, the northern Grampians, Balmoral and Nelson. Inhabit heavily vegetated gullies in eucalypt-dominated forests and taller woodlands, and on migration, occur in coastal forests, woodlands, mangroves and drier woodlands and open forests. Satin Flycatchers mainly inhabit eucalypt forests, often near wetlands or watercourses. They generally occur in moister, taller forests, often occurring in gullies. They also occur in eucalypt woodlands with open understorey and grass ground cover, and are generally absent from rainforest. In south-eastern Australia, they occur at elevations of up to 1400 m above sea level, and in the ACT, they occur mainly between 800 m above sea level and the treeline (Department of the Environment, 2016h, Pizzey and Knight, 2007).	EPBC	Low. No local records and no suitable habitat within survey area.
Ninox connivens	Barking Owl	V		Occurs in dry sclerophyll woodland. In the south west it is often associated with riparian vegetation while in the south east it generally occurs on forest edges. It nests in large hollows in live eucalypts, often near open country. It feeds on insects in the non-breeding season and on birds and mammals in the breeding season (Garnett and Crowley, 2000).	Bionet	Moderate Regional records limited to forested ranges and Lachlan River. May forage within survey area.
Numenius madagascariensis	Eastern Curlew		CEM	Inhabits coastal estuaries, mangroves, mud flats and sand pits. It is a migratory shorebird which generally inhabits sea and lake shore mud flats, deltas and similar areas, where it forages for crabs and other crustaceans, clam worms and other annelids, molluscs, insects and other invertebrates. Its migration route ranges from its wintering grounds in Australia to its breeding grounds in northern China, Korea and Russia (Pizzey and Knight, 2007).	EPBC	Low. One local record at the Parkes Sewerage Treatment Plant, but no available habitat within survey area.
Pandion cristatus (syn. P. haliaetus)	Eastern Osprey	V	M	Generally a coastal species, occurring in estuaries, bays, inlets, islands and surrounding waters, coral atolls, reefs, lagoons, rock cliffs and stacks. Sometimes ascends larger rivers to far inland. Builds nests high in tree, on pylon or on ground on islands. Feeds on fish (Pizzey and Knight, 2007).	EPBC	Low. No available habitat within survey area.

Scientific name	Common name	BC Act[1]	EPBC Status[2]	Habitat	Data source[3]	Likelihood of occurrence
Petroica phoenicea	Flame Robin	V		In NSW the Flame Robin breeds in upland moist eucalypt forests and woodlands, often on ridges and slopes, in areas of open understorey. It migrates in winter to more open lowland habitats. In winter lives in dry forests, open woodlands and in pastures and native grasslands, with or without scattered trees. In winter, occasionally seen in heathland or other shrublands in coastal areas. Occasionally occurs in temperate rainforest, and also in herbfields, heathlands, shrublands and sedgelands at high altitudes. The Flame Robin forages from low perches, feeding on invertebrates taken from the ground, tree trunks, logs and other woody debris. The robin builds an open cup nest of plant fibres and cobweb, which is often near the ground in a sheltered niche, ledge or shallow cavity in a tree, stump or bank (Office of Environment & Heritage, 2015b, Higgins and Peter, 2002).	Bionet	Moderate. Potential foraging habitat within remnant vegetation.
Plegadis falcinellus	Glossy Ibis		M	It feeds in very shallow water and nests in freshwater or brackish wetlands with tall dense stands of emergent vegetation (e.g. reeds or rushes) and low trees or bushes. It shows a preference for marshes at the edges of lakes and rivers, as well as lagoons, flood-plains, wet meadows, swamps, reservoirs, sewage ponds, rice-fields and irrigated cultivation. It less often occurs in coastal locations such as estuaries, deltas, saltmarshes and coastal lagoons. Roosting sites are often large trees that may be far from water. The nest is a platform of twigs and vegetation usually positioned less than 1 m above water in tall dense stands of emergent vegetation (e.g. reeds or rushes), low trees or bushes over water (BirdLife International, 2009).	Bionet	Moderate. Potential foraging habitat within agricultural areas.

Scientific name	Common name	BC Act[1]	EPBC Status[2]	Habitat	Data source[3]	Likelihood of occurrence
Polytelis swainsonii	Superb Parrot	V	V	Found throughout eastern inland NSW. On the South-western Slopes their core breeding area is roughly bounded by Cowra and Yass in the east, and Grenfell, Cootamundra and Coolac in the west. Birds breeding in this region are mainly absent during winter, when they migrate north to the region of the upper Namoi and Gwydir Rivers. The other main breeding sites are in the Riverina along the corridors of the Murray, Edward and Murrumbidgee Rivers where birds are present all year round. Inhabit Box-Gum, Box-Cypress-pine and Boree Woodlands and River Red Gum Forest. In the Riverina the birds nest in the hollows of large trees (dead or alive) mainly in tall riparian River Red Gum Forest or Woodland. On the South West Slopes nest trees can be in open Box-Gum Woodland or isolated paddock trees with hollows between 8 and 18 cm. Tree species known to be used are Blakely's Red Gum, Yellow Box, Apple Box and Red Box. Feed in trees and understorey shrubs and on the ground and their diet consists mainly of grass seeds and herbaceous plants. Also eaten are fruits, berries, nectar, buds, flowers, insects and grain (Office of Environment and Heritage, 2014) (Department of the Environment and Energy, 2017b, Garnett and Crowley, 2000).	Bionet, EPBC	Moderate. Local records and potential foraging habitat within remnant vegetation.
Pomatostomus temporalis temporalis	Grey-Crowned Babbler (Eastern subspecies)	V		The eastern form of the species formerly ranged throughout eastern Australia from South Australia, through Victoria and broadly through NSW and central Queensland but is now extinct in South Australia, coastal Victoria and the ACT. In NSW, it occurs on the western slopes and plains but is less common at the higher altitudes of the tablelands. Isolated populations are known from coastal woodlands on the North Coast, in the Hunter Valley and from the South Coast near Nowra (Blakers et al., 1984, Schodde and Mason, 1999).Grey-crowned Babblers occupy open woodlands dominated by mature eucalypts, with regenerating trees, tall shrubs, and an intact ground cover of grass and forbs. The species builds conspicuous dome-shaped nests and breeds co-operatively in sedentary family groups of 2-13 birds (Davidson and Robinson, 1992).Grey-crowned Babblers are insectivorous and forage in leaf litter and on bark of trees (NSW Scientific Committee, 2001a).	Bionet	Recorded. Individuals recorded within remnant roadside vegetation.
Rhipidura rufifrons	Rufous Fantail		M	Occurs in a range of habitats including the undergrowth of rainforests/wetter eucalypt forests/gullies, monsoon forests paperbarks, sub-inland and coastal scrubs, mangroves, watercourses, parks and gardens. When migrating they may also be recorded on farms, streets and buildings. Migrates to SE Australia in October-April to breed, mostly in or on the coastal side of the Great Dividing Range (Pizzey and Knight, 2007).	EPBC	Low. Marginal habitat within survey area. May occur as a rare vagrant.

Scientific name	Common name	BC Act[1]	EPBC Status[2]	Habitat	Data source[3]	Likelihood of occurrence
Rostratula australis (syn. R. benghalensis)	Australian Painted Snipe (Painted Snipe)	E1	VM	Inhabits shallow, vegetated, temporary or infrequently filled wetlands, including where there are trees such as Eucalyptus camaldulensis (River Red Gum), E. populnea (Poplar Box) or shrubs such as Muehlenbeckia florulenta (Lignum) or Sarcocornia quinqueflora (Samphire). Feeds at the water's edge and on mudlflats on seeds and invertebrates, including insects, worms, molluscs and crustaceans. Males incubate eggs in a shallow scrape nest (Garnett and Crowley, 2000).	EPBC	Low. Only a single record locally at the Parkes Sewerage Treatment Plant and no available habitat within survey area.
Stagonopleura guttata	Diamond Firetail	V		Distributed through central and eastern NSW, extending north into southern and central Queensland and south through Victoria to the Eyre Peninsula, South Australia. In NSW, the species occurs predominantly west of the Great Dividing Range, although populations are known from drier coastal areas (Blakers et al., 1984, Schodde and Mason, 1999). Occurs in a range of eucalypt dominated communities with a grassy understorey including woodland, forest and mallee. Most populations occur on the inland slopes of the dividing range (Garnett and Crowley, 2000). Firetails nest in trees and bushes, and forage on the ground, largely for grass seeds and other plant material, but also for insects (Blakers et al., 1984, Read, 1994).	Bionet	Moderate. Potential foraging habitat within remnant vegetation.
Stictonetta naevosa	Freckled Duck	V		In most years this species appear to be nomadic between ephemeral inland wetlands. In dry years they congregate on permanent wetlands while in wet years they breed prolifically and disperse widely, generally towards the coast. In inland eastern Australia, they generally occur in brackish to hyposaline wetlands that are densely vegetated with Lignum (Muehlenbeckia cunninghamii) within which they build their nests (Garnett and Crowley, 2000).	Bionet	Low. Local records at the Parkes Sewerage Treatment Plant, but no available habitat within survey area.
Tringa glareola	Wood Sandpiper		M	Found in well-vegetated, shallow, freshwater wetlands, such as swamps, billabongs, lakes, pools and waterholes. They are typically associated with emergent, aquatic plants or grass, and dominated by taller fringing vegetation, such as dense stands of rushes or reeds, shrubs, or dead or live trees and often with fallen timber. They also inhabit inundated grasslands, short herbage or wooded floodplains, where floodwaters are temporary or receding, and irrigated crops. This species uses artificial wetlands, including open sewage ponds, reservoirs, large farm dams, and bore drains and occasionally found in stony wetlands. The species forages on mud at the edges of wetlands, either along shores, among open scattered aquatic vegetation, or in clear shallow water (Higgins and Davies, 1996).	Bionet	Low. Local records at the Parkes Sewerage Treatment Plant, but no available habitat within survey area.

Scientific name	Common name	BC Act[1]	EPBC Status[2]	Habitat	Data source[3]	Likelihood of occurrence
Tringa nebularia	Common Greenshank		M	Occurs in a range of inland and coastal environments. Inland, it occurs in both permanent and temporary wetlands, billabongs, swamps, lakes floodplains, sewage farms, saltworks ponds, flooded irrigated crops. On the coast, it occurs in sheltered estuaries and bays with extensive mudflats, mangrove swamps, muddy shallows of harbours and lagoons, occasionally rocky tidal ledges. It generally prefers wet and flooded mud and clay rather than sand (Morcombe, 2003).	Bionet	Low. Local records at the Parkes Sewerage Treatment Plant, but no available habitat within survey area.
Tringa stagnatilis	Marsh Sandpiper			Occurs in coastal and inland wetlands (salt or fresh water), estuarine and mangrove mudflats, beaches, shallow or swamps, lakes, billabongs, temporary floodwaters, sewage farms and saltworks ponds (Morcombe, 2003).	Bionet, EPBC	Low. Local records at the Parkes Sewerage Treatment Plant, but no available habitat within survey area.
Fish						
Maccullochella peelii	Murray Cod		V	The Murray Cod was historically distributed throughout the Murray-Darling Basin (the Basin), which extends from southern Queensland, through New South Wales (NSW), the Australian Capital Territory (ACT) and Victoria to South Australia, with the exception of the upper reaches of some tributaries. The species still occurs in most parts of this natural distribution, up to approximately 1000 m above sea level. It utilises a diverse range of habitats from clear rocky streams, such as those found in the upper western slopes of NSW (including the ACT), to slow-flowing, turbid lowland rivers and billabongs. Preferred microhabitat consists of complex structural features in streams such as large rocks, snags (pieces of large submerged woody debris), overhanging stream banks and vegetation, tree stumps, logs, branches and other woody structures. (Department of the Environment, 2016f)	EPBC	Low. No available habitat within survey area.

Scientific name	Common name	BC Act[1]	EPBC Status[2]	Habitat	Data source[3]	Likelihood of occurrence
Macquaria australasica	Macquarie Perch		E	Macquarie Perch are found in the Murray-Darling Basin (particularly upstream reaches) of the Lachlan, Murrumbidgee and Murray rivers, and parts of south-eastern coastal NSW, including the Hawkesbury/Nepean and Shoalhaven catchments. Macquarie Perch are found in both river and lake habitats; especially the upper reaches of rivers and their tributaries. It prefers clear water and deep, rocky holes with lots of cover. As well as aquatic vegetation, additional cover may comprise of large boulders, debris and overhanging banks. Spawning occurs just above riffles (shallow running water). (Department of the Environment, 2016e) (Department of Primary Industries, 2016).	EPBC	Low. No available habitat within survey area.
Mammals						
Chalinolobus picatus	Little Pied Bat	V		The Little-Pied Bat is found in inland Queensland and NSW (including Western Plains and slopes) extending slightly into South Australia and Victoria and has been recorded in dry open forest, open woodland, Mulga woodlands, chenopod shrublands, Callitris forest and mallee (Churchill, 1998, Shelly, 1998). The species roosts and breeds in tree hollows, fissures or cracks, buildings, powerpoles, fenceposts, caves, cliff crevices, mine shafts and tunnels. Roost sites in caves are usually warm and dry but the species can tolerate roost temperatures of more than 40 degrees Celsius (Office of Environment and Heritage, 2011).	Bionet	Moderate. Potential foraging and roosting habitat within remnant vegetation.
Nyctophilus corbeni (syn. N. timoriensis)	South-eastern Long-eared Bat (Corben's Long-eared Bat & Greater Long-eared Bat)	V	V	Overall, the distribution of the south eastern form coincides approximately with the Murray Darling Basin with the Pilliga Scrub region being the distinct stronghold for this species. Inhabits a variety of vegetation types, including mallee, bulloke (Allocasuarina leuhmanni) and box eucalypt dominated communities, but it is distinctly more common in box/ironbark/cypress-pine vegetation that occurs in a north-south belt along the western slopes and plains of NSW and southern Queensland. Roosts in tree hollows, crevices, and under loose bark. (Department of the Environment, 2016b) (Office of Environment & Heritage, 2012a) (Churchill, 2008).	EPBC	Low. May occur locally in forested ranges by no suitable habitat within the survey area.

