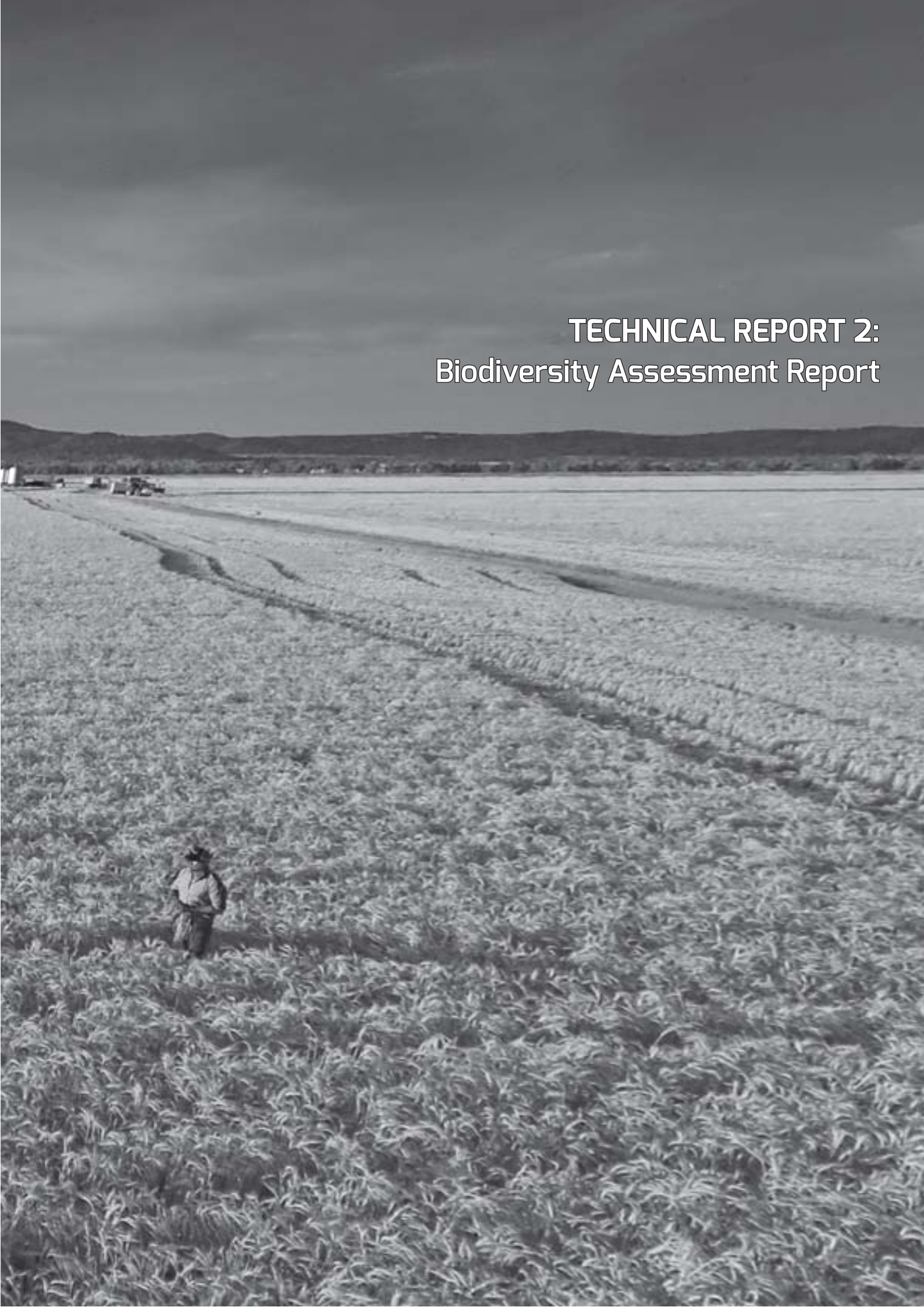

# TECHNICAL REPORT 2:
# Biodiversity Assessment Report

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# INLAND RAIL – PARKES TO NARROMINE

Biodiversity Assessment Report

**FINAL**

**June 2017**

# INLAND RAIL – PARKES TO NARROMINE

Biodiversity Assessment Report

## FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Australian Rail Track Corporation

| | |
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This report was prepared using Umwelt's ISO 9001 certified Quality Management System.

# Executive Summary

The Australian Government has committed to building a significant new piece of national transport infrastructure by constructing an inland railway between Melbourne and Brisbane, via central-west New South Wales (NSW) and Toowoomba in Queensland. The Inland Rail project ('Inland Rail') is a major national project that will enhance Australia's existing national rail network and serve the interstate freight market. This report relates to the Parkes to Narromine section of Inland Rail.

The proposal will involve upgrading the existing rail line between Parkes and Narromine including upgrading the existing track and track formation, replacing culverts and bridges, constructing three new crossing loops, rationalising and upgrading level crossings, curve easing and other ancillary works.

This Biodiversity Assessment Report (BAR) has been prepared on behalf of the Australian Rail Track Corporation (ARTC) to assess the potential ecological impacts of the proposal in accordance with the *Framework for Biodiversity Assessment – NSW Biodiversity Offsets Policy for Major Projects (FBA)*.

The BioBanking Credit Calculator (BBCC) was applied following extensive literature reviews, the identification of relevant landscape features and detailed flora and fauna field surveys undertaken in October 2014, July and December 2015 and January, May and June 2016 of the Development Site, in accordance with the Framework for Biodiversity Assessment (FBA) (OEH 2014a).

Following the application of appropriate avoidance and mitigation measures, the BioBanking Assessment identified the following biodiversity credits required to offset the impacts of the proposal:

- 2,561 ecosystem credits for nine plant community types occurring within the Development Site including impacts on seven threatened ecological communities (TECs)
- 491 species credits for koala (*Phascolarctos cinereus*).

An offset strategy will be developed for the proposal in accordance with the FBA to satisfy these credit requirements.

# Glossary

| | |
|---|---|
| BAR | Biodiversity Assessment Report |
| BBAM | BioBanking Assessment Methodology |
| BBCC | BioBanking Credit Calculator |
| Buffer Area | 550 metre buffer established along each side of the centre line of a linear shaped development footprint. |
| BVT | Biometric Vegetation Type |
| CEEC | Critically Endangered Ecological Community |
| CMA | Catchment Management Authority Area |
| DECC | NSW Department of Environment and Climate Change (now OEH) |
| DECCW | NSW Department of Environment, Climate Change and Water (now OEH) |
| Development Site | The total impact zone associated with the proposal which incorporates both permanent and temporary disturbance. |
| Development Footprint | The area of permanent impact within the Development Site. |
| DNG | Derived Native Grassland |
| DoE | Commonwealth Department of the Environment (now DoEE) |
| DoEE | Commonwealth Department of the Environment and Energy (formerly DoE) |
| DSEWPC | Department of Sustainability, Environment, Water, Population and Communities (now DoEE) |
| Ecosystem credit | a measurement of the value of EECs, CEECs and threatened species habitat for species that can be reliably predicted to occur with a PCT. Ecosystem credits measure the loss in biodiversity values at a development site and the gain in biodiversity values at an offset site. |
| EEC | Endangered Ecological Community |
| EP | Endangered Population |
| EP&A Act | *Environmental Planning and Assessment Act 1979* (NSW) |
| EPBC Act | *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth) |
| FBA | Framework for Biodiversity Assessment |
| FM Act | *Fisheries Management Act 1994* (NSW) |
| GIS | Geographical Information System |
| Greenfield | Previously undeveloped sites for commercial development or exploitation |
| IBRA | Interim Biogeographic Regionalisation for Australia (Version 7) |
| LGA | Local Government Area |
| LPI | Land and Property Information |
| IR | Inland Rail |
| KMA | Koala Management Area |
| KP | Kilometre point (rail line kilometerage) |

| | |
|---|---|
| MGA | Map Grid of Australia |
| MNES | Matters of National Environmental Significance |
| NSW | New South Wales |
| OEH | NSW Office of Environment and Heritage |
| PCT | Plant Community Type |
| PMST | Protected Matters Search Tool |
| SAT | Spot Assessment Technique |
| 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. |
| SSI | State Significant Infrastructure |
| Strahler Stream Order | Classification system that gives a waterway an 'order' according to the number of tributaries associated with it. |
| TEC | Threatened Ecological Community |
| TSC Act | *Threatened Species Conservation Act 1995* (NSW) |
| TSPD | Threatened Species Profile Database |
| VIS | Vegetation Information System |
| WoNS | Weed of National Significance |

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# 1.0 Introduction

The Australian Government has committed to delivering a significant piece of national transport infrastructure by constructing a high performance and direct interstate freight rail corridor. The Inland Rail programme (Inland Rail) involves the design and construction of a new inland rail connection, about 1,700 kilometres long, between Melbourne and Brisbane, via central-west New South Wales (NSW) and Toowoomba in Queensland. Inland Rail would enhance Australia's existing national rail network and serve the interstate freight market.

Australian Rail Track Corporation Ltd (ARTC) is seeking approval to construct and operate the Parkes to Narromine section of Inland Rail ('the proposal'), which consists of 106 kilometres of upgraded rail track and associated facilities.

The proposal requires approval from the NSW Minister for Planning under Part 5.1 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). The proposal is also a controlled action under the Commonwealth *Environment Protection Biodiversity Conservation Act 1999* (EPBC Act), and requires approval from the Australian Minister for the Environment and Energy.

This report has been prepared by Umwelt Australia Pty Ltd (Umwelt) as part of the environmental impact statement (EIS) for the proposal. The EIS has been prepared to accompany the application for approval of the proposal, and addresses the environmental assessment requirements of the Secretary of the Department of Planning and Environment (the SEARs), issued on 8 November 2016.

## 1.1 The Proposal

### 1.1.1 Location

The proposal is generally located in the existing rail corridor between the towns of Parkes and Narromine, via Peak Hill. In addition, a new connection to the Broken Hill rail line ('the Parkes north west connection') is proposed outside the existing rail corridor at the southern end of the proposal site near Parkes. The location of the proposal is shown in **Figure 1.1**.

### 1.1.2 Key features

The key features of the proposal involve:

- upgrading the track, track formation, and culverts within the existing rail corridor for a distance of 106 kilometres between Parkes and Narromine
- realigning the track where required within the existing rail corridor to minimise the radius of tight curves
- providing three new crossing loops within the existing rail corridor, at Goonumbla, Peak Hill, and Timjelly
- providing a new 5.3 kilometre long rail connection to the Broken Hill Line to the west of Parkes ('the Parkes north west connection'), including a road bridge over the existing rail corridor at Brolgan Road ('the Brolgan Road overbridge').

The key features of the proposal are shown in**Figure 1.2**.

Ancillary work would include works to level crossings, signalling and communications, signage and fencing, and services and utilities.

Further information on the proposal is provided in the EIS.

### 1.1.3 Timing

Subject to approval of the proposal, construction is planned to start in early to mid 2018, and is expected to take about 18 months. The proposal is expected to be operational in 2020. Inland Rail as a whole is expected to be operational in 2025.

### 1.1.4 Operation

Prior to the opening of Inland Rail as a whole, the proposal would be used by existing rail traffic, which includes trains carrying grain and ore at an average rate of about four trains per day. It is estimated that the operation of Inland Rail would involve an annual average of about 8.5 trains per day in 2025, increasing to 15 trains per day in 2040. The trains would be a mix of grain, intermodal (freight), and other general transport trains.

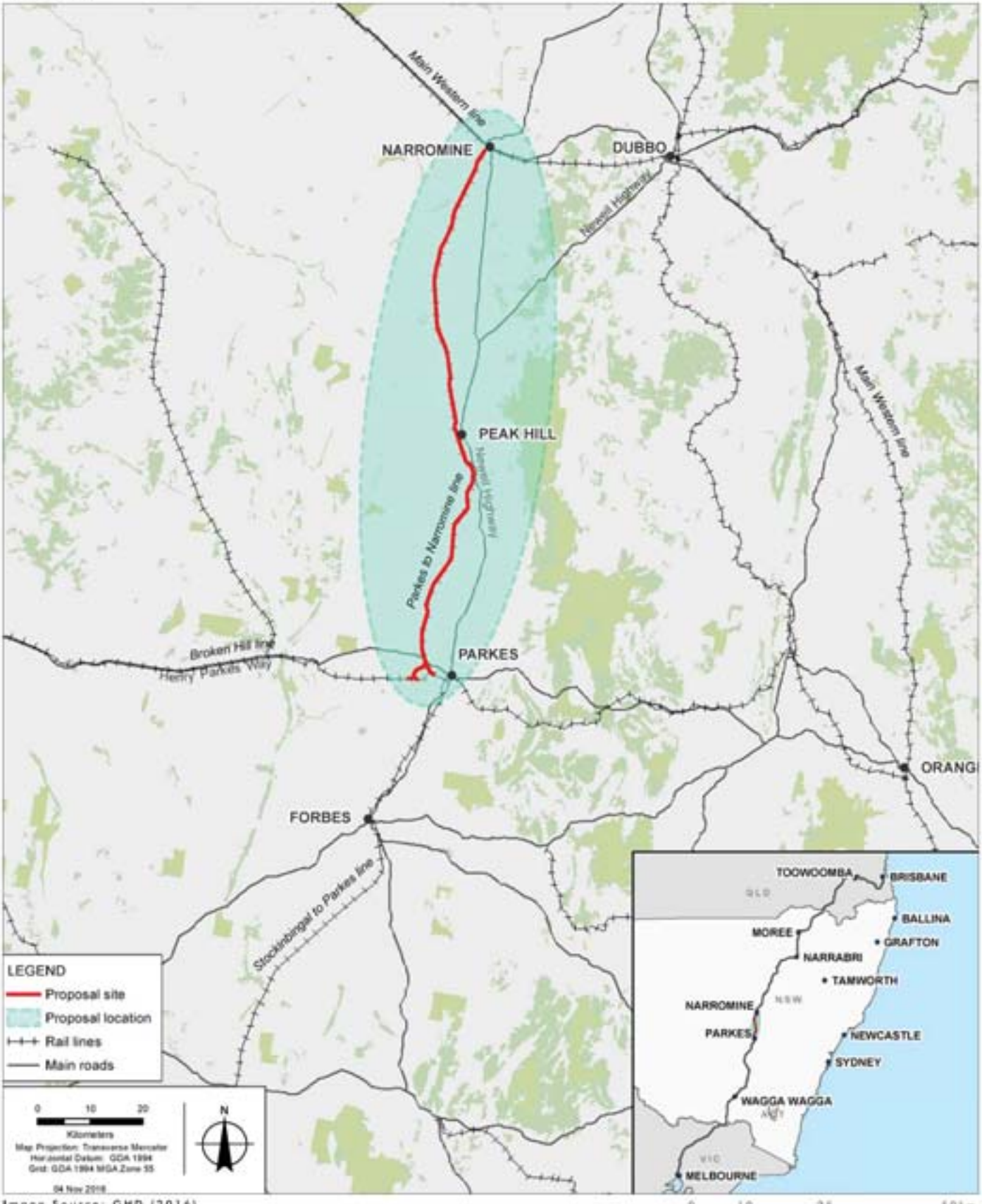
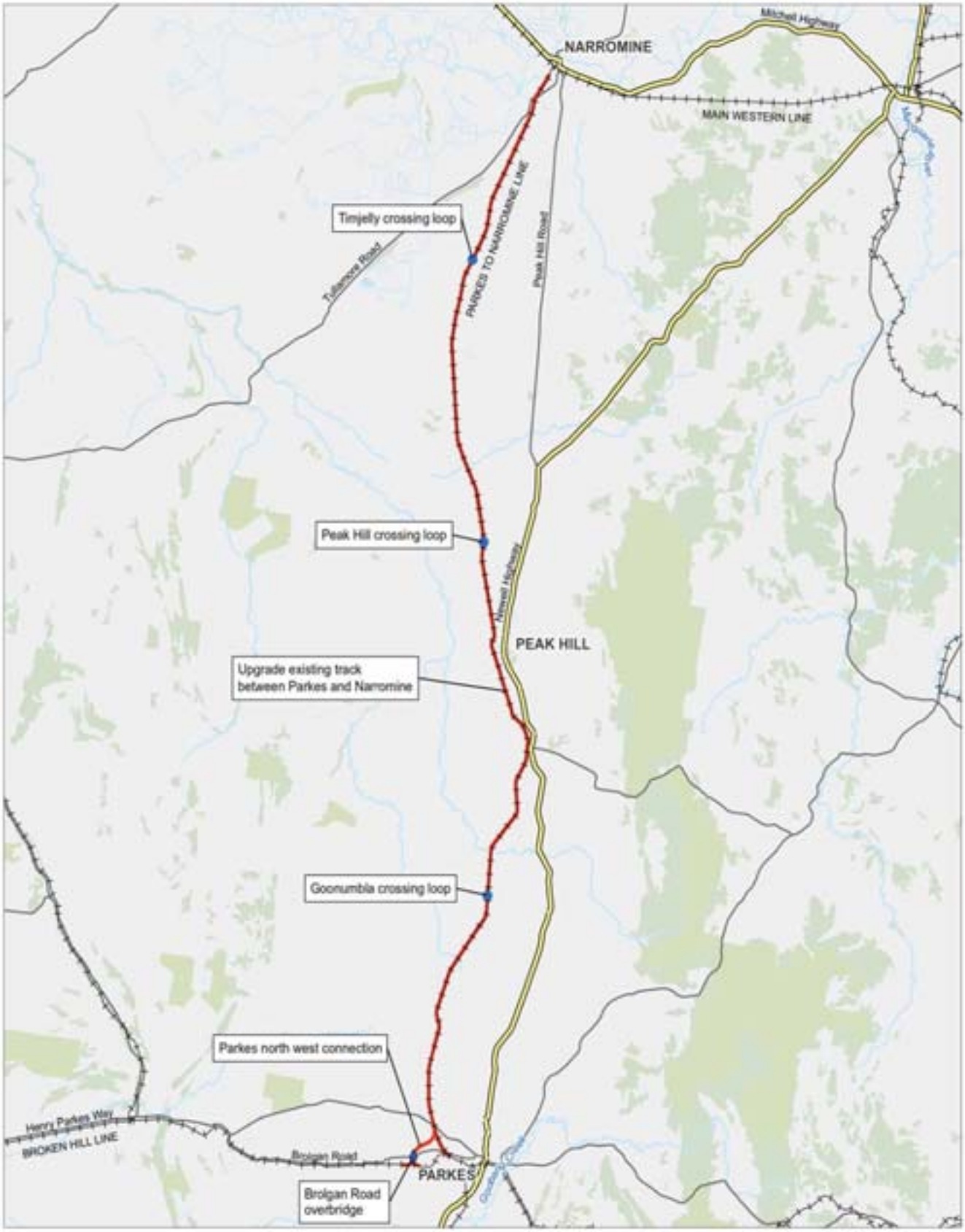