Scientific name	Common name	BC Act[1]	EPBC Status[2]	Habitat	Data source[3]	Likelihood of occurrence
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V		This species is widespread through tropical Australia and migrates to southern Australia in summer. Occurs in eucalypt forest where it feeds above the canopy and in mallee or open country where it feeds closer to the ground. Generally a solitary species but sometimes found in colonies of up to 10. It roosts and breeds in tree hollows but has also been recorded roosting under exfoliating bark, in burrows of terrestrial mammals, in soil cracks and under slabs of rock and in the nests of bird and sugar gliders (Office of Environment & Heritage, 2014c).	Technical opinion	Moderate Potential foraging and roosting habitat within remnant vegetation.
Phascolarctos cinereus	Koala	V	V	The Koala has a fragmented distribution throughout eastern Australia from north-east Queensland to the Eyre Peninsula in South Australia. In NSW it mainly occurs on the central and north coasts with some populations in the west of the Great Dividing Range. Inhabits eucalypt woodlands and forests. Koalas Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species. The preferred tree species vary widely on a regional and local basis. Some preferred species include Forest Red Gum *Eucalyptus tereticornis*, Grey Gum *E. punctata.* In coastal areas, Tallowwood *E. microcorys* and Swamp Mahogany *E. robusta* are important food species, while in inland areas White Box *E. albens*, Bimble Box *E. populnea* and River Red Gum *E. camaldulensis* are favoured (NSW National Parks and Wildlife Service, 1999a, NSW National Parks and Wildlife Service, 2003, Office of Environment and Heritage, 2015). Hawks Nest and Tea Gardens Population and population in the Pittwater LGA listed as Endangered under the NSW TSC Act(Office of Environment & Heritage, 2016a, Office of Environment & Heritage, 2013).	Bionet, EPBC	Low. Very few records within locality. Likely density is low. Marginal habitat within survey area, may intermittently occur within remnant vegetation.
Pseudomys novaehollandiae	New Holland Mouse		V	The New Holland Mouse has a fragmented distribution across Tasmania, Victoria, New South Wales and Queensland. Known to inhabit open heathlands, woodlands and forests with a heathland understorey and vegetated sand dunes. Due to the largely granivorous diet of the species, sites where the New Holland Mouse is found are often high in floristic diversity, especially leguminous perennials (Department of the Environment, 2016g) (Office of Environment & Heritage, 2014b).	EPBC	Low. No available habitat within survey area.

Scientific name	Common name	BC Act[1]	EPBC Status[2]	Habitat	Data source[3]	Likelihood of occurrence
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	Occurs in the coastal belt from Rockhampton in central Queensland to Melbourne in Victoria. However, only a small proportion of this range is used at any one time, as the species selectively forages where food is available. As a result, patterns of occurrence and relative abundance within its distribution vary widely between seasons and between years. At a local scale, the species is generally present intermittently and irregularly. At a regional scale, broad trends in the distribution of plants with similar flowering and fruiting times support regular annual cycles of migration. Whilst Brisbane, Newcastle, Sydney and Melbourne are occupied continuously, elsewhere, during spring, Grey-headed Flying-foxes are uncommon south of Nowra and widespread in other areas of their range. The species is widespread throughout their range in summer, whilst in autumn it occupies coastal lowlands and is uncommon inland. In winter, the species congregates in coastal lowlands north of the Hunter Valley and is occasionally found on the south coast of NSW (associated with flowering Spotted Gum *Corymbia maculata*) and on the northwest slopes (generally associated with flowering White Box *Eucalyptus albens* or Mugga Ironbark *E. sideroxylon*). Occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Feed on the nectar and pollen of native trees, in particular Eucalyptus, Melaleuca and Banksia, and fruits of rainforest trees and vines (Office of Environment & Heritage, 2015c) (Department of the Environment, 2016d).	EPBC	Low. May occur within survey area intermittently whilst utilising greater locality for foraging. May occur within urban areas utilising planted fruit trees. No records within locality.
Reptiles						
Aprasia parapulchella	Pink-tailed Worm Lizard (syn. Pink-tailed Legless Lizard)	V	V	This lizard is known from four sites in eastern Australia: near Canberra in the ACT, Tarcutta and Bathurst in NSW, and near Bendigo in Vic. In general, lizards occur in open grassland habitats that have a substantial cover of small rocks (Osbourne and Jones, 1995). Lizards also show a preference for sunny aspects, avoiding S facing slopes. Some specimens have been collected from grassland sites that appear not to support any native grasses and several animals have been found on the edge of *Callitris enlicheri* woodland and *Eucalyptus macrorhyncha* woodland (Barrer, 1992). A burrowing species, it is usually found under rocks on well-drained soil and in ant nests, occasionally with several individuals found under the same rock (Swan et al., 2004).	EPBC	Low. No available habitat within survey area.

Scientific name	Common name	BC Act[1]	EPBC Status[2]	Habitat	Data source[3]	Likelihood of occurrence
Delma impar	Striped Legless Lizard	V	V	The Striped Legless Lizard occurs in the Southern Tablelands, the South West Slopes and possibly on the Riverina. Populations are known in the Goulburn, Yass, Queanbeyan, Cooma and Tumut areas. Also occurs in the ACT, Victoria and south-eastern South Australia. Found mainly in Natural Temperate Grassland but has also been captured in grasslands that have a high exotic component. Also found in secondary grassland near Natural Temperate Grassland and occasionally in open Box-Gum Woodland. Habitat is where grassland is dominated by perennial, tussock-forming grasses such as Kangaroo Grass *Themeda australis*, spear-grasses *Austrostipa spp*. and poa tussocks *Poa spp*., and occasionally wallaby grasses *Austrodanthonia spp*. Sometimes present in modified grasslands with a significant content of exotic grasses. Also sometimes found in grasslands with significant amounts of surface rocks, which are used for shelter (Department of the Environment, 2016c, Corrigan et al., 1996).	EPBC	Low. No available habitat within survey area.

Note: All pelagic species (e.g. Albatross's, marine turtles etc.) have been removed from the table due the site containing no available habitat or their occurrence being unlikely.

1. Vulnerable (V), Endangered (E1) as listed on the *Biodiversity Conservation Act 2016.*
2. Vulnerable (V), Endangered (E), Critically Endangered (CE), Migratory (M) as listed on the *Environment Protection and Biodiversity Conservation Act 1999.*
3. EPBC=EPBC Protected Matters Search Tool (Department of the Environment and Energy, 2017a), Bionet, = BioNet Atlas of NSW wildlife (Office of Environment & Heritage, 2017), Technical opinion= based on internal technical knowledge, experience and best practise.

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Appendix E

Assessments of significance

Significant assessments

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E1 Vegetation communities

E1.1 Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion (PCT 80/LA153)

Correlation of threatened ecological communities and associated with PCT 80/ LA153 Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion:

- Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions (BC Act, Endangered)
- Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia (EPBC Act, Endangered).

Status

Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia (*Grey Box Woodlands*) is listed as an Endangered Ecological Community under the *EPBC Act 1999* (Department of the Environment, 2016a). This is broadly equivalent to Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions listed as Endangered under the *Threatened Species Conservation Act 1995.*

Description

Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-Eastern Australia (Grey Box Woodlands) occupy a position in the landscape that is transitional between the temperate woodlands and forests of the lower slopes and tablelands of south-eastern Australia, and the semi-arid communities further inland. The ecological community typically occurs in landscapes of low-relief on productive soils derived from alluvial or colluvial materials but may occur on a range of substrates. The ecological community tends to occupy drier sites of the belt of grassy woodlands in south-eastern Australia, within a rainfall zone of 375–700 mm/year (Department of the Environment, 2016a).

This community includes those woodlands in which the dominant tree species is *Eucalyptus microcarpa* (Inland Grey Box), and is often found in association with *E. populnea* subsp. *bimbil* (Bimble or Poplar Box), *Callitris glaucophylla* (White Cypress Pine), *Brachychiton populneus* (Kurrajong), *Allocasuarina luehmannii* (Bulloak) or *E. melliodora* (Yellow Box), and sometimes with *E. albens* (White Box). Shrubs are typically sparse or absent, although this component can be diverse and may be locally common, especially in drier western portions of the community. A variable ground layer of grass and herbaceous species is present at most sites. At severely disturbed sites the ground layer may be absent. The community generally occurs as an open woodland 15–25 m tall, but in some locations the overstorey may be absent as a result of past clearing or thinning, leaving only an understorey (Department of the Environment, 2016a).

Distribution

The Grey Box (*E. microcarpa*) Grassy Woodlands and Derived Native Grasslands of South Eastern Australia ecological community occurs from central-western NSW, through northern and central Victoria into South Australia. Occurring predominantly within the Riverina and South West Slopes regions of NSW down to the Victorian border (Department of the Environment, 2016a).

Specific impacts

This community was identified as occurring within the survey area as disjunct remnant patches of highly modified woodland scattered across a fragmented landscape. The majority of this community within the survey area has been previously subjected to agricultural cropping or grazing pressures. These pressures have resulted in the groundcover being highly disturbed and limited to disturb tolerant native tussock grasses with few native herbs and forbs present. Areas of highest quality *Grey Box Woodlands* were identified along road reserve and in areas were agricultural grazing has been excluded.

The extent of the EPBC Act listed *Grey Box Woodlands* within the survey area is approximately 18.85 ha. The proposed action will result in potential removal of up to 0.84 ha or 3% of this threatened ecological community within the survey area.

Possible indirect impacts on the community may include erosion impacts and sediment deposition from surface water flow, downslope of areas of soil disturbance, and the spread and proliferation of weeds. As well as potential alteration to hydrological regime and flooding regime, and associated impacts due to construction of culverts and bridges. Mitigation measures would be developed to minimise these potential impacts and they are unlikely to have a permanent impact on the community.

BC Act assessment

In the case of a Threatened species, whether the proposed development or activity 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

Not applicable

In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

- 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
- 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

Due to agricultural land use, *Grey Box Woodlands* within the locality generally occurs as fragmented disjunct remnants and as scattered paddock trees. The most intact remnants occur along road reserves and in areas where agricultural activities have been limited or excluded. Within the locality the community is fragmented by agricultural land use practices (i.e. cropping and grazing), residential areas and existing utility infrastructure. This has created a mosaic of large agricultural properties and scattered remnants of native vegetation that are intersected by existing roads, rail and power lines.

The action proposed will require the removal and /or disturbance to 0.84 ha *Grey Box Woodlands* to develop a lineal road corridor. Furthermore, the project will avoid clearing of this community where possible and minimise indirect impacts through the implementation of mitigation measures.

The proposed action will reduce the local occurrence of this community by 0.84 ha or 3% of the recorded extent within the survey area. Within the locality this community extends south within the Newell Highway road reverse and travelling stock route. The reduction of 0.84 ha of *Grey Box Woodlands* is unlikely 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.

Further, the reduction of 0.84 ha or 3% of the recorded extent of *Grey Box Woodlands* within the survey area is unlikely to adversely modify the extent and/or composition of this community that its local occurrence be placed at risk of extinction.

In relation to the habitat of a Threatened species or ecological community:

- The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and
- Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and
- The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality

The proposed action will result in direct removal of up to 0.84 ha of this endangered community within a lineal alignment.

The proposed action would slightly increase fragmentation within the landscape by increasing the distance between patches of remnant vegetation present.

Given the fragmented nature of the landscape and the minor extent of impact on *Grey Box Woodlands* within the survey area, the removal of 0.84 ha, is unlikely to affect the long term survival of the community within the locality

Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

Areas of outstanding biodiversity value (AOBVs) refers to those areas of land listed in under the Biodiversity Conservation Act, these areas contain irreplaceable biodiversity values that are important to the whole of NSW, Australia or globally. No AOBVs has been listed for this threatened ecological community.

Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

The action proposed constitutes or forms part of the following key threatening processes:

- Clearing of native vegetation
- Loss of hollow-bearing trees
- Removal of dead wood and dead trees.

The action proposed will result in the clearing of native vegetation, loss of hollow-bearing trees and the removal of dead wood and dead trees that constitute key threatening processes to this community. As such, the action proposed is considered likely to result in the operation of a key threatening processes to *Grey Box Woodlands*.

The action proposed also has the potential to result in the operation of, or increase the impact of the following key threatening process:

- Invasion of native plant communities by exotic perennial grasses.

In respect to this key threatening process, the action proposed will incorporate ameliorative measures that will mitigate such processes that will not lead to an exacerbation in the operation or increase the impact of the exotic perennial grasses

Conclusion

The action proposed will result in the removal of 0.84 ha of *Grey Box Woodlands.* This action is considered unlikely to adversely affect occurrence and composition of this community such that it would be lead to the local occurrence becoming extinct. Further, the removal of 0.84 ha is unlikely to result in a long-term adverse effect on fragmentation, isolation, and modification of the community within the locality. Whilst the action proposed does constitute key threatening processes the project will incorporate ameliorative measures that will mitigate such processes.