Image Source: GHD (2016)

FIGURE 1.1

**Location of the Proposal**




LEGEND

- New bridge
- Crossing loop
- The proposal
- Railway
- Highway
- Road

0 2.5 5 10 15
Kilometers
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

FIGURE 1.2

**Key Features of the Proposal**

Image Source: GHD (2017)

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## 1.2 Purpose and Scope of this Report

This report provides the findings of the Biodiversity Assessment of the proposal. It addresses the Biodiversity Assessment Report (BAR) specific requirements of the SEARs and the submission from OEH in relation to biodiversity impacts that informed the preparation of the SEARs (refer to **Table 1.1**).

The BAR has been prepared in accordance with the NSW Framework for Biodiversity Assessment (FBA) (OEH 2014a) which applies to all State Significant Infrastructure (SSI).

**Table 1.1 SEARs Related to Biodiversity Assessment Report and OEH Submission on SEARs**

| Requirements for Biodiversity | Where addressed in this report |
|---|---|
| **SEARs** | |
| 1. The Proponent must assess biodiversity impacts in accordance with the current guidelines including the Framework for Biodiversity Assessment (FBA). | Throughout this BAR |
| 2. The Proponent must assess any impacts on biodiversity values not covered by the FBA as specified in s2.3 | Section 5.7 |
| 3. The Proponent must assess impacts on the EECs, threatened species and/or populations as listed in Attachment B and provided the information specified in s9.2 of the FBA. | Section 5.4 |
| 4. The Proponent must identify whether the project as a whole, or any component of the project, would be classified as a Key Threatening Process in accordance with the listing in the *Threatened Species Conservation Action 1995* (TSC Act), *Fisheries Management Act 1994* (FM Act) and *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). | Section 5.5 |
| **OEH Submission** | |
| 1. Biodiversity impacts related to the proposed project are to be assessed and documented in accordance with the Framework for Biodiversity Assessment, unless otherwise agreed by OEH, by a person accredited in accordance with s142B(1)(c) of the *Threatened Species Conservation Act 1995*. | Throughout this BAR and Section 1.6 |
| 2. Impacts on the species and ecological communities listed in Attachment B will require further consideration and provision of the information specified in s9.2 of the Framework for Biodiversity Assessment. | Section 5.4 |

| Requirements for Biodiversity | Where addressed in this report |
|---|---|
| Attachment B – Species/Populations/Ecological Communities which require further consideration.<br>• *Fuzzy Box Woodland on alluvial Soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions* EEC under the TSC Act<br>• *White Box Yellow Box Blakely's Red Gum Woodland* EEC under the TSC Act and CEEC under the EPBC Act<br>• *Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions* EEC under the TSC and EPBC Acts<br>• a speargrass (*Austrostipa wakoolica*), endangered under the TSC and EPBC Acts<br>• spiny peppercress (*Lepidium aschersonii*), vulnerable under the TSC and EPBC Acts<br>• small purple-pea (*Swainsona recta*), endangered under the TSC and EPBC Acts<br>• silky Swainson-pea (*Swainsona sericea*), vulnerable under the TSC Act. | Section 5.4 |

Specifically this assessment:

- describes the existing terrestrial environment of the Development Site in terms of its ecological values, including type and condition of vegetation communities and terrestrial habitats
- identifies flora and fauna species and ecological communities within the Development Site that have the potential to be impacted by the proposal
- determines the presence or likelihood of occurrence of threatened flora and fauna species and populations and Threatened Ecological Communities (TECs) listed under the *Threatened Species Conservation Act 1995* (TSC Act) and *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- calculates the offset credit requirements for ecosystem credits and species credits generated as a result of the permanent impacts of the proposal in accordance with the FBA (OEH 2014a).

The FBA process requires the calculation of biodiversity credits using a NSW Government credit calculator. The credits calculated and presented in this report have been prepared based on a proposal site as shown on the Figures in **Appendix A**. It is noted that since this time, a range of alterations to the proposal were made following completion of further technical assessments and engineering design of the proposal which result in some changes to the proposal site. For this reason the proposal site used in this assessment, whilst substantially similar to the final proposal site, is different to that described in the remainder of the EIS. It is expected that the final credit generation for the proposal will be confirmed as an outcome of the detailed design process and that biodiversity offsetting for the proposal will be based on the final credit calculations.

The FBA requires specific terminology to be used to describe the site and impact area being assessed in an FBA report. For this reason the terminology in this report which is FBA specific differs from that used in the EIS. To avoid any doubt, **Table 1.2** below compares the terminology.

**Table 1.2 Comparison of BAR and EIS Terminology**

| FBA Terminology | EIS Terminology |
|---|---|
| Development Site | Proposal site and the additional assessment area |
| Development Footprint | Proposal site |

It is noted that the SEARs specifically relating to Commonwealth Matters of National Environmetnal Significance (MNES) are addressed in the *ARTC Inland Rail – Parkes to Narromine Commonwealth Matters Assessment* (Umwelt 2017a).

## 1.3 Development Site Information

The Development Site will be subjected to a range of permanent and temporary disturbances as outlined in **Sections 4.3** and **4.4**. The Development Footprint comprises the portion of the Development Site that will be subject to permanent impact and for which ecosystem and threatened species credits have been calculated in accordance with the FBA. The Development Site is shown on the figures in **Appendix A**.

### 1.3.1 Location

The proposal will generally be located within the rail corridor between Parkes and Narromine (refer to **Figure 1.3**). The rail corridor commences on the northern side of Parkes, passes through Peak Hill on the existing corridor and ends on the southern side of Narromine in NSW. The Parkes north west connection is also proposed at the southern end of the Development Site near Parkes.

The rail corridor is defined by fences located approximately 20 metres either side of the rail line, however in some sections where fences are not present the rail corridor may be wider, extending out to about 30 to 40 metres from the rail line or wider where site compounds are proposed. The Development Footprint varies along the length of the proposal depending on the construction activities that are proposed in any given area.

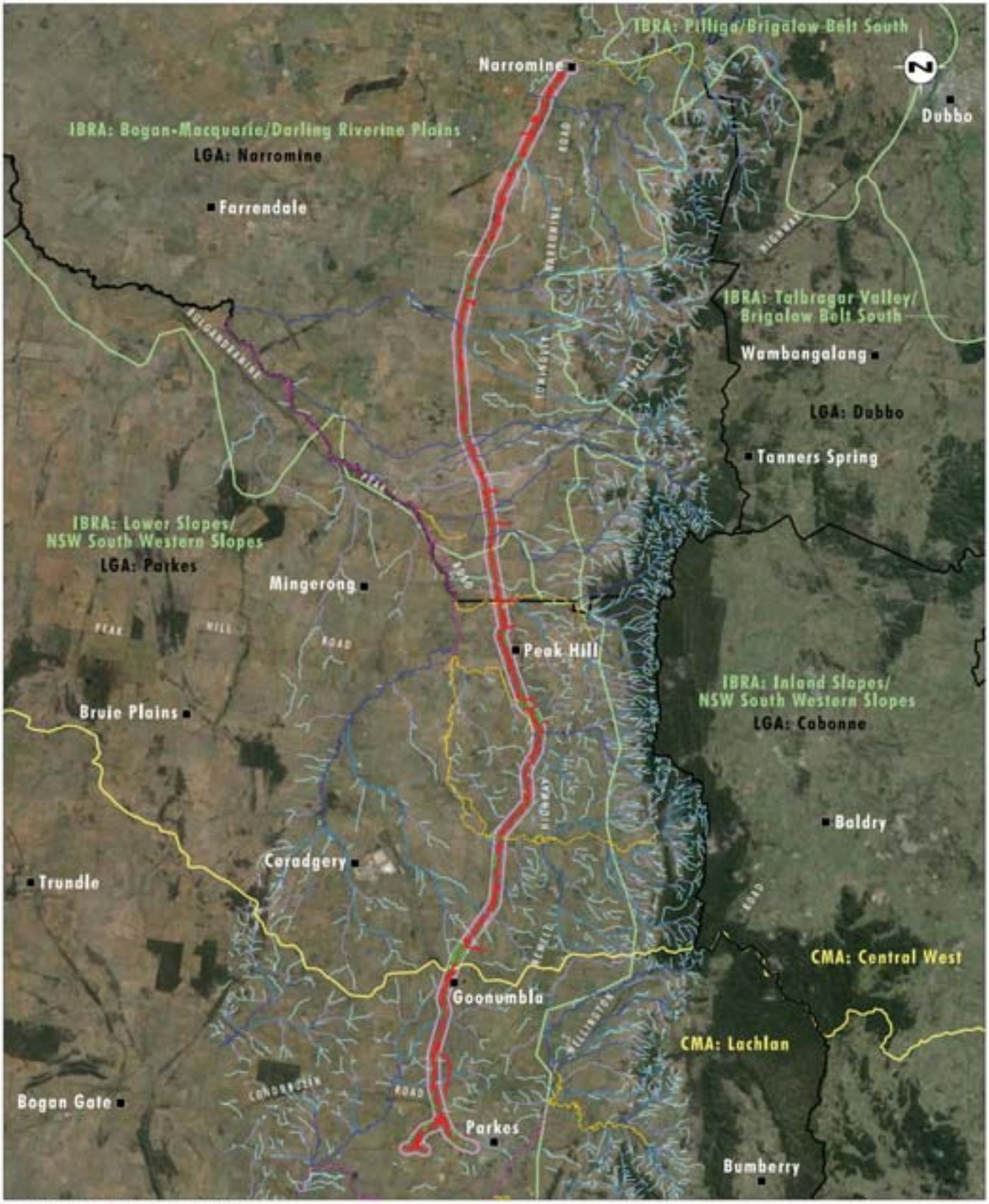


Image Source: Google Earth (2013)
Data Source: Geoscience Australia (2009), Parsons Brinckerhoff (2014), Umwelt (2016)

0 5 10 20km
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**Legend**

- Development Site
- 550m Buffer Area
- IBRA Regions and Subregion Areas
- Local Government Area
- Catchment Management Authority
- Native Vegetation Area
- Town Location

Stream Order:
- 1st Order
- 2nd Order
- 3rd Order
- 4th Order
- 5th Order
- 6th Order

FIGURE 1.3

**Parkes to Narromine Section of Inland Rail**

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**Table 1.3 Development Site Location in the Landscape**

| Parkes to Narromine | |
|---|---|
| **IBRA Bioregions** | NSW South Western Slopes<br>Darling Riverine Plains |
| **IBRA Subregions** | Lower Slopes<br>Bogan Macquarie |
| **Major Catchment Areas** | Lachlan<br>Central West |
| **Mitchell Landscapes** | Bimbi Plains<br>Bogan Alluvial Plains<br>Boggy Cowal Alluvial Plains<br>Boggy Cowal Channels and Floodplains<br>Goonumbla Hills<br>Narromine Hills |
| **LGAs** | Parkes<br>Narromine |

### 1.3.2 Size

The Development Site covers approximately 923 hectares.

### 1.3.3 Topography and Natural Features

The Development Site is typical of the South Western Slopes and Darling Riverine Plains Bioregions. The southern extent of the proposal (at Parkes) is situated in the Lachlan River basin and north of the Lachlan River, with the nearest named watercourse being Goobang Creek. The northern extent of the proposal is situated in the Macquarie River floodplain. The proposal crosses 29 waterways including major creeks (such as Burrill Creek, Stanfords Creek, Barrabadeen Creek, Tomingley Creek and Yellow Creek) and other watercourses, most of which are ephemeral.

The Development Site is located within the Central Lachlan Fold Belt. Near surface materials include Tertiary to Quaternary aged red silty alluvium over folded and faulted Silurian and Ordovician aged sedimentary and minor metamorphic sequences which outcrop intermittently along the existing rail corridor (GHD 2014). Thick reactive brown and grey clay soils are predominantly associated with the near level terrain north of about Peak Hill while moderately thick red and brown sandy and silty clay soils are typically associated with the undulating terrain south of about Peak Hill (GHD 2014). Given the distance of the existing rail corridor from the coast and the elevation of the areas (>10 metres Australian Height Datum (AHD)), no acid sulfate soils are expected or known to occur (GHD 2014).