In light of the above assessment the action proposed is considered unlikely to lead to a significant impact on *Grey Box Woodlands* or its habitat.

EPBC Act significance assessment

Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-Eastern Australia is listed as endangered under the EPBC Act. The following assessment has been undertaken following the Matters of National Environmental Significance, Significant Impact Guidelines 1.1 (Department of Environment, 2013).

An action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will:

- Reduce the extent of an ecological community.

The proposed action would result in a reduction of the extent of the *Grey Box Woodlands* within the survey area. Up to 0.84 ha of the EPBC listed ecological community would be removed. This vegetation is of highly modified and fragmented condition, the proposed action will remove of vegetation along a linear transect. The removal of up to 0.84 ha of disturbed and fragmented vegetation to create a linear corridor is not considered to significantly reduce the extent of the community within the region.

Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines.

Grey Box Woodlands generally occur as fragmented disjunct remnants and as scattered paddock trees within the locality. The most intact remnants occur along road reserves and in areas where agricultural grazing has been excluded. Within the locality the community is fragmented by agricultural practices (i.e. cropping and grazing) and existing utility infrastructure forming a mosaic of large agricultural properties and scattered remnants of native vegetation intersected by existing roads, rail and power lines.

The proposed action will involve the construction of a road corridor which is generally within areas cleared of vegetation or on the edge of native vegetation, however, the project would slightly increase fragmentation within the landscape by increasing the distance between patches of *Grey Box Woodlands*

The proposed action will contribute to a small inhibition of ecological functioning; for example the movement of fauna and dispersal of flora species. Although the project would add incrementally to fragmentation within the survey area it is unlikely to exacerbate fragmentation at a regional scale that is likely to be significant to the community given its already highly fragmented state within the locality.

Adversely affect habitat critical to the survival of an ecological community

No critical habitat has been listed for the *Grey Box Woodlands* ecological community under the *Environment Protection and Biodiversity Conservation Act 1999* (Department of Environment and Energy, 2017).

Habitat critical to the survival of ecological communities also refers to areas that are necessary:

- For activities such as foraging, breeding, roosting, or dispersal
- For the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators)
- To maintain genetic diversity and long term evolutionary development, or
- For the reintroduction of populations or recovery of the species or ecological community.

Grey Box Woodlands recorded within the survey area currently occurs as highly fragmented patches. These areas are unlikely to be habitat critical for the community based on the above criteria given the current condition and extent of the community. Furthermore, the project will avoid, clearing of this community where possible, especially high condition patches. Indirect impacts would also be minimised through the implementation of mitigation measures.

Modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns.

The proposed action will require the removal of up to 0.84 ha of *Grey Box Woodlands*.

Any earthworks that would be undertaken in close proximity and upslope of the occurrence of the community would be managed to avoid substantial flow of sediment-laden water into the community.

Any large-scale excavation that occurs in close proximity to the community or to marginal patches will involve mitigation measures to minimise sedimentation and hydrological impacts. Therefore the project is considered unlikely to substantially modify or destroy these abiotic factors.

Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting.

The project will involve the removal of approximately 0.84 ha of this community.

The project will avoid where possible core, less-disturbed, areas of this community and will not result in increased burning, grazing, harvesting or other disturbance that would be likely to affect species composition.

Additionally the community generally occurs in a highly modified condition as a result of land uses (agricultural grazing and residential) and existing infrastructure (road and power). This has resulted in the modification of the communities structurally integrity i.e. absence of one or more strata.

Therefore the project is considered unlikely to substantially change the species composition of an occurrence of this community.

Will the action cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:

- Assisting invasive species, that are harmful to the listed ecological community, to become established
- Causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community.

Grey Box Woodlands within the survey area are currently subject to weed and pest invasion. Additionally the majority of the survey area occurs on agricultural properties which are subjected to high disturbances relating to agricultural practices such as cropping, grazing, and the application of fertilisers. Therefore it is considered unlikely that the project would substantially reduce the quality or integrity of the community's occurrence or increase spread of invasive species.

Additionally mitigation measures will be implemented during construction to minimise the likelihood of spread of weeds or pathogens into the site. These mitigation measures will aid in reducing potential impacts associated with the project that may otherwise result in the further reduction of the community's quality.

Interfere with the recovery of an ecological community

To date, no recovery plan has been developed by the Department of the Environment for *Grey Box Grassy Woodlands* (Department of the Environment, 2016a). Conservation Advice on *Grey Box Woodlands* recognises the main ongoing threats to this ecological community to include: incremental clearance of vegetation; inappropriate grazing regimes; fragmentation; loss and/or decline of mature trees; weed invasion; inappropriate use of fertilisers and herbicides (Department of the Environment, 2010).

The Grey Box (*E. microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-Eastern Australia Conservation Advice (Department of the Environment, 2010) also provides a number research priorities, and priority recovery and threat abatement actions. The project does not interfere with any of these actions or research priorities.

The patches of the community within the study are already fragmented and most show evidence of high levels of disturbance. The action will avoid direct impacts on high-quality areas where possible. The likelihood and intensity of indirect impacts will be minimised through the implementation of mitigation measures.

Conclusion

The *Grey Box Woodlands* recorded within the survey area currently occurs already as disjunct remnant patches of highly modified woodland scattered across a fragmented landscape. The majority of this community within the survey area has been previously subjected to agricultural cropping or grazing pressures. The possible removal of up to 0.84 ha of *Grey Box Woodlands* is unlikely to have a significant impact for the following reasons:

- The project is unlikely to exacerbate fragmentation at a regional scale that is likely to be significant to the community given its already fragmented state
- The project is considered unlikely to substantially modify or destroy abiotic factors (such as water, nutrients, or soil) given the current state of the community and implementation of appropriate mitigation measures
- The project is considered unlikely to substantially change the community composition and/or quality given its current state and the implementation of appropriate mitigation measures.

E1.2 White Box – White Cypress Pine – Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion (PCT 267 / BVT LA218)

Correlation of threatened ecological communities associated with PCT 267/LA218).

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

As stated in Section 3.12 of this report the occurrence of PCT267 BVT LA218 does not meet condition threshold criteria for the EPBC Act listed White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland. Given this no further assessment of this community is required.

Status

The White Box Yellow Box Blakely's Red Gum Woodland community is listed as Endangered Ecological Community under the BC Act and critically endangered under the EPBC Act.

Description

White Box Yellow Box Blakely's Red Gum Woodland (commonly referred to as *Box-Gum Woodland*) is characterised by a species-rich understorey of native tussock grasses, herbs and scattered shrubs, and the dominance, or prior dominance, of White Box *Eucalyptus albens*, Yellow Box *E. melliodora* and Blakely's Red Gum *E. blakelyi*. tree-cover is generally discontinuous and consists of widely-spaced trees of medium height.

In its pre-1750 state, this ecological community was characterised by:

- A ground layer dominated by tussock grasses
- An overstorey dominated or co-dominated by White Box, Yellow Box or Blakely's Red Gum, or Grey Box in the Nandewar bioregion
- A sparse or patchy shrub layer.

The Australian Government listing of White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland is slightly different to the NSW listing. Areas that are part of the Australian Government listed ecological community must have either:

- An intact tree layer and predominately native ground layer; or
- An intact native ground layer with a high diversity of native plant species but no remaining tree layer.

Box-Gum Grassy Woodland occurs along the western slopes and tablelands of the Great Dividing Range from southern Queensland through New South Wales and the Australian Capital Territory to Victoria.

Due to the ecological community's occurrence on fertile soils it has been extensively cleared for agriculture and intact remnants, including both trees and unmodified understorey, are now extremely rare. Clearing and fragmentation for urban, rural residential, agricultural and infrastructure development remain on-going threats to this ecological community, while degradation resulting from inappropriate management and weed invasion by introduced perennial grasses continues to erode the conservation value of remnant areas.

Specific impacts

This community was identified as occurring within the survey area as disjunct remnant patches of highly modified woodland scattered across a fragmented landscape. The majority of this community within the survey area has been previously subjected to agricultural cropping or grazing pressures. These pressures have resulted in the groundcover being highly disturbed and limited to disturb tolerant native

tussock grasses with few native herbs and forbs present. Areas of highest quality *Box-Gum Woodland* were identified along road reserve and in areas were agricultural grazing has been excluded.

The extent of the EPBC Act listed *Box-Gum Woodland* to be removed is approximately 0.1 ha.

Given the highly modified nature of the landscape, land uses of these areas (i.e. cropping and agricultural grazing) and poor condition of *Box-Gum Woodland* observed during the field assessment, the extent of this community is likely to be less if surveyed in more detail.

The proposed action will result in direct removal of up to 0.1 ha of this endangered community.

Possible indirect impacts on the community may include erosion impacts and sediment deposition from surface water flow, downslope of areas of soil disturbance, and the spread and proliferation of weeds. As well as potential alteration to hydrological regime and flooding regime, and associated impacts due to construction of culverts and bridges. Mitigation measures would be developed to minimise these potential impacts and they are unlikely to have a permanent impact on the community.

BC Act assessment

In the case of a Threatened species, whether the proposed development or activity 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

Not applicable

In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

- 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
- 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

Due to agricultural land use, *Box-Gum Woodland* within the locality generally occurs as fragmented disjunct remnants and as scattered paddock trees. The most intact remnants occur along road reserves and in areas where agricultural activities have been limited or excluded. Within the locality the community is fragmented by agricultural land use practices (i.e. cropping and grazing), residential areas and existing utility infrastructure. This has created a mosaic of large agricultural properties and scattered remnants of native vegetation that are intersected by existing roads, rail and power lines.

The project will require the removal and /or disturbance to 0.1 ha *Box-Gum Woodland* to develop a lineal road corridor. The proposed action would slightly increase fragmentation within the landscape by increasing the distance between patches of remnant vegetation present, it is unlikely adversely modify the extent and/or composition of this community that its local occurrence be placed at risk of extinction.

In relation to the habitat of a Threatened species or ecological community:

- The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and
- Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and
- The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality

The proposed action will result in direct removal of up to 0.1 ha of this endangered community within a lineal alignment.

The proposed action would slightly increase fragmentation within the landscape by increasing the distance between patches of remnant vegetation present.

Given the highly fragmented nature of the landscape and poor condition of *Box-Gum Woodland* observed, the removal of 0.1 ha, is unlikely to affect the long term survival of the community within the locality

Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

Areas of outstanding biodiversity value (AOBVs) refers to those areas of land listed in under the Biodiversity Conservation Act, these areas contain irreplaceable biodiversity values that are important to the whole of NSW, Australia or globally. No AOBVs has been listed for this threatened ecological community.

Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

Mitigation measures will be implemented to minimise the likelihood of spread of weeds or pathogens into the subject sites. This will include cleaning all machinery and vehicles prior to entering site and preventing access to core areas of the community. The project will not include the use of fertilisers or the introduction of soil from outside of the national park. The project is unlikely to contribute significantly to any key threatening process.

Conclusion

The *Box-Gum Woodlands* recorded within the survey area currently occurs as disjunct remnant patches of highly modified woodland scattered across a fragmented landscape. The majority of this community within the lineal alignment is or has been previously degraded through agricultural land use practices, existing infrastructure and residential uses. The proposed action is unlikely to have a significant impact upon *Box-Gum Woodland* TEC for the following reasons:

- The potential clearing of 0.84 ha for a lineal road corridor alignment is relatively insignificant and of low to minimal consequence to the TEC's decline at the national scale
- It is considered unlikely that the project will substantially modify this community given the current state of the community and implementation of appropriate mitigation measures
- It is unlikely to significantly interfere with the recovery of the *Box-Gum Woodland* TEC.

E2 Flora

E2.1 Austrostipa wakoolica

Status

Austrostipa wakoolica is listed as Endangered under the EPBC Act and the BC Act (Threatened Species Scientific Committee, 2014).

Description

Austrostipa wakoolica is a densely-tufted, perennial spear-grass that grows to 1 m tall. Austrostipa wakoolica flowers in response to rain. The species has been recorded flowering from October to December (Threatened Species Scientific Committee, 2014).

Distribution and habitat

Austrostipa wakoolica is confined to the floodplains of the Murray River tributaries of central-western and south-western NSW {Threatened Species Scientific Committee, 2014 #7590}. 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. Associated species include *Callitris glaucophylla, Eucalyptus microcarpa, E. populnea, Austrostipa eremophila, A. drummondii, Austrodanthonia eriantha* and *Einadia nutans* (Department of Environment and Conservation, 2005).

Threats

Identified threats to *Austrostipa wakoolica* include {Threatened Species Scientific Committee, 2014 #7590}:

- Habitat reduction and modification from pastoral development, irrigation and altered flooding regimes
- Grazing: total grazing pressure has increased with higher numbers of rabbits, domestic stock and kangaroos; the species is probably palatable to sheep and rabbits
- Drought – as the species is rainfall-dependant, the flowering season is affected by drought or prolonged dry periods
- Weed invasion and competition, particularly from exotic grasses.

Recovery strategies

Specific impacts

No threatened plants species were recorded during the surveys. The surveys were undertaken during peak flowering periods and involved targeted searches throughout available habitat within the survey area.