Patches of native vegetation exist sporadically within the Development Site which are typically connected to small woodland patches in adjacent agricultural land. These patches generally comprise a woodland community with the dominant canopy species including inland grey box (*Eucalyptus microcarpa*), fuzzy box

(*Eucalyptus conica*) and yellow box (*Eucalyptus melliodora*). Patches of weeping myall (*Acacia pendula*) were also recorded within the Development Site.

The majority of the Development Site has been heavily modified by past and ongoing disturbances associated with the rail corridor and surrounding agricultural activities. Clearance and maintenance of the rail corridor has resulted in the fragmentation and subsequent high level of disturbance and degradation of vegetation communities within the rail corridor.

## 1.4 Key Resources, Policies and Documents

The following key resources, policies and documents were used to prepare the Biodiversity Assessment Report for the proposal:

- Framework for Biodiversity Assessment – NSW Biodiversity Offsets Policy for Major Projects (OEH 2014a)
- Credit Calculator for Major Projects and BioBanking Operational Manual (OEH 2016a)
- BioBanking Assessment Methodology 2014 (OEH 2014b)
- Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities –Working Draft (DEC 2004)
- BioBanking Credit Calculator (Major Project Assessment Type) (BBCC 2016), accessed in July 2016
- OEH Threatened Species Profile Database (TSPD) (OEH 2016b), assessed between April and July 2016
- Vegetation Information System (VIS) Classification Database (OEH 2016c), accessed between April and July 2016
- BioNet Atlas of NSW Wildlife database and mapping tool (OEH 2016d), accessed in April 2016
- Department of the Environment (DoE) (now the Department of the Environment and Energy) Protected Matters Database (DoE 2016a), accessed in April 2016.
- NSW Guide to Surveying Threatened Plants (OEH 2016e)

## 1.5 Report Preparation

This Biodiversity Assessment Report (BAR) was prepared by Ryan Parsons (Senior Ecologist) and Kate Connolly (Senior Ecologist), with review and technical direction from Allison Riley (Principal Ecologist). Field surveys were led by Ryan Parsons and Amy Nelson (Ecologist). Each BAR contributor is accredited under the TSC Act as BioBanking and BioCertification Assessors.

### 1.5.1 Structure of the Report

The structure of the report is outlined below:

- Section 1 – provides the introduction to the report
- Section 2 – outlines the methods used in the assessment
- Section 3 - outlines the results of the field surveys and BioBanking credit calculator application
- Section 4 – describes the avoidance measures implemented and minimisation of impacts as part of the proposal
- Section 5 – provides a summary of impacts in accordance with the FBA
- Section 6 – summarises the biodiversity offsetting options for the proposal
- Section 7 – provides a list of references used throughout the report and assessment.

# 2.0 Methods

## 2.1 Assessment Approach

The long linear nature of the Development Site meant that multiple regions within the landscape were crossed. The FBA methodology and credit calculator is based on assessing a Development Site within specific regions. Overall the Development Site crosses the following regions:

- **Catchment Management Authority (CMA) boundaries**
    - Central West
    - Lachlan
- **Local Government Areas (LGA)**
    - Parkes
    - Narromine
- **Interim Biogeographic Regionalisation of Australia (IBRA)**
    - NSW South Western Slopes
    - Darling River Plains
- **IBRA Subregions**
    - Lower Slopes
    - Bogan-Macquarie
- **Mitchell Landscapes**
    - Bimbi Plains
    - Bogan Alluvial Plains
    - Boggy Cowal Alluvial Plains
    - Boggy Cowal Channels and Floodplains
    - Goonumbla Hills
    - Narromine Hills

OEH BioBanking expert John Seidel was consulted regarding the most appropriate assessment approach where multiple regions are intersected by a linear Development Site. It was recommended that for each combination of the CMA and IBRA subregion a separate FBA assessment should be undertaken as these are the most important regions to consider according to the FBA Methodology. In order to enter the vegetation communities into the BBCC a Biometric Vegetation Type (BVT) needs to be assigned which is based on the CMA area. The IBRA subregion is used to filter the species-credit species which are required to be surveyed and assessed. As a result each combination of the CMA and IBRA subregion require a separate assessment, comprising the following:

- Assessment 1 – Lachlan CMA/Lower Slopes IBRA Subregion
- Assessment 2 – Central West CMA/Lower Slopes IBRA Subregion
- Assessment 3 – Central West CMA/Bogan Macquarie IBRA Subregion.

In addition, it was recommended by OEH that the landscape value assessment be completed for the whole Development Site rather than for each individual assessment area. The six Mitchell landscapes intersected by the Development Site are assessed in the landscape value assessment by entering the largest patch size for each Mitchell Landscape. The other regions including LGA and IBRA region are not relevant in an FBA Assessment and are not included in the BBCC.

It was also confirmed by OEH that plot/transect data collected from within the Development Site across the range of CMA and IBRA subregions could be used to undertake each of the three separate assessments described above, irrespective of where in the Development Site the data was collected. This approach allows plot/transect data collected for each vegetation zone delineated within the Development Site to be used in each of the adjacent BBCC assessments, with additional replicate sampling in accordance with the minimum plot/transects (refer to **Table 2.1**) per vegetation zone not required.

Refer to **Figure 2.1** which illustrates the three assessment areas.

## 2.2 Landscape Features

### 2.2.1 Identifying Landscape Features

Landscape features within the Development Site and the 550 metre buffer area were determined through reviewing aerial photography and relevant GIS layers. For linear developments, the FBA (OEH 2014a) requires a 550 metre buffer area of the Development Site located from the centre line of the linear development (refer to Figures A1-A36 in **Appendix A**). Landscape features that were reviewed included:

- IBRA bioregions and IBRA subregions
- Mitchell landscapes
- rivers, streams and estuaries (using the Strahler (1952) ordering system) at 1:50,000 scale
- wetlands
- native vegetation extent, and
- State and/or regional biodiversity links.