Available habitat for these species were estimated based on a combination of broad-scale vegetation mapping and field verification within areas were access was available.

The project will potentially require the direct removal or modification of up to approximately 0.94 ha of potential habitat in the form of:

- PCT 80 / BVT LA153 Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes and Riverina Bioregions
- PCT267 / BVT LA218 White Box – White Cypress Pine – Western Grey Box shrub/grass/forb woodland in the NSW South-western Slopes Bioregion.

BC Act significance assessment

In the case of a Threatened species, whether the proposed development or activity 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

Austrostipa wakoolica is known to flower between October and December usually in response to rain. The species disperses seed via wind, rain and flood events which is thought to be viable for up to 5 years and therefore a long-lived seed bank is considered unlikely (Office of Environment and Heritage, 2017). Given this, it is considered unlikely that the project would disrupt the breeding cycle of this species given the seed is highly mobile and should still be capable of crossing the road corridor via wind, rain and flood events. In addition areas of habitat subjected to a long history of heavy grazing and cropping may no long contain a viable seed bank.

Whilst the proposed action will result in the removal of up to 0.94 ha of potential habitat for *Austrostipa wakoolica* it is considered unlikely 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.

In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

- 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
- 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

Not applicable.

In relation to the habitat of a Threatened species or ecological community:

- The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and
- Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and
- The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality

The proposed works will require the removal of 0.94 ha of potential habitat for *Austrostipa wakoolica*. Although the project will result in the loss of potential habitat, it is likely to only represent a small component of locally occurring potential habitat accessible to these species.

Connectivity within a plant population relates to the ability of individuals to disperse and cross pollinate. As previously mentioned above the project is unlikely to affect the mechanisms by which this species cross-pollinates or disperses. The survey area is already largely fragmented, and habitat remaining occurs as disjunct remnant patches and as scattered paddock trees within the locality. It is considered unlikely that the project will fragment or modify the existing habitat in a way that will impact the long term survival of this species.

Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

Areas of Outstanding Biodiversity Value (AOBVs) are those declared by the Minister for the Environment, these areas contain irreplaceable biodiversity values that are important to the whole of NSW, Australia or globally. Areas of declared critical habitat under the Threatened Species Conservation Act 1995, (including Little Penguin and Wollemi Pine declared areas), have become the first AOBVs in NSW with the commencement of the Biodiversity Conservation Act. No AOBVs have been listed for this species, nor is the study area likely to have an effect of any other declared AOBVs.

Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

The proposed works will directly involve one Key Threatening Process for this species: clearing of native vegetation. The project will remove/modify approximately 0.94 ha of potential habitat for *Austrostipa wakoolica.* The habitat within the survey area is relatively disturbed and likely to constitute marginal potential habitat for this species. Mitigation measures will be implemented to minimise the likelihood of spread of weeds or pathogens into the survey area.

Conclusion

No *Austrostipa wakoolica* was recorded within the survey area. The project will remove approximately 0.94 ha of potential habitat identified within the survey area. The habitat within the survey area is likely to constitute marginal potential habitat for this species. Although the project will remove potential habitat it is considered unlikely to lead to a long-term decrease in a population, fragment an existing population, adversely affect critical habitat for the species, disrupt the breeding cycle of the species, introduce or lead to the establishment of invasive species to a degree that would result in the decline of the species provided that the appropriate mitigation measured are developed and implemented during the later stages of the project.

Given this, the proposed action is considered unlikely to lead to a significant impact on *Austrostipa wakoolica* or its habitat.

EPBC Act assessment

Lead to a long-term decrease in the size of a population

Approximately 0.94 ha of potential habitat for *Austrostipa wakoolica* would be affected by the project. No individuals were recorded during surveys. Habitat is unlikely to be of high importance given its condition and the existence of better quality habitat within wider region. Given that the potential habitat within the survey area is likely to be marginal for this species and condition of similar habitats with the wider locality, the project is unlikely to significantly contribute to a long-term decline in the size of a population of this species.

Reduce the area of occupancy of the species

The species has not been recorded within the survey area. The project is however likely to affect approximately 0.94 ha of potential habitat for *Austrostipa wakoolica* within the locality. Although the project will result in the loss of potential habitat, it is of marginal quality and is likely to only represent a small component of locally occurring resources accessible to this species. Nevertheless, the removal of this habitat is considered to be an incremental loss of suitable habitat locally and as such has the potential to reduce the area of occupancy of this species should they occur.

Fragment an existing population into two or more populations

Habitat connectivity is unlikely to be affected by the project. The majority of the project area occurs on previously disturbed land. The area of marginal habitat likely to be affected by the project will be limited to a wide lineal road corridor. The survey area is already largely fragmented, and habitat remaining occurs as disjunct remnant patches and as scattered paddock trees within the locality. It is considered unlikely that the project will fragment an existing population into two or more populations given the ecology of the species and current fragmented state of potential habitat.

Adversely affect habitat critical to the survival of a species

No critical habitat has been listed for *Austrostipa wakoolica* to date. The Significant impact Guidelines 1.1 also defines critical habitat as hat required:

- For activities such as foraging, breeding, roosting, or dispersal
- For the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators)
- To maintain genetic diversity and long term evolutionary development, or
- For the reintroduction of populations or recovery of the species or ecological community.

No areas of known habitat are to be removed as a result of the project. Given that the survey area is in a degraded and fragmented condition in comparison with adjacent woodland habitats, it is unlikely that this is important to the long-term survival of the species in the locality. The project is therefore unlikely affect habitat of critical importance to this species.

Disrupt the breeding cycle of a population

Austrostipa wakoolica is known to flower between October and December usually in response to rain. The species disperses seed via wind, rain and flood events which is thought to be viable for up to 5 years and therefore a long-lived seed bank is considered unlikely (Office of Environment and Heritage, 2017). Therefore it is considered unlikely that the project would disrupt the breeding cycle of this species given that the seed is highly mobile and should still be capable of crossing the road corridor via wind, rain and flood events. In addition areas of habitat subjected to a long history of heavy grazing and cropping may no long contain a viable seed bank.

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

Potential habitat that occurs within the survey area occurs as disjunct remnant patches of highly modified woodland, scattered across a fragmented landscape. Potential habitat has been previously and/or currently disturbed by agricultural cropping and grazing. The higher quality habitat occurred along road reserves and areas were grazing has been excluded.

The project could remove up to approximately 0.94 ha of potential habitat for *Austrostipa wakoolica*. The removal of this marginal habitat is considered to be an incremental loss, decreasing the amount of potential habitat available locally. Additionally, the project will remove vegetation along a linear corridor. Considering the highly modified nature of observed habitats, land uses of these areas (i.e. cropping and agricultural grazing) and the poor condition of Woodland habitat observed it is unlikely that the project will modify, destroy, remove or isolate habitat for this species to the extent that is likely to cause the species to decline.

Result in invasive species that are harmful to an Endangered species becoming established in the Endangered species´ habitat

Invasive species known to be harmful to these species include invasive grasses and feral herbivore species (i.e. rabbits, goats etc.). The survey area occurs in a highly fragmented landscape where these invasive species already exist and are well established. Therefore the project is considered unlikely to introduce additional invasive species that are harmful to them. Additionally mitigation measures will be developed to minimise the likelihood of further spread or establishment of invasive species into the habitat of this species.

Introduce disease that may cause the species to decline

No diseases are known to harm these species. The project is unlikely to introduce any diseases.

Mitigation measures will be prepared to minimise the likelihood of the introduction and spread of pathogens into the habitat of this species.

Interfere with the recovery of the species

No national recovery plans for this species has been prepared. The Threatened Species Scientific Committee (Threatened Species Scientific Committee, 2014) have identified priority recovery and threat abatement actions to support *Austrostipa wakoolica*. The project has potential to interfere with one of these actions being to prevent further loss of extant populations. The project will impact on marginal habitat for this species, however there are no known individuals in the survey area. The project is considered unlikely to significantly interfere with the recovery of this species.

Conclusion

Austrostipa wakoolica has not been recorded within the survey area. The project will remove/modify approximately 0.94 ha of potential habitat for *Austrostipa wakoolica.* The habitat within the survey area is highly disturbed and likely to constitute marginal habitat for this species.

Although the project will remove potential habitat of this species it is considered unlikely to lead to a long-term decrease in a population, fragment an existing population, adversely affect critical habitat for the species, disrupt the breeding cycle of the species, introduce or lead to the establishment of invasive species to a degree that would result in the decline of the species provided that the appropriate mitigation measured are developed and implemented during the later stages of the project. Given this, the proposed action is considered unlikely to lead to a significant impact on *Austrostipa wakoolica* or its habitat.

E3 Fauna

E3.1 Hollow-dependant microchiropteran bat species

Threatened hollow-dependent species of microchiropteran bat have been assessed together as they generally share similar habitat requirements, threats that affect their recovery, and potential impacts as result of the project. Hollow-dependent microchiropteran bats considered for the impact assessment are:

- Little Pied Bat (*Chalinolobus picatus*)
- Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*).

These species have been assessed as a guild because of their similarity in habitat usage and habits, which are described in Table E-1.

Table E-1 Details of threatened species of hollow-dwelling microchiropteran bat

Common name (scientific name)	BC Act[1]	EPBC Act	Habitat and distribution	Threats
Little Pied Bat (Chalinolobus picatus)	V	–	The Little-Pied Bat is found in inland Queensland and NSW, extending slightly into South Australia and Victoria. Occurs in dry open forest, open woodland, mulga woodlands, chenopod shrublands, cypress pine forest and mallee and Bimbil box woodlands. Roosts in caves, rock outcrops, mine shafts, tunnels, tree hollows and buildings.	• Loss or modification of habitat. • Predation by cats. • Application of pesticides in or adjacent to foraging areas
Yellow-bellied Sheathtail Bat (Saccolaimus flaviventris).	V	–	The Yellow-bellied Sheathtail-bat is a very distinctive, large, insectivorous bat up to 87 mm long. The Yellow-bellied Sheathtail-bat is a wide-ranging species found across northern and eastern Australia. Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. When foraging for insects, flies high and fast over the forest canopy, but lower in more open country. Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory.	• Disturbance to roosting and summer breeding sites. • Foraging habitats are being cleared for residential and agricultural developments, including clearing by residents within rural subdivisions. • Loss of hollow-bearing trees; clearing and fragmentation of forest and woodland habitat. • Pesticides and herbicides may reduce the availability of insects, or result in the accumulation of toxic residues in individuals' fat stores.

1. V = Vulnerable under the BC Act.

Specific impacts

These species have not been recorded within the survey area , but the species are known to occur within wider locality (Office of Environment & Heritage, 2016a). Potential habitat for these species was observed within the survey area as disjunct remnant patches of highly modified woodland, scattered across a fragmented landscape. This habitat has been previously disturbed by agricultural cropping and

grazing. The highest quality habitat occurred along road reserves and areas where grazing has been excluded.

Data from field investigations and broad scale vegetation mapping, it was estimated that the project will involve the removal of approximately 3.32 ha of potential foraging and roosting habitat for these species in the form of landscape plantings, White Cypress Pine Woodland, White-Box Gum Woodland and Grey Box Woodland, differing in overall quality and containing approximately 10 hollow-bearing trees.

BC Act significance assessment

Little Pied Bat and Yellow-bellied Sheathtail-bat are all listed Vulnerable under the BC Act.

In the case of a Threatened species, whether the proposed development or activity 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

The survey area contains predominantly disturbed land in the form of pasture and cropping lands. Approximately 3.32 ha of vegetation to be impacted provides foraging and roosting for microchiropteran bats, will be removed as part of the project and avoidance has been made where possible. This habitat exists as disjunct remnant patches of highly modified woodland, scattered across a fragmented landscape. In addition, approximately 10 hollow-bearing trees within the project area will be impacted by the project.

Whilst 3.32 ha of foraging and roosting habitat may be removed as part of the project, this is considered minimal compared to the higher quality roosting opportunities occur in the wider locality.

The action proposed is unlikely to have an adverse effect on the life cycle of hollow-dwelling microchiropteran bats to the point that these species are likely to be placed at risk of extinction.

In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

- 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

Not applicable.

- 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

Not applicable.

In relation to the habitat of a Threatened species or ecological community:

- The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

Approximately 10 hollow-bearing trees and 3.32 ha of vegetation representing potential habitat for these species is likely to be affected by the proposed action.

- Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

The survey area occurs in predominantly disturbed land. This habitat has been previously disturbed by agricultural cropping and grazing. The highest quality habitat occurred along road reserves and areas were grazing has been excluded. As the project will result in disturbance to linear corridors through disturbed habitat, and given the species high mobility, the proposed action is unlikely to represent significant increases to habitat isolation and or fragmentation.

- The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality

A relatively small area of potential foraging and roosting habitat (3.32 ha) will be affected by the proposed action. The project would not impact habitat considered critical to the long-term survival of populations in the locality and is unlikely to further create a barrier to movement for these species.

Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

Areas of Outstanding Biodiversity Value (AOBVs) are those declared by the Minister for the Environment, these areas contain irreplaceable biodiversity values that are important to the whole of NSW, Australia or globally. Areas of declared critical habitat under the Threatened Species Conservation Act 1995, (including Little Penguin and Wollemi Pine declared areas), have become the first AOBVs in NSW with the commencement of the Biodiversity Conservation Act. No AOBVs have been listed for these species, nor is the study area likely to have an effect of any other declared AOBVs.

Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

With respect to hollow-dwelling microchiropteran bats, the project is consistent with three key threatening processes under the BC Act:

- Clearing of native vegetation
- Loss of hollow-bearing trees
- Removal of dead wood and trees.

The extent of native vegetation clearing and habitat removal associated with the project is considered relatively small, 3.32 ha of marginal and fragmented habitat. Although the project will represent the loss of potential foraging and roosting habitat (approximately 10 hollow-bearing trees), such habitat would only be a small component of locally occurring resources accessible to these species.

Removal of hollow-bearing trees will be from disturbed areas to minimise the impact on hollow-dwelling microchiropteran bats. Furthermore, nest boxes will be used to replace any potential hollows lost for hollow dwelling microchiropteran bats.

Conclusion

There are no known records of these species within the survey area, but there is potential habitat in the form of remnant woodland containing hollow-bearing trees, which may be used by these species for foraging and roosting purposes. Field surveys and broad scale vegetation mapping identified approximately 10 hollow-bearing trees and 3.32 ha of potential foraging habitat and roosting habitat for hollow-dwelling microchiropteran bats. Habitat to be removed is predominantly land disturbed by agricultural cropping and grazing. The highest quality habitat occurred along road reserves and areas were grazing has been excluded. As the project will result in disturbance to linear corridors through disturbed habitat, and given the high mobility of assessed species, the proposed action is unlikely to represent significant increases to habitat isolation and or fragmentation. The habitat is not considered critical habitat to long term survival of these species within the locality.. Given this, the proposed action is considered unlikely to lead to a significant impact on these species their habitat.

E3.2 Hollow dependant woodland birds

Brown Treecreeper (*Climacteris picumnus victoriae)* and Superb Parrot (*Polytelis swainsonii*) are listed as a Vulnerable species under the *Threatened Species Conservation Act 1995* (NSW Scientific Committee, 2005) and Superb Parrot is also listed as Vulnerable under *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). These species have been assessed together as they generally share similar habitat requirements, threats that affect their recovery, and potential impacts as result of the project. The habitat and ecology of the threatened, hollow dependent woodland/forest birds is summarised in the below table.

Table E-2 Habitat and ecology of the threatened, hollow dependent woodland/forest birds

Common name (scientific name)	BC Act	EPBC Act	Habitat distribution	Threats
Brown Treecreeper (Climacteris picumnus victoriae)	V	-	Found in eucalypt woodlands and dry open forest of the inland slopes and plains inland of the Great Dividing Range; mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts. Nesting occurs in tree hollows (Office of Environment and Heritage, 2011b).	• Historical loss of woodland, forest and mallee habitats as a result of agriculture, forestry, mining and residential development. • Fragmentation of woodland and forest remnants which isolates populations and causes local extinctions. • Ongoing degradation of habitat, particularly the loss of tree hollows and fallen timber from firewood collection and overgrazing. • Lack of regeneration of eucalypt overstorey in woodland due to overgrazing and too-frequent fires. • Loss of ground litter from compaction and overgrazing. • Inappropriate forestry management practices. • Loss of understorey habitat. • Competition from invasive weeds. • Aggressive exclusion from forest and woodland habitat by over abundant Noisy Miners.

Common name (scientific name)	BC Act	EPBC Act	Habitat distribution	Threats
Superb Parrot (Polytelis swainsonii)	V	V	The Superb Parrot mainly inhabits forests and woodlands dominated by eucalypts, especially River Red Gums and Box-Gums, also occurs in Box-Cypress-pine and Boree Woodlands. In the Riverina the birds nest in the hollows of large trees (dead or alive) mainly in tall riparian River Red Gum Forest or Woodland. On the South West Slopes nest trees can be in open Box-Gum Woodland or isolated paddock trees. The Superb Parrot is found throughout eastern inland NSW. On the South-western Slopes their core breeding area is roughly bounded by Cowra and Yass in the east, and Grenfell, Cootamundra and Coolac in the west.	• Loss of hollow bearing trees, breeding and foraging habitat. • Loss of habitat trees from fire damage, clearing, grazing, degradation and fragmentation. • Lack of knowledge of breeding ecology, key flight paths and population trends of the Superb Parrot. • Competition with native and exotic species for breeding and foraging habitat and resources.

Specific impacts

Although these species were not recorded during field surveys, there are records from the locality and potential habitat was recorded. Potential habitat for this species occurred within the survey area as disjunct remnant patches of highly modified woodland, scattered across a fragmented landscape. Potential habitat has been previously disturbed by agricultural cropping and grazing. The highest quality habitat occurred along road reserves and areas where grazing has been excluded.

Broad scale vegetation mapping and field investigations identified and estimated that the project will involve the removal of approximately 3.32 ha of potential foraging, roosting and nesting habitat for these species in the form of landscape plantings, White Cypress Pine Woodland, White-Box Gum Woodland and Grey Box Woodland, differing in overall quality.

BC Act significance assessment

In the case of a Threatened species, whether the proposed development or activity 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

Although these species were not recorded during field surveys, potential habitat for these species was recorded. There are previous records of these species within the project locality. Potential habitat for these species consists of disturbed and fragmented patches of vegetation

Generally, the habitat throughout the survey area was of low-moderate condition, with low structural diversity in the understorey strata. Similar and higher quality potential habitat occurs within the wider locality (Goobang National Park). The Superb Parrot is a very mobile species, and can generally exist in relatively fragmented landscapes, this lineal impact is unlikely to affect the life cycle of this species. The Brown Treecreeper is less mobile and is vulnerable to fragmentation of its habitat and reduction of woodland patch size.

For the following reasons the works are unlikely to affect the lifecycle of these species such that they would be a significantly elevated risk of extinction:

- The Brown Treecreeper, which is a sedentary species, was not observed during field surveys, so the survey area is unlikely to be used by this species
- Habitat affected is of marginal quality
- Pre-clearing surveys would be conducted to detect and manage potential impacts on nesting birds
- The habitat affected is a very small proportion of potential habitat for the two species in the locality.

The project incremental increase to fragmentation within the already disturbed environment, is unlikely to affect their ability to disperse throughout this locality.

In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

- 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

Not applicable

- 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

Not applicable

In relation to the habitat of a Threatened species or ecological community:

- The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

Approximately 3.32 ha of native vegetation representing potential habitat for these species is likely to be affected by the proposed action.

- Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

The potential habitat in the survey area consists of disturbed, low condition vegetation, predominated fragmented by agriculture and existing infrastructure. The highest quality habitat occurred along road reserves and areas were grazing has been excluded. The habitat affected is a very small proportion of potential habitat for the species in the locality. Similar and higher quality habitat occurs within the wider locality.

- The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality

The project will result in removal of marginal vegetation to create linear road corridor, and given this species high mobility, the proposed action is unlikely to represent significant increases to habitat isolation and or fragmentation. The project would not impact habitat considered critical to the long-term survival of populations in the locality and is unlikely to further create a barrier to movement for these species.

Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

Areas of Outstanding Biodiversity Value (AOBVs) are those declared by the Minister for the Environment, these areas contain irreplaceable biodiversity values that are important to the whole of NSW, Australia or globally. Areas of declared critical habitat under the Threatened Species Conservation Act 1995, (including Little Penguin and Wollemi Pine declared areas), have become the first AOBVs in NSW with the commencement of the Biodiversity Conservation Act. No AOBVs have been listed for these species, nor is the study area likely to have an effect of any other declared AOBVs.

Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

With respect to these two species, the project contributes to one key threatening process – clearing of native vegetation. Potential habitat occurred within the survey area as already disjunct remnant patches of highly modified woodland, scattered across a fragmented landscape. Potential habitat has been previously and/or currently disturbed by agricultural impact and is unlikely to be significant considering the condition of the vegetation within the survey area, resources within the wider locality, and the high mobility Superb Parrots and the unlikelihood that they would be used by Brown Treecreepers. The project will minimise impacts by completing targeted pre-clearing surveys to detect and manage potential impacts on nesting birds.

Conclusion

For the following reasons the works are unlikely to significantly affect these species or their habitat:

- Habitat affected is of marginal quality
- The habitat affected is a small proportion of potential habitat for these species in the locality
- The works are unlikely to interfere with the recovery of the species
- Management measures would be implemented to minimise potential impacts during works
- The works are unlikely to significantly fragment and/or isolate these species that would place it them at risk of extinction in the region.

EPBC Act significance assessment

The Superb Parrot is listed as Vulnerable under the EPBC Act. The following assessment has been undertaken following the Matters of National Environmental Significance, Significant Impact Guidelines 1.1 (Department of Environment, 2013). Under the Act, important populations are:

- Likely to be key source populations either for breeding or dispersal
- Likely to be necessary for maintaining genetic diversity, and/or
- At or near the limit of the species range.

Is an important population likely to be present

Although this species was not recorded during the field surveys, potential habitat for this species was present. There are previous records of these species within the survey area's locality. Potential habitat for this species occurred within the survey area as disjunct remnant patches of highly modified woodland, scattered across a fragmented landscape. Potential habitat has been previously disturbed by agricultural cropping and grazing. The highest quality habitat occurred along road reserves and areas were grazing has been excluded.

It was estimated that the project will involve the removal of approximately 3.32 ha of potential foraging and nesting habitat for this species. This species is considered as one single population across its range (Department of the Environment and Energy, 2017) with majority of breeding occurring in the Riverina and South-west Slopes of NSW. Local occurrences of this species are likely part of key source populations for breeding and dispersal. Therefore individuals that occur within the area are considered as part of 'an important population'.

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

- Lead to a long-term decrease in the size of an important population of a species

The project would impact approximately 3.32 ha of potential habitat, in the form of native disjunct remnant patches of highly modified woodland, scattered across a fragmented landscape. The extent of potential habitat to be removed is a small component of available habitat locally with an abundance of

similar quality habitat and that of much higher quality in the greater locality, such as occurs in Goobang National Park. It is unlikely that the disturbance of 3.32 ha of potential habitat associated with the project would lead to a long term decrease in the size of the population.

Reduce the area of occupancy of an important population

The Superb Parrot is known to prefer forests and woodlands dominated by eucalypts including, River Red Gums (*Eucalyptus camaldulensis*), Yellow Box (*Eucalyptus melliodora*) and Grey Box (*Eucalyptus macrocarpa*). In addition, it prefers large mature eucalypts typically close to watercourses and associated with extensive tracts of suitable foraging habitat (Department of the Environment and Energy, 2017). Whilst the survey area has small occurrences of box woodland (approximately 3.32 ha) these areas are isolated and fragmented within the landscape, nor do they occur beside watercourses or within extensive woodland tracts. Although it is likely that individuals may occur within the survey area on an intermittent basis, the availability of habitat within the survey area is unlikely to constitute important habitat, due to the marginal quality of survey area habitat resources. Therefore it is considered unlikely that the disturbance of 3.32 ha of potential habitat will reduce the area of occupancy of the population.

Fragment an existing important population into two or more populations

The Superb Parrot is a highly mobile species able to transverse fragmented landscapes to isolated patches of vegetation. It is known that part of the population undertakes regular seasonal movements from breeding areas to foraging habitats across central and north-central NSW, often coinciding with flowering eucalypts (Department of the Environment and Energy, 2017). In addition, it is also known that when Superb Parrots undertake local movements they prefer to move along wooded corridors and limit traversing extensive open areas (Department of the Environment and Energy, 2017). As potential habitat within the survey area already occurs within a highly fragmented landscape, it is considered unlikely that the disturbance of habitat in the survey area would fragment the existing population into two or more populations.

Adversely affect habitat critical to the survival of a species

Critical habitats are areas of land that are crucial to the survival of particular threatened species, populations and ecological communities. No ‘critical habitat’ has been listed for the Superb Parrot under the *Environment Protection and Biodiversity Conservation Act 1999* (Department of Environment and Energy, 2017).

Habitat critical to the survival of species also refers to areas that are necessary:

- For activities such as foraging, breeding, roosting, or dispersal
- For the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators)
- To maintain genetic diversity and long term evolutionary development, or
- For the reintroduction of populations or recovery of the species or ecological community.

The project will involve the removal of an estimated 3.32 ha of potential foraging, roosting and nesting habitat for this species in the form of landscape plantings, White Cypress Pine Woodland, White-Box Gum Woodland and Grey Box Woodland, differing in overall quality.

The habitat observed within the survey area was highly fragmented and of degraded condition, therefore the removal of 3.32 ha of habitat is considered unlikely to be critical to the survival of this species.

Disrupt the breeding cycle of an important population

Approximately 3.32 ha of potential habitat would be disturbed as part of the project. Within habitat to be disturbed a number of hollow bearing trees would been impacted (approximately 10 hollow-bearing trees). Superb Parrots nest in large hollow-bearing trees usually River Red Gums, Blakely’s Red Gum and Box eucalypts. Preferred nest trees are located along watercourses and within 10km of foraging

habitat (Department of the Environment and Energy, 2017). Whilst the survey area has the presence of hollow-bearing trees, the location of these do not occur within preferred breeding habitat (i.e. watercourse). Despite this, there is still potential for individuals to utilise hollow trees within the survey area. However, it is unlikely that the removal of approximately 10 hollow-bearing trees and disturbance of 3.32 ha of potential habitat would disrupt the breeding cycle of this population, as this would be a small proportion of available resources within the greater locality.

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

No areas of known Superb Parrot habitat are to be removed as a result of the project.