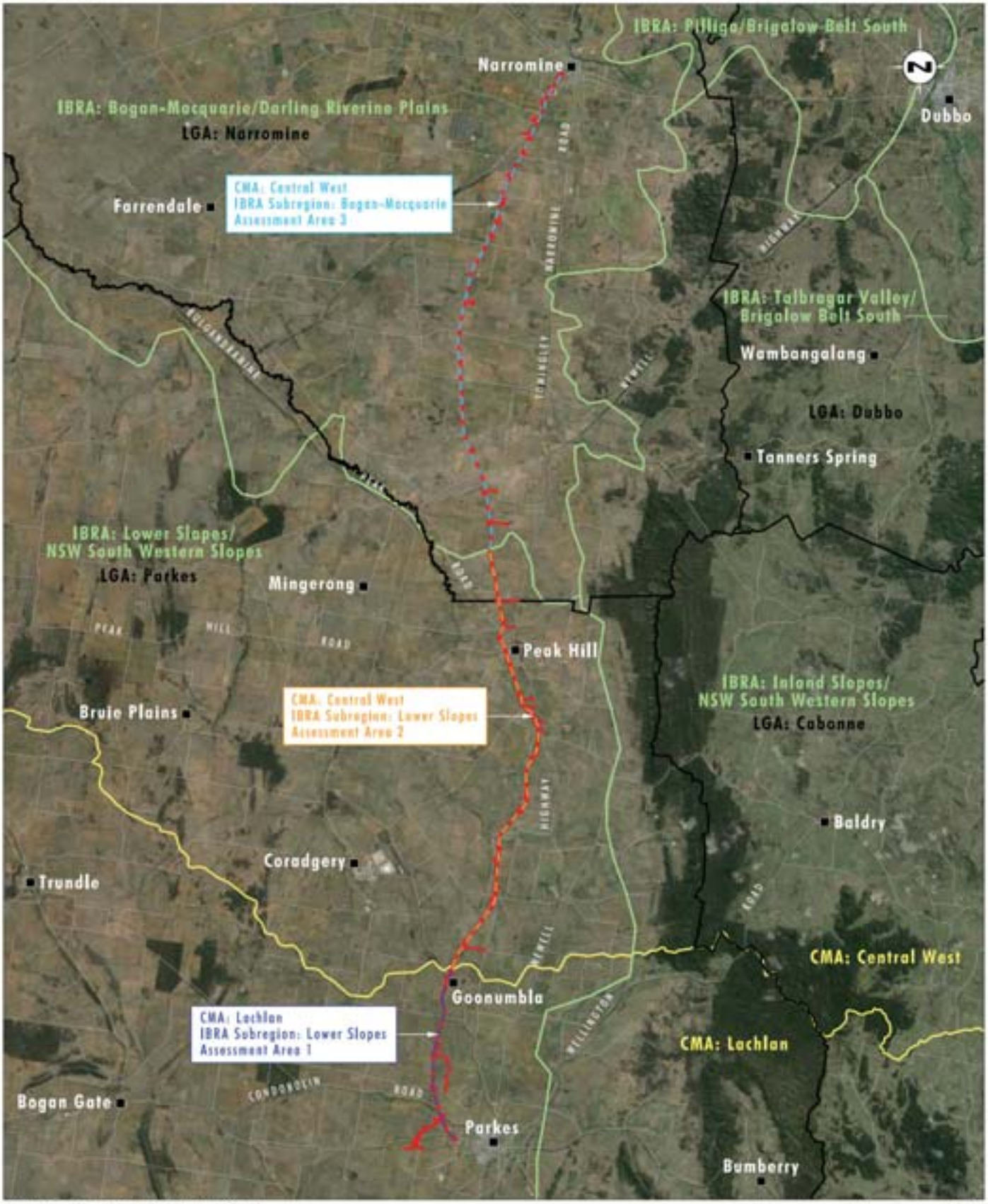


Image Source: Google Earth (2013)
Data Source: Geoscience Australia (2009), Parsons Brinckerhoff (2014), Umwelt (2016)

0 5 10 20km
1:500 000

**Legend**

- Development Site
- IBRA Regions and Subregion Areas
- Local Government Area
- Catchment Management Authority
- Town Location

FIGURE 2.1

**Assessments Undertaken in the Biodiversity Assessment Report (BAR)**

File Name (A4): R06/3606_042.dgn
20160530 11:30

### 2.2.2 Determining Landscape Value

Determining the 'Landscape Value' of the Development Site (linear-based developments) is calculated by assessing the following landscape attributes:

- current and future per cent native vegetation cover
- connectivity value
- patch size
- change in area to perimeter ratio.

For this proposal, and in accordance with Appendix 5 of the FBA (OEH 2014a), the buffer area was established 550 metres either side of the centre of the rail line for the proposal.

#### 2.2.2.1 Per cent Native Vegetation Cover

'Per cent Native Vegetation Cover' is determined by the current per cent native vegetation cover and the future per cent native vegetation cover within the buffer area. This was determined using digital aerial photography interpretation using the Manifold GIS software package. Aerial photographs captured during 2014-2015 were used to digitise all native vegetation within the buffer area. Further refinement of these areas was undertaken following field surveys of the Development Site.

#### 2.2.2.2 Connectivity Value

To determine the connectivity value, the Development Site was assessed for the presence of native vegetation connecting links, and state, regional or local biodiversity links as required by the FBA (OEH 2014a).

Connecting links are present when an area of native vegetation in a Development Site adjoins native vegetation surrounding the Development Site and it is:

- in moderate to good condition, and
- has a patch size of > 1 hectare, and
- is separated by a distance of < 100 metres (or ≤ 30 metres for non-woody ecosystems), and
- is not separated by a large waterbody, dual carriageway, wider highway or similar hostile link.

Connectivity value scores are determined based on the following connecting links, as defined in Table 17 of Appendix 5 of the FBA (OEH 2014a):

- State significant biodiversity link
- regionally significant biodiversity link
- very large area biodiversity link
- large area biodiversity link, and
- local area biodiversity link.

#### 2.2.2.3 Patch Size

A 'Patch' is an area of native vegetation that:

- occurs on the Development Site, and
- is in moderate to good condition, and
- includes native vegetation that has a gap of less than 100 metres from the next area of moderate to good condition native vegetation (or ≤ 30 metres for non-woody vegetation).

For linear-based developments, the patch size is calculated for each Mitchell Landscape occurring within the Development Footprint. The patch may extend onto adjoining land that is not part of the Development Site. An assessment of the patch size class and the patch size score was then determined using Table 18 of the FBA (OEH 2014a).

#### 2.2.2.4 Change in Area to Perimeter Ratio

The change in area to perimeter ratio was calculated by selecting all patches of native woody vegetation greater than 1 hectare in size within the 550 metre buffer zone which would be impacted by the Development Site. The total area in metres squared was divided by the total perimeter in metres before development. This was then completed again for the post development scenario and entered into the Credit Calculator.

## 2.3 Native Vegetation Assessment

### 2.3.1 Literature and Database Review

A review of previous documents and reports relevant to the proposal was undertaken. This included regional and sub-regional vegetation mapping reports, site-specific monitoring surveys, ecological surveys undertaken in the vicinity of the Development Site and also relevant ecological database searches. The information obtained was used to inform survey design, and was also used to assist in the assessment of potentially occurring threatened and migratory species, endangered populations (EPs) and Threatened Ecological Communities (TECs). Relevant documents included:

- Reconstructed and Extant Distribution of Native Vegetation in the Central West and Lachlan Catchment (DEC 2006)
- Travelling Stock Reserve Conservation Values spatial layer (Rural Lands Protection Board 2010)
- Melbourne Brisbane Inland Railway Parkes to Narromine and Narrabri to North Star – Ecological Investigations (Umwelt 2014)
- VIS Classification Database (OEH 2016c), accessed between April and July 2016
- OEH Threatened Species Profile Database for known/predicted Threatened Ecological Communities (TECs) in the Lower Slopes and Bogan Macquarie IBRA subregion, accessed between April and July 2016
- DoEE Protected Matters Search Tool for known/predicted EPBC Act-listed TECs, accessed April 2016.

## 2.3.2 Digital Aerial Photograph Interpretation

Digital imagery (aerial photographs) of the Development Site was viewed prior to and after vegetation survey to identify spatial patterns in vegetation, land use and landscape features. These informed field survey design and implementation, ecological assessment and vegetation community mapping of the Development Site.

Vegetation communities in the Development Site were mapped on-screen overlaying the 2014-2015 high resolution aerial photographs provided by ARTC. Mapping was undertaken using the Manifold System 8.0 Enterprise Edition GIS in a 32 bit mode. Use of GIS allowed zooming to a relatively large scale, generally at a scale between 1:2000 and 1:4000.

Generally the minimum mapping unit for a vegetation zone was 0.1 hectare, however mapping was completed at a finer scale in order to map the small stands of weeping myall woodland, narrow bands of vegetation as well as smaller patches connected to larger areas of remnant vegetation outside the Development Site. A 3 to 1 crown separation ratio was generally applied for mapping areas of remnant woodland.

## 2.3.3 Systematic Plot/Transect Surveys

A total of 48 systematic plots/transect surveys were conducted across the Development Site during the surveys undertaken for this assessment (refer to Figures A1-A36 in **Appendix A**). These surveys were undertaken over 17 days and three survey periods, being:

- 11 – 21 January 2016
- 2 – 5 May 2016
- 1 – 2 June 2016.

Furthermore, rapid vegetation assessments were undertaken over three days between 16 and 18 September 2014 as part of the ecological constraints analysis undertaken by Umwelt (2014) (refer to **Section 2.3.4**).