The project will involve the removal of approximately 3.32 ha of potential foraging and nesting habitat. Potential habitat occurred as disjunct remnant patches of highly modified woodland, scattered across a fragmented landscape. Potential habitat has been previously and/or currently disturbed by a long history of agricultural cropping and grazing. The higher quality habitat occurred along road reserves and areas were grazing has been excluded.

The project generally exists within areas cleared of vegetation or on the edge of native vegetation. Although habitat within the project is of relatively low quality for the Superb Parrot, the project will decrease and modify available habitat for this species within the survey area. The project includes construction along a linear corridor (no more than 50 m), which passes through or along the edges of small remnant patches of vegetation. Considering the mobile nature of the Superb Parrot, this action is unlikely to isolate Superb Parrot habitat to an extent that will cause the species to decline. Given the highly modified nature of observed habitats, a long history of pastoral land-use practices over these areas (i.e. cropping and agricultural grazing) and the poor condition of woodland habitat observed, it is considered unlikely that the project will modify, destroy, remove or isolate habitat for this species to the extent that it may cause the species to decline locally.

Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species´ habitat

Habitat for this species within the survey area is in highly disturbed condition and is subject to weed and pest invasion. In addition, the majority of the survey area occurs on agricultural properties which have been long subjected to high disturbances relating to agricultural practices such as cropping, grazing, burning and the application of fertilisers. Therefore it is considered unlikely that the project would substantially reduce the quality or integrity of the community's occurrence or increase spread of invasive species. Additionally, mitigation measures will be developed to minimise the likelihood of an increase or establishment of invasive species into the habitat of this species.

Introduce disease that may cause the species to decline

It is not considered likely that the project would introduced disease into the survey area.

Nevertheless, mitigation measures will be prepared to minimise the likelihood of spread of pathogens into potential Superb Parrot habitats within the survey area.

Will the action interfere with the recovery of the species?

A national recovery plan for *Superb Parrot* has been developed by the Department of Environment (Baker-Gabb, 2011). The recovery plan has outlined four recovery objectives for this species, which are outlined in Table E-3. The project will not impact upon any of the objectives of the national recovery plan for this species.

Table E-3 National recovery actions for Superb Parrot

Recovery objective	Affected by the project
Determine population trends	No
Increase knowledge of ecological requirements	No
Develop and implement threat abatement strategies	No
Increase community involvement and awareness of recovery program	No

Conclusion

The project traverses a highly fragmented and degraded landscape that contains potential foraging and roosting habitat for the Superb Parrot. Superb Parrots occurring on the South-west Slopes of NSW are part of a key breeding population and therefore considered an important population. While the project will remove 3.32 ha of potential Superb Parrot habitat, including potential breeding habitat, the degraded nature of the habitat, and its subsequent low value to the species, is considered to render it as of low significance to the population as a whole. It is suggested that mitigation measures be implemented during the design, construction and operational phases of the project to minimise impacts on local Superb Parrot habitat, especially those areas that contain tree stands which may represent potential breeding habitat for the species.

For the following reasons the works are unlikely to significantly affect these species or their habitat:

- Habitat affected is of marginal quality
- The habitat affected is a very small proportion of potential habitat for the species in the locality
- The works are unlikely to interfere with the recovery objectives of the species
- Management measures would be implemented to minimise potential impacts during works. For example washing down procedures and pre-work surveys for nesting birds
- The works are unlikely to contribute significantly to key threatening processes.

E3.3 Woodland birds

Grey-Crowned Babbler (*Pomatostomus temporalis temporalis*), Dusky Woodswallow *(Artamus cyanopterus),* Varied Sittella *(Daphoenositta chrysoptera),* Flame Robin (*Petroica phoenicea)* and Diamond Firetail (*Stagonopleura guttata)* have been grouped for assessment owing to their similar preference for open woodland habitat. These five threatened woodland birds generally share similar habitat requirements; threats that affect their recovery; and potential impacts as a result of the project (refer Table E-4). All species are listed as Vulnerable under the BC Act.

Table E-4 Details of threatened woodland birds

Common name (scientific name)	BC Act	EPBC Act	Habitat and distribution	Threats
Grey-Crowned Babbler (Pomatostomus temporalis temporalis)	V	–	The Grey-crowned Babbler is found mainly in rural districts where it predominantly lives in roadsides and private land (Schulz 1991). Suitable habitats are usually abundant with leaf litter and debris; often dominated by eucalypts including box and ironbark species, partly-cleared woodland, acacia shrubland and adjoining farmland (Higgins, 1999).	• Loss, degradation and fragmentation of woodland habitat • degradation and loss of important habitat components (woody debris) • invasion of weeds, including exotic perennial grasses. • Inappropriate fire regimes • Aggressive exclusion from Noisy Miner • Nest predation
Dusky Woodswallow (Artamus cyanopterus)	V	–	The Dusky Woodswallow is widespread in eastern, southern and southwestern Australia. In NSW, it is widespread from coast to inland, including the western slopes of the Great Dividing Range and farther west. Often reported in woodlands and dry open sclerophyll forests, usually dominated by eucalypts, including mallee associations. Also recorded in shrublands and heathlands and various modified habitat, including regenerating forest; very occasionally in moist forest or rainforests(Higgins and Peter, 2002).	• Apparent decline has been attributed to declining habitat • Poor regeneration of open forest and woodland habitats due to habitat removal and modification • Aggressive exclusion by Noisy Miner • Inappropriate fire regimes.
Diamond Firetail (Stagonopleura guttata)	V	–	Diamond Firetails are found in grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum Woodlands. They occur also in open forest, mallee, native grasslands, and in secondary grasslands derived from other communities (Trail and Duncan, 2000). They feed exclusively on the ground, on ripe and partly-ripe grass and herb seeds and green leaves, and on insects (especially in the breeding season).	• Clearing and fragmentation of habitat • Invasion of weeds • Modification and destruction of ground- and shrub layers within habitat • Predation of eggs and nestlings • Risk of local extinction due to small, isolated populations • Aggressive exclusion by Noisy Miner • (NSW Scientifc Committee, 2015)

Common name (scientific name)	BC Act	EPBC Act	Habitat and distribution	Threats
Varied Sittella (Daphoenositta chrysoptera)	V	-	The Varied Sittella inhabits most of mainland Australia except the treeless deserts and open grasslands. It inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. The Varied Sittella feeds on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees, and from small branches and twigs in the tree canopy. It builds a cup-shaped nest of plant fibres and cobwebs in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years (Office of Environment & Heritage, 2016b)	• Habitat clearing and isolation • Reductions in tree species diversity, tree canopy cover, shrub cover, ground cover, logs, fallen branches and litter • Dominance of Noisy Miners (Manorina melanocephala). in woodland patches • Habitat degradation through small-scale clearing for fence lines and road verges, and firewood collection.
Flame Robin (Petroica phoenicea)	V	-	In NSW, the Flame Robin breeds in upland moist eucalypt forests and woodlands, often on ridges and slopes, in areas of open understorey. It migrates in winter to more open lowland habitats (Higgins and Peter, 2002). The Flame Robin forages from low perches, feeding on invertebrates taken from the ground, tree trunks, logs and other woody debris. The robin builds an open cup nest of plant fibres and cobweb, which is often near the ground in a sheltered niche, ledge or shallow cavity in a tree, stump or bank (Harpers Somers O'Sullivan Pty Ltd, 2007).	• Clearing and degradation of breeding and wintering habitats • Degradation and simplification of habitat by removal of standing dead timber, logs and coarse woody debris • Nest predation by native and exotic predators • Habitat fragmentation • Reduction of the native ground cover in favour of exotic grasses • Reduction in the structural complexity of habitat, including reductions in canopy cover, shrub cover, ground cover, logs, fallen branches and leaf litter, and • Reduction of size of remnant patches.

Specific impacts

One threatened woodland bird, Grey-crowned Babbler was recorded during surveys. No other threatened woodland birds were observed during the field surveys; however approximately 3.32 ha of potential habitat for the threatened woodland birds listed above may be impacted as a result of this project.

BC Act significance assessment

In the case of a Threatened species, whether the proposed development or activity 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

Approximately 3.32 ha of potential habitat in narrow linear patches would be affected by the project. This habitat provides potential foraging, roosting and breeding resources for these species. This area is only a very small portion of the available habitats in the area. The majority of the investigation area is confined to previously disturbed lands, with a relatively small amount (3.32 ha) of suitable habitat likely to be affected.

The project is considered unlikely to exacerbate connectivity issues that already exist within the fragmented survey area and locality. Furthermore, the small area of potential habitat likely to be affected would likely only occur as a small component of locally occurring resources that would be accessible to this species. Consequently, the project is considered unlikely to impact threatened woodland birds such that a viable local population is placed at risk of extinction.

In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

- 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

Not applicable

- 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

Not applicable.

In relation to the habitat of a Threatened species or ecological community:

- The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

It is estimated that approximately 3.32 ha of potential woodland bird habitat would be affected by the project. However, local populations of four of these species (Dusky Woodswallow, Diamond Firetail, Varied Sittella and Flame Robin) are not restricted to habitat resources contained within the survey area due their mobility and the availability of similar and higher quality habitat resources within the greater locality.

In contrast Grey-crowned Babblers occur in family groups within discrete territories from 1.5 to 53 ha in extent, the size of which is likely to be a function of vegetation density and/or habitat quality (Higgins and Peter 2002). The removal of 3.32 ha of potential habitat will occur over the length of the project and will not result in the clearing of potential patch sizes >1 ha.

- Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

Habitat connectivity is unlikely to be affected by the project. Available threatened woodland bird habitat in the locality is already fragmented by agriculture, existing infrastructure, and residential development. It is unlikely that the project would contribute significantly to the fragmented state of woodland bird habitat, however it would add incrementally to the disturbance of available habitat for these species within the survey area.

- The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality

The proposal will not create a significant barrier to the movement of these species between areas of suitable habitat. The quality and importance of habitat which may be impacted by activities is not considered to be significantly important for the long term survival of any local population of these species.

Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

Areas of Outstanding Biodiversity Value (AOBVs) are those declared by the Minister for the Environment, these areas contain irreplaceable biodiversity values that are important to the whole of NSW, Australia or globally. Areas of declared critical habitat under the Threatened Species Conservation Act 1995, (including Little Penguin and Wollemi Pine declared areas), have become the first AOBVs in NSW with the commencement of the Biodiversity Conservation Act. No AOBVs have been listed for these species, nor is the study area likely to have an effect of any other declared AOBVs.

Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

With respect to threatened woodland birds, the proposal is consistent with two key threatening processes, being clearing of native vegetation and removal of dead wood and dead trees. The extent of native vegetation clearing and habitat removal associated with the proposal is considered poor quality and relatively small in terms of the available habitat for these species within the proposal locality. In addition, mitigation measures are recommended for revegetation, habitat restoration and timber salvaging to ensure that impacts will be minor, but rather will enhance adjacent vegetation and remnant habitat.

Conclusion

Six threatened woodland birds considered to have potential habitat in the survey area, one was recorded during surveys, the Grey-crowned babbler. It is estimated that approximately 3.32 ha of potential habitat would be affected by the proposal. Similar habitats of equal or greater quality will remain within and surrounding the proposal footprint. Populations, if present, are considered to be small patches of a larger metapopulation. The proposal is unlikely to increase fragmentation any greater than that currently occurring in the survey area and wider locality. Habitats for threatened woodland birds of similar or greater quality would remain in proximity the survey area and wider locality. Based on the above assessment, threatened woodland birds are unlikely to be significantly impacted by the proposal.

E3.4 Blossom nomads

Little Lorikeet (*Glossopsitta pusilla*) Regent Honeyeater (*Anthochaera phrygia* (syn. *Xanthomyza Phrygia*)) and Swift Parrot (*Lathamus discolor*) have been grouped for assessment owing to similarities in ecology and habitat preference. Under the BC Act, Little Lorikeet are listed as Vulnerable, while the Swift Parrot is listed as Endangered and the Regent Honeyeater is listed as Critically Endangered. Under the EPBC Act the Swift Parrot and Regent Honeyeater are listed as Endangered.

Table E-5 Details of threatened opportunistic blossom nomads

Common name (scientific name)	BC Act	EPBC Act	Habitat and distribution	Threats
Little Lorikeet (Glossopsitta pusilla)	V		The Little Lorikeet is a small green lorikeet with black bill and red patch on forehead and throat. The underside is yellow-green. Immatures are duller with less red on face and brown bill. Found in forests, woodland, treed areas along watercourses and roads. Forages mainly on flowers, nectar and fruit. Found along coastal east Australia from Cape York in Queensland down east coast and round to South Australia. Uncommon in southern Victoria (Higgins, 1999).	• Extensive clearing of woodlands for agriculture has significantly decreased food for the lorikeet. • Small scale clearing, destroys habitat and foraging sites. • Loss of hollow bearing trees has reduced nest sites, and increased competition with other native and exotic species for nest sites. • Competition with the introduced Honeybee for both nectar and hollows.
Regent Honeyeater (Anthochaera phrygia (syn. Xanthomyza Phrygia))	CE	E	Occurs mostly in box-ironbark forests and woodland and prefers wet, fertile sites such as along creek flats, broad river valleys and foothills. Riparian forests with Casuarina cunninghamiana and Amyema cambagei are important for feeding and breeding. Spotted Gum and Swamp Mahogany forests are also important feeding areas in coastal areas. Important food trees include Eucalyptus sideroxylon (Mugga Ironbark), E. albens (White Box), E. melliodora (Yellow Box) and E. leucoxylon (Yellow Gum) (Garnett and Crowley, 2000a).	• Loss, fragmentation and degradation of habitat from clearing. • Loss of key habitat tree species and remnant woodlands. • Suppression of natural regeneration of overstorey tree species and shrub species from overgrazing. • Inappropriate forestry management practices that remove large mature resource-abundant trees. • Competition from larger aggressive honeyeaters, particularly Noisy Miners, Noisy Friarbirds and Red Wattlebirds. • Egg and nest predation by native birds.

Common name (scientific name)	BC Act	EPBC Act	Habitat and distribution	Threats
Swift Parrot (Lathamus discolor)	E	CE	Breeding occurs in Tasmania, majority migrates to mainland Australia in autumn, over-wintering, particularly in Victoria and central and eastern NSW, but also south-eastern Queensland as far north as Duaringa. Until recently it was believed that in New South Wales, swift parrots forage mostly in the western slopes region along the inland slopes of the Great Dividing Range but are patchily distributed along the north and south coasts including the Sydney region, but new evidence indicates that the forests on the coastal plains from southern to northern NSW are also extremely important. In mainland Australia is semi-nomadic, foraging in flowering eucalypts in eucalypt associations, particularly box-ironbark forests and woodlands. Preference for sites with highly fertile soils where large trees have high nectar production, including along drainage lines and isolated rural or urban remnants, and for sites with flowering Acacia pycnantha, is indicated. Sites used vary from year to year. (Garnett and Crowley, 2000a) (Swift Parrot Recovery Team, 2001)	• Loss of habitat through clearing for agriculture, and urban and industrial development. • Collisions with wire netting fences, windows and cars, during the breeding season and winter migration.

Specific impacts

Although none of these species were recorded during the field surveys, these species are known to occur within the CMA subregion of which this proposal occurs (Office of Environment & Heritage, 2016a). The proposal will affect approximately 3.32 ha of potential foraging habitat for these opportunistic blossom nomads. Potential foraging habitat was observed across a range of woodlands occurring within the survey area in the form of landscape plantings, White Cypress Pine Woodland, White-Box Gum Woodland and Grey Box Woodland, differing in overall quality.

Potential foraging habitat within the survey area occurs as disjunct remnant patches of highly modified woodland, scattered across a fragmented landscape. Habitat has been previously disturbed by agricultural cropping and grazing. The higher quality habitat occurred along road reserves and areas were grazing has been excluded.

BC Act significance assessment

In the case of a Threatened species, whether the proposed development or activity 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

The majority of the investigation area is confined to previously disturbed lands, from agriculture and existing infrastructure. Approximately 3.32 ha of potential habitat is likely to be affected by the proposal. Although the proposal will represent the loss of potential foraging habitat, the proposal footprint would

only be a small component of locally occurring resources that would be accessible to these species. Thus, the proposal is not considered likely to impact blossom nomads such that a viable local or intermittent seasonal population would be placed at a significant risk of extinction.

The Little Lorikeet could possibly utilise the survey area for breeding, whereas the Swift Parrot only breeds in Tasmania and the Regent Honeyeater only breeds in high quality habitats of a type that are absent from the survey area. Within the Regent Honeyeaters current distribution there are four known key breeding areas where the species is regularly recorded. These are the Bundarra-Barraba, Capertee Valley and Hunter Valley districts in New South Wales, and the Chiltern area in north-east Victoria. The closest breeding area being Capertee Valley is over 200km form the survey area (Higgins et al., 2001).

The proposal will remove vegetation along a linear corridor which will be no larger 50m wide at given locations. Considering the mobile nature of these species, this action is unlikely to isolate the species habitat significantly. Given the highly modified nature of observed habitats, land uses of these areas (i.e. cropping and agricultural grazing), the poor condition of woodland habitat observed, the ecology of this species, it is unlikely that the proposal will have an adverse effect on the life cycle of this species, such that a viable local populations is to be placed at risk of extinction.

In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

- 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
- 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

Not applicable.

In relation to the habitat of a Threatened species or ecological community:

- The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and
- Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and
- The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality

It is estimated that approximately 3.32 ha of potentially suitable habitat would be affected by the proposal.

Potential habitat occurred within the survey area as already disjunct remnant patches of highly modified woodland, scattered across a fragmented landscape. Potential habitat has been previously and/or currently disturbed by agricultural cropping and grazing. The higher quality habitat occurred along road reserves and areas were grazing has been excluded. Furthermore, these species are highly mobile and nomadic, the proposal would not present a significant barrier to these species. It is considered unlikely that the proposal will fragment an existing population into two or more populations given the ecology of the two species and current fragmented state of potential habitat.

The extent of potential habitat to be removed represents a small proportion of habitat available within the locality and surrounding landscape. Owing to the small extent of potential habitat likely to be affected, the proposal is unlikely to affect the long-term survival of these species.

Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

Areas of Outstanding Biodiversity Value (AOBVs) are those declared by the Minister for the Environment, these areas contain irreplaceable biodiversity values that are important to the whole of NSW, Australia or globally. Areas of declared critical habitat under the Threatened Species Conservation

Act 1995, (including Little Penguin and Wollemi Pine declared areas), have become the first AOBVs in NSW with the commencement of the Biodiversity Conservation Act. No AOBVs have been listed for these species, nor is the study area likely to have an effect of any other declared AOBVs.

Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

With respect to threatened blossom nomads, the proposal is consistent with three key threatening processes under the BC Act:

- Clearing of native vegetation
- Loss of hollow-bearing trees (in the case of the Little Lorikeet only in the locality)
- Removal of dead wood and trees.

The extent of native vegetation clearing and habitat removal associated with the proposal is considered relatively small in terms of the available habitat for these species within the surrounding landscape, although it is considered to be an incremental loss of suitable habitat locally. Removal of hollow-bearing trees will occur, and impacts to nesting birds will be managed by undertaking pre-clearing surveys.

Conclusion

Although none of these species were recorded during the field surveys, these species are known to occur within the CMA sub region of which this proposal occurs (Office of Environment & Heritage, 2016a). The proposal will affect approximately 3.32 ha of potential foraging habitat for these opportunistic blossom nomads. Potential foraging habitat was observed across a range of woodlands occurring within the survey area in the form of landscape plantings, White Cypress Pine Woodland, White-Box Gum Woodland and Grey Box Woodland, differing in overall quality.

Potential foraging habitat within the survey area occurs as disjunct remnant patches of highly modified woodland, scattered across a fragmented landscape. Habitat has been previously disturbed by agricultural cropping and grazing. The higher quality habitat occurred along road reserves and areas were grazing has been excluded. Although the loss of foraging habitat for blossom nomads is considered to be an incremental loss locally, the proposal is unlikely to have a significant impact upon these species or their habitat.

EPBC Act significance assessment

The Swift Parrot is listed as Endangered and the Regent Honeyeater is listed as Critically Endangered under the EPBC Act. The following assessment has been undertaken following the Matters of National Environmental Significance, Significant Impact Guidelines 1.1 (Department of Environment, 2013).

An action is likely to have a significant impact on a Critically Endangered or Endangered species if there is a real chance or possibility that it will result in one or more of the following:

- Lead to a long-term decrease in the size of a population of a species

Approximately 3.32 ha of potential foraging habitat for the Regent Honeyeater and Swift Parrot would be affected by the proposal. Surveys and broad scale vegetation mapping were used to identify approximately 3.32 ha of potential foraging habitat. Records of these species occur at Back Yamma and Goobang National Park. This habitat is highly modified by previous land uses in this area (i.e. cropping and agricultural grazing).

Habitat is unlikely to be of high importance due greater quality habitat within wider region. Any identified population of Regent Honeyeater or Swift Parrot in the area would not be restricted to habitat within the survey area. Due to the species' large home range, nomadic nature and higher quality foraging habitat elsewhere in the locality and region, the proposal is not considered likely to significantly contribute to a long-term decline in the size of a population of these species.

Reduce the area of occupancy of the species

The proposal is likely to affect approximately 3.32 ha of marginal potential foraging habitat for these species within the locality. Although the proposal will result in the loss of potential foraging habitat, it is of marginal quality and is likely to only represent a small component of locally occurring resources accessible to these species.

Nevertheless, the removal of approximately 3.32 ha of foraging habitat is considered to be an incremental loss of suitable habitat locally and as such has the potential to reduce the area of occupancy for the Regent Honeyeater and Swift Parrot during seasons when individuals of this species may be reliant on local resources.

Fragment an existing population into two or more populations

Habitat connectivity is unlikely to be affected by the proposal. The majority of the proposal footprint occurs on previously disturbed land. Approximately 3.32 ha of potential foraging habitat is likely to be affected by the proposal with vegetation removal largely limited to 50 m wide road corridor. The survey area is already largely fragmented, and habitat remaining occurs as disjunct remnant patches and as scattered paddock trees within the locality. Furthermore, these species are highly mobile and nomadic, the proposal would not present a significant barrier to these species. It is considered unlikely that the proposal will fragment an existing population into two or more populations given the ecology of the two species and current fragmented state of potential habitat.

Adversely affect habitat critical to the survival of a species

No critical habitat has been listed for the Regent Honeyeater or Swift Parrot to date. As outlined in the National Recovery Plan Habitat critical to the survival of the Regent Honeyeater includes:

- Any breeding or foraging areas where the species is likely to occur
- Any newly discovered breeding or foraging locations.

There are no records of these species within the survey area, the records that occur within the locality are largely confined to the state forest within the greater region, where better quality habitat would be present. Hence it is unlikely that this proposal will adversely affect habitat critical to the survival of these species.

Disrupt the breeding cycle of a population

Swift Parrots breed in Tasmania during spring and summer, migrating to south-eastern Australia during autumn and winter (Department of Environment and Conservation, 2006b). While Swift Parrots are dependent on flowering resources across a wide range of habitats (woodlands and forests) within their NSW wintering grounds, the removal of approximately 3.32 ha of potential foraging habitat is unlikely to disrupt their movements to Tasmanian breeding grounds. As such the proposal is unlikely to affect their breeding cycle.

Within the Regent Honeyeaters current distribution there are four known key breeding areas where the species is regularly recorded. These are the Bundarra-Barraba, Capertee Valley and Hunter Valley districts in New South Wales, and the Chiltern area in north-east Victoria. The closest breeding area being Capertee Valley is over 200km form the survey area. Furthermore, this species is highly mobile and is known to disperse widely (Higgins et al., 2001). The 3.32 ha potential marginal foraging habitat likely to be affected is representative of larger patches of locally occurring resources that would be accessible to this species. Therefore, the removal of about 3.32 ha of potential marginal foraging habitat is unlikely to disrupt the breeding cycle of a population of Regent Honeyeater.

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

Potential habitat occurred within the survey area as already disjunct remnant patches of highly modified woodland, scattered across a fragmented landscape. Potential habitat has been previously and/or currently disturbed by agricultural cropping and grazing. The higher quality habitat occurred along road reserves and areas were grazing has been excluded.

The proposal could remove up to 3.32 ha of native vegetation considered to be foraging habitat for these two nomadic blossom forages. The removal of approximately 3.32 ha of potential habitat is considered to be an incremental loss, decreasing the amount of suitable foraging habitat available locally. However this species is likely to forage in the higher quality habitat within state forest and national park to the east of the survey area (Back Yamma and Goobang National Park).

This proposal will decrease and modify available habitat for this species within the survey area. The proposal will remove vegetation along a linear corridor which will be no larger 50 m wide at given locations. Considering the mobile nature of these species, this action is unlikely to isolate the species habitat significantly. Given the highly modified nature of observed habitats, land uses of these areas (i.e. cropping and agricultural grazing) and the poor condition of Woodland habitat observed it is unlikely that the proposal will modify, destroy, remove or isolate habitat for this species to the extent that is likely to cause the species to decline.

Result in invasive species that are harmful to an Endangered species becoming established in the Endangered species´ habitat

Habitat for this species within the survey area is in highly disturbed condition and is subject to weed and pest invasion. Additionally the majority of the survey area occurs on agricultural properties which are subjected to high disturbances relating to agricultural practices such as cropping, grazing, burning and the application of fertilisers. Therefore it is considered unlikely that the proposal would substantially reduce the quality or integrity of the community's occurrence or increase spread of invasive species. Additionally mitigation measures will be developed to minimise the likelihood of further spread or establishment of invasive species into the habitat of these species.

Introduce disease that may cause the species to decline

No. It is unlikely that disease would be increased by the proposal.

Mitigation measures will be prepared to minimise the likelihood of spread of pathogens into the habitat of these species.

Interfere with the recovery of the species

The *Action Plan for Australian Birds* (Garnett and Crowley, 2000b) notes pressure on Swift Parrot breeding areas from forestry and firewood collection in Tasmania. On the mainland though pressures relate to the loss of foraging habitats due to clearing for agriculture and residential development (Garnett and Crowley, 2000b).

A National Recovery Plan for the Swift Parrot *Lathamus discolor* was prepared in 2011 (Saunders, 2011). Recovery actions outlined in this plan include:

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

Based on the potential ecological impacts of the proposal on the Swift Parrot, as discussed above, it is likely the proposal would be in conflict with the second recovery action above, to manage and protect swift parrot habitat at the landscape scale.

For the Regent Honeyeater, the *Action Plan for Australian Birds* (Garnett and Crowley, 2000b) addresses the need for further ecological research on the species and the conservation and protection of roosting habitat and identification of specific breeding requirements.