### 2.3.3.1 Plot/Transect Selection and Stratification of the Development Site

Designing an appropriate survey requires consideration of both survey methods and effort. Reference was made to the VIS Classification Database to identify Plant Community Types (PCTs), as well as reviews of other regional and local vegetation mapping and reporting (refer to **Section 2.3.1**) when designing the field survey. The Development Site PCTs were further stratified into Vegetation Zones (condition states) following the initial field survey of the site to determine the appropriate number of transect/plots required in accordance with the FBA (OEH 2014a) as outlined in **Table 2.1**.

**Table 2.1 Minimum Number of Plots/Transects Required per Zone Area (OEH 2014a)**

| Vegetation Zone Area (ha) | Minimum Number of Plot/Transect |
|---|---|
| 0-4 | 1 transect/plot per 2 ha (or part thereof) or 1 transect/plot if vegetation is in low condition |
| >4-20 | 3 transects/plots or 2 transects/plots if vegetation is in low condition |
| >20-50 | 4 transects/plots or 3 transects/plots if vegetation is in low condition |

| Vegetation Zone Area (ha) | Minimum Number of Plot/Transect |
|---|---|
| >50-100 | 5 transects/plots or 3 transects/plots if vegetation is in low condition |
| >100-250 | 6 transects/plots or 4 transects/plots if vegetation is in low condition |
| >250-1000 | 7 transects/plots or 5 transects/plots if vegetation is in low condition<br>(More transects/plots may be needed if the condition of the vegetation is variable across the zone) |
| >1000 | 8 transects/plots or 5 transects/plots if vegetation is in low condition or in a homogenous landscape in the Western Division<br>(More transects/plots may be needed if the condition of the vegetation is variable across the zone) |

**Table 2.2** below outlines the adequacy of the plot/transect flora survey with respect to the FBA Methodology (OEH 2014a) pertinent to the Development Site.

**Table 2.2 Adequacy of Vegetation Survey in the Development Site**

| Veg Zone | PCT ID (BVT IDs) and PCT Name<br>*Condition Class* | Area in the Development Site (ha) | Number of Biometric Plots/Transects | |
|---|---|---|---|---|
| | | | Required (FBA 2014) | Undertaken During Survey |
| 1 | PCT26 (CW205, LA212) Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion<br>*Moderate to Good* | 3.47 | 2 | 3 |
| 2 | PCT36 (CW183, LA193) River Red Gum tall to very tall open forest / woodland wetland on rivers on floodplains mainly in the Darling Riverine Plains Bioregion<br>*Moderate to Good* | 0.87 | 1 | 1 |
| 3 | PCT36 (CW183, LA193) River Red Gum tall to very tall open forest / woodland wetland on rivers on floodplains mainly in the Darling Riverine Plains Bioregion<br>*Low_Regeneration* | 0.62 | 1 | 1 |
| 4 | PCT55 (CW104, LA105) Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions<br>*Moderate to Good* | 1.12 | 1 | 1 |

| Veg Zone | PCT ID (BVT IDs) and PCT Name<br><br>*Condition Class* | Area in the Development Site (ha) | Number of Biometric Plots/Transects | |
|---|---|---|---|---|
| | | | Required (FBA 2014) | Undertaken During Survey |
| 5 | PCT55 (CW104, LA105) Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions<br><br>*Moderate to Good_DNG* | 7.12 | 3 | 3 |
| 6 | PCT70 (CW220, LA223) White Cypress Pine woodland on sandy loams in central NSW wheatbelt<br><br>*Moderate to Good* | 1.95 | 1 | 1 |
| 7 | PCT76 (CW145, LA154) Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions<br><br>*Moderate to Good* | 10.13 | 3 | 7 |
| 8 | PCT76 (CW145, LA154) Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions<br><br>*Moderate to Good_DNG* | 32.06 | 4 | 4 |
| 9 | PCT244 (CW172, LA178) Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt)<br><br>*Moderate to Good* | 3.38 | 2 | 7 |
| 10 | PCT244 (CW172, LA178) Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt)<br><br>*Moderate to Good_DNG* | 14.45 | 3 | 3 |
| 11 | PCT201 (CW138, LA145) Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion<br><br>*Moderate to Good* | 1.88 | 1 | 2 |
| 12 | PCT267 (CW213, LA218) White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion<br><br>*Moderate to Good* | 3.24 | 2 | 2 |

| Veg Zone | PCT ID (BVT IDs) and PCT Name<br><br>*Condition Class* | Area in the Development Site (ha) | Number of Biometric Plots/Transects | |
|---|---|---|---|---|
| | | | Required (FBA 2014) | Undertaken During Survey |
| 13 | PCT267 (CW213, LA218) White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion<br><br>*Moderate to Good_DNG* | 0.57 | 1 | 1 |
| 14 | PCT276 (CW226, LA226) Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion<br><br>*Moderate to Good* | 7.16 | 3 | 3 |
| 15 | PCT276 (CW226, LA226) Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion<br><br>*Moderate to Good_DNG* | 13.96 | 3 | 3 |
| - | Cleared/Non-native vegetation | 820.76 | 0 | 6 |
| **Total** | | **922.74** | **31** | **48** |

#### 2.3.3.2 Plot/Transect Data Collected

At each plot/transect data was recorded according to Section 5 of the FBA (OEH 2014a). This involved setting out 20 x 50 metre and 20 x 20 metre plots and a 50 metre transect. The location of each quadrat was recorded using a hand-held GPS with accuracy of ± 5 metres. The Map Grid of Australia (MGA) coordinate system was used. The location of the 44 plots/transects undertaken within the Development Site is shown in Figures A1-A36 in **Appendix A**.

At each plot/transect, roughly 45 to 60 minutes was spent searching for all vascular flora species present within the 20 x 20 metre plot. Searches of each 20 x 20 metre plot were generally undertaken through parallel transects from one side of the plot to another. Most effort was spent on examining the groundcover, which usually supported well over half of the species present, however the composition of the shrub, mid-storey, canopy and emergent layers were also thoroughly examined. Effort was made to search the tree canopy and tree trunks for mistletoes, vines and epiphytes.

For each flora species recorded in the plot, the following data was collected in accordance with Table 1 of the FBA (OEH 2014a):

- stratum/layer in which the species occurs
- growth form
- scientific name and common name

- cover
- abundance.

At each standard flora plot, 10 points along a 50 metre transect were assessed for:

- percentage native overstorey cover
- percentage native mid-storey cover.

In addition, 50 points along a 50 metre transect were assessed for:

- percentage native groundcover (grass)
- percentage native groundcover (shrubs)
- percentage native ground cover (other)
- percentage exotic plant cover.

Additional details were also recorded in each quadrat, including soil texture, drainage and depth; site disturbances; physiography (position in the landscape); and vegetation structure (strata percentage covers, heights and dominant species). Photographic records were also taken at each site.

### 2.3.4 Semi-quantitative Rapid Sampling

A total of 218 rapid vegetation assessments were completed within the Development Site (refer to Figures A1-A36 in **Appendix A**) during the floristic surveys and as part of the ecological constraints analysis undertaken by Umwelt (2014). Assessment areas were not fixed area-based, but were generally confined to an area similar to a plot. The railway corridor was often defined by fences located approximately 20 metres either side of the tracks, however in sections where fences were not present surveys were extended out to approximately 30 to 40 metres.

Rapid sampling was used in combination with rapid reconnaissance and meandering transects primarily to assist in the delineation and refinement of vegetation mapping with respect to the distribution of native and non-native vegetation areas. Rapid vegetation assessment points were located within distinct vegetation community units (rather than within ecotones) to allow data collection for each community without confounding effects from adjacent communities. Dominant, common and some uncommon plant taxa were recorded within each rapid vegetation assessment points. The vegetation structure at each rapid vegetation assessment point was documented, including the dominant species in each stratum.