Recovery strategies outlined in Regent Honeyeater Recovery Plan (Department of the Environment, 2016b) include:

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

Based on the potential ecological impacts of the proposal on this species, as discussed above, it is likely that the proposal would be in conflict with the first objective above to a small extent, by not improving the extent of habitat for the Regent Honeyeater.

Conclusion

The extent of native vegetation clearing and foraging habitat removal associated with the proposal is considered to be small in terms of available habitat for the species within region. Records of these species occur at Back Yamma and Goobang National Park, where higher quality habitat occurs. However, the irregular distribution of blossom resources, which is a key driver of nomadism of these species, may cause this species to occasionally forage within the survey area. Although it is considered unlikely that the loss of potential foraging habitat will cause the local extinction of the Regent Honeyeater or Swift Parrot, the proposal will remove habitat that may be utilised by this species under some intermittent seasonal contexts. The proposal is not considered to fragment any locally occurring populations, affect habitat critical to their survival, disrupt their breeding cycles, or interfere with the recovery of these species. The proposal therefore, is considered to represent an incremental loss of available local habitat, although it is not considered likely to have a significant impact as it is unlikely to affect the long-term viability of the species.

E3.5 Raptors

Spotted Harrier (*Circus assimilis),* Black Falcon (*Falco subniger),* and the Little Eagle (*Hieraaetus morphnoides*) have been grouped for assessment owing to family similarities and overlap in ecology and habitat preferences. Details of each species are given below (refer Table E-6). The Little Eagle and the Square-tailed Kite are listed as Vulnerable under the BC Act.

Table E-6 Details of threatened raptors

Common name (scientific name)	BC Act	EPBC Act	Habitat and distribution	Threats
Little Eagle	V	–	The Little Eagle is distributed throughout the Australian mainland occupying habitats rich in prey within open eucalypt forest, woodland or open woodland. Sheoak or acacia woodlands and riparian woodlands of interior NSW are also used. For nest sites it requires a tall living tree within a remnant patch, where pairs build a large stick nest in winter and lay in early spring. Prey includes birds, reptiles and mammals, with the occasional large insect and carrion. Most of its former native mammalian prey species in inland NSW are extinct and rabbits now form a major part of the diet (Marchant and Higgins, 1993).	• Further clearing and degradation of foraging and breeding habitat. • Loss of breeding sites • Competition with the larger and more dominant Wedge-tailed Eagle.
Black Falcon	V	–	The Black Falcon is widely, but sparsely, distributed in New South Wales, mostly occurring in inland regions. Some reports of 'Black Falcons' on the tablelands and coast of New South Wales are likely to be referable to the Brown Falcon. In New South Wales there is assumed to be a single population that is continuous with a broader continental population, given that falcons are highly mobile, commonly travelling hundreds of kilometres. The Black Falcon occurs as solitary individuals, in pairs, or in family groups of parents and offspring. (Office of Environment and Heritage, 2011a).	• Loss of large old trees from the landscape, a resource that is critical for nesting and hunting. • Potential for secondary poisoning via prey such as rabbits. • Disturbance to nesting activity from over-abundant ravens and cockatoos.

Common name (scientific name)	BC Act	EPBC Act	Habitat and distribution	Threats
Spotted Harrier	V	–	The Spotted Harrier is widespread throughout most of the Australian mainland. Individuals disperse widely, with this species being nomadic and irruptive in response to local conditions (food abundance). The Spotted Harrier occupies grassy open woodland, inland riparian woodland and grasslands, but is most commonly associated with native grassland and agricultural environments (NSW Scientific Committee – preliminary determination). This species builds a stick nest in open or remnant woodland and generally breeds from August to December or February to April (Pizzey and Knight, 2007). The diet of the Spotted Harrier generally consists of terrestrial mammals (rodents), birds (quail) and reptiles (NSW Scientific Committee, 2009).	• Loss of foraging and breeding habitat, particularly that which affects prey densities • Loss of mature trees from rural landscapes • Secondary poisoning from the use of pindone in rabbit control • Secondary poisoning from rodenticides • Lack of knowledge of locations of key breeding habitat and breeding ecology and success

Specific impacts

These species were not recorded during surveys informing this report. However, approximately 61.44 ha of potential habitat was recorded in the proposal footprint, which 58.12 ha consisted of highly disturbed land (pasture and cropping land) and 3.32 ha in native vegetation communities including landscape plantings, White Cypress Pine Woodland, White-Box Gum Woodland and Grey Box Woodland.

BC Act significance assessment

In the case of a Threatened species, whether the proposed development or activity 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

Threatened raptors were not recorded in the survey area during surveys informing this report. Approximately 58.12 ha of cropping and pasture land (foraging habitat) and a relatively small amount (3.32 ha) of native vegetation, is likely to be affected by the proposal. Due to the mobility and large home range of these species, and the linear footprint of this proposal, it unlikely to affect their life cycle or their ability to forage and breed. Any identified population of threatened raptors would not be restricted to habitat within the proposal footprint, as similar and likely better quality habitat occurs widely in the locality.

Furthermore, the proposal footprint contained only marginal quality habitat in that approximately 3.32 ha essentially occurred as disjunct remnant patches of highly modified woodland, scattered across a fragmented landscape. Approximately 58.12 ha of foraging habitat has been previously disturbed by agricultural cropping and grazing. The higher quality habitat occurred along road reserves and areas were grazing has been excluded. Although the proposal will represent the loss of potential foraging habitat, such habitat would only be a small component of locally occurring resources accessible to these species, and it is unlikely to constitute important habitat that if impacted, would have an adverse effect on the life cycle of these species.

In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

- 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
- 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

Not applicable.

In relation to the habitat of a Threatened species or ecological community:

- The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and
- Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and
- The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality

The proposal is likely to affect approximately 61.44 ha of potential foraging habitat (58.12 ha of cropping and pasture land and 3.32 ha of native vegetation and landscape plantings) for these species.

Habitat connectivity is unlikely to be affected by the proposal. The majority of the proposal footprint occurs on previously disturbed land. Vegetation removal will largely be limited to a linear corridor (no wider than 50 m at points). As the proposal footprint is largely confined to previously disturbed areas, the proposal would not further fragment or isolate any previously undisturbed patches of habitat. Furthermore, given these species' high mobility and that similar and likely more significant habitat occurs widely in the locality, it is considered unlikely that habitat would become further isolated or fragmented significantly beyond that currently existing in the survey area.

A relatively small linear area of native vegetation (3.32 ha) providing potential foraging habitat and also 58.12 ha of disturbed cropping and pasture land is likely to be affected by the proposal. Foraging opportunities will continue to exist and an abundance of similar and better quality foraging opportunities will be retained both within the survey area and wider locality. Owing to the relatively small extent of potential native vegetation (3.32 ha) to be affected and the vast abundance of disturbed cropping and pasture land in the locality, the proposal is unlikely to significantly affect their long-term survival, although the loss of native vegetation habitat must be considered to be an incremental loss of local habitat.

Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

Areas of Outstanding Biodiversity Value (AOBVs) are those declared by the Minister for the Environment, these areas contain irreplaceable biodiversity values that are important to the whole of NSW, Australia or globally. Areas of declared critical habitat under the Threatened Species Conservation Act 1995, (including Little Penguin and Wollemi Pine declared areas), have become the first AOBVs in NSW with the commencement of the Biodiversity Conservation Act. No AOBVs have been listed for these species, nor is the study area likely to have an effect of any other declared AOBVs.

Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

With respect these species, the proposal is consistent with one key threatening process, being clearing of native vegetation. The extent of native vegetation clearing and habitat removal associated with the proposal is considered relatively small (3.32 ha) in terms of the available habitat for these species within the surrounding landscape, although it is considered to be an incremental loss of suitable habitat locally.

Conclusion

Approximately 58.12 ha of disturbed pasture and cropping land and 3.32 ha of native vegetation and landscape plantings will be disturbed due to the proposal. Owing to the relatively small extent of potential native vegetation (3.32 ha) to be affected and the vast abundance of disturbed cropping and pasture land in the locality, the disturbance of this habitat is unlikely to adversely affect these species. Although the loss of habitat will represent an incremental loss of potentially suitable habitat, the proposal is unlikely to have a significant impact upon these species.

E3.6 Barking Owl (Ninox connivens)

Status

The Barking Owl (*Ninox connivens*) is listed as Vulnerable under the BC Act.

Habitat and ecology

The Barking Owl occurs in dry sclerophyll woodland. In the south-west it is often associated with riparian vegetation while in the south-east it generally occurs on forest edges. It nests in large hollows in live eucalypts, often near open country. It feeds on insects in the non-breeding season and on birds and mammals in the breeding season (Garnett and Crowley, 2000b).

Specific Impacts

This species was not recorded during surveys informing this report. However, approximately 61.44 ha of potential habitat was recorded in the proposal footprint, which 58.12 ha consisted of highly disturbed land (pasture and cropping land) and 3.32 ha in native vegetation communities including landscape plantings, White Cypress Pine Woodland, White-Box Gum Woodland and Grey Box Woodland. The better quality habitat occurred within the survey area as disjunct remnant patches of highly modified woodland, scattered across a fragmented landscape. The highest quality habitat occurred along road reserves and areas where grazing has been excluded.

BC Act significance assessment

In the case of a Threatened species, whether the proposed development or activity 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

This species was not recorded in the survey area during surveys informing this report. Approximately 58.12 ha of cropping and pasture land (foraging habitat) and a relatively small amount (3.32 ha) of native vegetation and landscape plantings, is likely to be affected by the proposal. Due to the mobility and large home range of this species, and the linear footprint of this proposal, it unlikely to affect their life cycle or their ability to forage and breed. Any identified population of threatened raptors would not be restricted to habitat within the proposal footprint, as similar and likely better quality habitat occurs widely in the locality.

Furthermore, the proposal footprint contained only marginal quality habitat in that approximately 3.32 ha essentially occurred as disjunct remnant patches of highly modified woodland, scattered across a fragmented landscape. Approximately 58.12 ha of foraging habitat has been previously disturbed by agricultural cropping and grazing. The higher quality habitat occurred along road reserves and areas were grazing has been excluded. Although the proposal will represent the loss of potential foraging habitat, such habitat would only be a small component of locally occurring resources accessible to these species, and it is unlikely to constitute important habitat that if impacted, would have an adverse effect on the life cycle of this species.

In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

- 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
- 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

Not applicable

In relation to the habitat of a Threatened species or ecological community:

- The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and
- Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and
- The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality

The proposal is likely to affect approximately 61.44 ha of potential foraging habitat (58.12 ha of cropping and pasture land and 3.32 ha of native vegetation and landscape plantings) for this species.

Habitat connectivity is unlikely to be affected by the proposal. The majority of the proposal footprint occurs on previously disturbed land. Vegetation removal will largely be limited to a linear corridor (no wider than 50m at points). As the proposal footprint is largely confined to previously disturbed areas, the proposal would not further fragment or isolate any previously undisturbed patches of habitat. Furthermore, given this species high mobility and that similar and likely more significant habitat occurs widely in the locality, it is considered unlikely that habitat would become further isolated or fragmented significantly beyond that currently existing in the survey area.

A relatively small linear area of native vegetation (3.32 ha) providing potential foraging habitat and also 58.12 ha of disturbed cropping and pasture land is likely to be affected by the proposal. Foraging opportunities will continue to exist and an abundance of similar and better quality foraging opportunities will be retained both within the survey area and wider locality. Owing to the relatively small extent of potential native vegetation (3.32 ha) to be affected and the vast abundance of disturbed cropping and pasture land in the locality, the proposal is unlikely to significantly affect their long-term survival, although the loss of native vegetation habitat must be considered to be an incremental loss of local habitat

Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

Areas of Outstanding Biodiversity Value (AOBVs) are those declared by the Minister for the Environment, these areas contain irreplaceable biodiversity values that are important to the whole of NSW, Australia or globally. Areas of declared critical habitat under the Threatened Species Conservation Act 1995, (including Little Penguin and Wollemi Pine declared areas), have become the first AOBVs in NSW with the commencement of the Biodiversity Conservation Act. No AOBVs have been listed for this species, nor is the study area likely to have an effect of any other declared AOBVs.

Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

With respect to large forest owls, the proposal is consistent with three key threatening processes under the BC Act:

- Clearing of native vegetation
- Loss of hollow-bearing trees

The extent of native vegetation clearing and habitat removal associated with the proposal is considered relatively small in terms of the available habitat for these species within the surrounding landscape, although it is considered to be an incremental loss of suitable habitat locally. Removal of hollow-bearing trees will occur, and impacts to nesting birds will be managed by undertaking pre-clearing surveys.

Conclusion

No individuals were recorded during surveys. Approximately 58.12 ha of disturbed pasture and cropping land and 3.32 ha of native vegetation and landscape plantings will be disturbed due to the proposal. Owing to the relatively small extent of potential native vegetation (3.32 ha) to be affected and the vast abundance of disturbed cropping and pasture land in the locality, the disturbance of this habitat is

unlikely to adversely affect these species. Similar habitats of equal or greater quality will remain within and surrounding the proposal footprint. As the project will result in disturbance to linear corridors through disturbed habitat, and given the species high mobility, the proposed action is unlikely to represent significant increases to habitat isolation and or fragmentation. The habitat is not considered critical habitat to long term survival of this species within the locality. Although the loss of habitat will represent an incremental loss of potentially suitable habitat, the project is unlikely to have a significant impact upon these species.

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