### 2.3.5 Meandering Transects

Meandering transects were undertaken through vegetation units across much of the Development Site, particularly for the delineation and refinement of vegetation mapping and searching for threatened and otherwise significant species, endangered populations and TECs. Meandering transects enabled floristic sampling across a much larger area than systematic plots, allowing the survey to achieve a combination of detailed observation and broader appreciation. Records along transects supplemented floristic sampling carried out as part of plot survey, however, the data collected was in the form of presence records. Where meandering transects revealed significant variation within a vegetation unit, or a potential new vegetation community, additional plot survey was undertaken.

Meandering transects provided invaluable information on spatial patterns of vegetation that informed vegetation community mapping of the Development Site.

### 2.3.6 Plant Identification and Nomenclature Standards

All vascular plants recorded or collected within plots and on meandering transects were identified using keys and nomenclature in Harden (1992, 1993, 2000 and 2002). Where known, changes to nomenclature and classification have been incorporated into the results. Updated taxonomy has been derived from PlantNET (Royal Botanic Gardens Sydney 2016).

Common names used follow Harden (1992, 1993, 2000 and 2002) where available, and draw on other sources such as local names where these references do not provide a common name.

### 2.3.7 Vegetation Mapping

Vegetation mapping was undertaken using best-practice techniques to delineate vegetation communities across the Development Site. Vegetation mapping involved the following key steps:

- preliminary review of digital airborne imagery to explore vegetation distribution patterns as dictated by change in canopy texture, tone and colour, as well as topography
- preliminary review of the modelled distribution of vegetation communities as part of the Reconstructed and Extant Distribution of Native Vegetation in the Central West and Lachlan Catchment (DEC 2006)
- predicting the distribution of particular vegetation communities based on understanding the distribution of Biometric vegetation types (OEH 2016c) and plant communities
- preparation of a draft vegetation community map based on interpretation of digital airborne imagery and preliminary delineation of vegetation community floristics
- ground-truthing of the vegetation map based on survey effort documented in **Section 2.3**
- revision of vegetation community floristic delineations based on plot data, and
- revision of the vegetation map based on ground-truthing.

Vegetation communities were delineated through the identification of repeating patterns of plant species assemblages in each of the identified strata. Communities were named in accordance with their site character, with consideration of the naming conventions of those vegetation communities identified by the VIS Classification Database (OEH 2016c).

### 2.3.8 Threatened Ecological Community Delineation Techniques

Vegetation communities identified in the Development Site were compared to TECs listed under the Commonwealth EPBC Act and NSW TSC Act and an assessment of similarity with the NSW Scientific Committee Final Determinations and the Commonwealth Threatened Species Scientific Committee Listing and Conservation Advice. The following approach was used:

- full-floristic quadrat assessment, rapid assessments and meandering survey to determine floristic composition and structure of each ecological community

- comparison with published species lists, including lists of 'important species' as identified on the listing advice provided by the NSW Scientific Committee and/or Commonwealth Threatened Species Scientific Committee

- comparison with habitat descriptions and distributions for listed TECs

- assessment using guidelines and recovery plans published by the Commonwealth DoEE and the NSW OEH

- comparison with other assessments of TECs in the region.

### 2.3.9 Plant Community Type (PCT)/Biometric Vegetation Type (BVT) Allocation

Each of the vegetation communities described within the Development Site were aligned with an equivalent PCT/BVT as detailed in the VIS Classification Database (OEH 2016c). For each vegetation community described in the Development Site, the dominant and characteristic species were entered into the online plant community identification tab and an initial list of PCTs/BVTs was generated. The profiles for each of the possible PCT/BVT were then interrogated and the most appropriate match assigned based on floristic, structure, soil, landform and distribution details.

## 2.4 Threatened Species

### 2.4.1 Literature and Database Review

A review of previous documents and reports relevant to the proposal was undertaken. This included reports, previous ecological surveys undertaken in the vicinity of the Development Site and also relevant ecological database searches. The information obtained was used to inform survey design, and was also used to assist in the assessment of potentially occurring ecosystem-credit and species-credit species. Relevant documents and resources included:

- OEH Threatened Species Profile Database for known/predicted threatened species in the Bogan-Macquarie and Lower Slopes IBRA subregions, accessed between April and July 2016

- OEH BioNet Atlas of NSW Wildlife database and mapping tool (OEH 2016d), accessed in April 2016

- PlantNET (Royal Botanic Gardens Sydney) database search for Rare or Threatened Australian Plant species within the Parkes and Narromine LGAs, accessed July 2016

- DoEE Protected Matters Search Tool for known/predicted EPBC Act-listed TECs, accessed April 2016

- Melbourne to Brisbane Inland Rail Alignment Study – Appendix H Preliminary Environmental Assessment (Parsons Brinckerhoff et al. 2010)

- Environmental Assessment Northparkes Step Change Project (Umwelt 2013).

A preliminary assessment using the TSPD was undertaken which provided a list of species-credit species that might require survey and the suitable survey periods for each species. The results of the database searches, literature review and TSPD review were used to design the survey requirements for species-credit species so that adequate surveys were undertaken.

Note: Ecosystem-credit species are predicted by the landscape attributes and are not required to be specifically targeted during field surveys.

The *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities – Working Draft* (DEC 2004) and Commonwealth Threatened Species Survey and Assessment Guidelines were considered when undertaking the threatened species surveys in the Development Site.

### 2.4.2 Species-credit Flora Surveys

Species-credit flora surveys were undertaken over 21 days and four survey periods, being:

- 15 – 16 October 2014
- 11 – 21 January 2016
- 2 – 5 May 2016
- 1 – 2 June 2016.

A preliminary list of species-credit flora species with potential to occur in the Development Site was generated during the literature review, completion of database searches, review of the Attachment B of the SEARs (refer to **Section 1.3**) and the TSPD. Searches of the TSPD were undertaken by the applicable IBRA subregions (Lower Slopes and Bogan-Macquarie) and CMA regions (Lachlan and Central West).

**Table 2.3** identifies the species-credit flora species that were determined to potentially occur in the Development Site and therefore require targeted and seasonal surveys.

Targeted surveys were undertaken for the species listed in **Table 2.3** and included targeted on-ground searches in suitable habitat throughout the Development Site. Searches for these species were undertaken in suitable habitat along numerous walking meandering transects and within the plot/transect surveys. These generally involved walking suitable habitat areas and searching for the targeted species between the rail tracks and the fences marking the edge of the corridor. Where there were no fences, surveys were undertaken up to 30 metres either side of the tracks, or wider where required by the Development Footprint. The seasonal survey requirements for all species-credit flora species with the potential to occur within the Development Site were met during the October 2014, January 2016 and May 2016 survey periods.

**Table 2.3 Species-credit Flora Species Requiring Targeted Survey**

| Common Name<br>*Scientific Name* | TSC Status | EPBC Status | Location by CMA/IBRA Subregion and KP | | | Required Survey Period^ | Survey Technique, Timing and Location |
|---|---|---|---|---|---|---|---|
| | | | **Assessment 1**<br>Lachlan CMA<br>Lower Slopes IBRA Subregion<br>KP 449– 466.5 | **Assessment 2**<br>Central West CMA<br>Lower Slopes IBRA Subregion<br>KP 466– 509 | **Assessment 3**<br>Central West CMA<br>Bogan Macquarie IBRA Subregion<br>KP 508.5– 555.5 | | |
| *Austrostipa wakoolica* | E | E | ✓ | ✓ | × | September - December | Targeted threatened flora searches in suitable habitat undertaken in October 2014 throughout the Development Site.<br>Opportunistic observations undertaken throughout all Umwelt survey periods. |
| *Austrostipa metatoris* | V | V | ✓ | × | × | All year | Targeted threatened flora searches in suitable habitat undertaken in October 2014, January 2016 and May 2016 throughout the Development Site.<br>Opportunistic observations undertaken throughout all Umwelt survey periods. |

| Common Name<br>*Scientific Name* | TSC Status | EPBC Status | Location by CMA/IBRA Subregion and KP | | | Required Survey Period^ | Survey Technique, Timing and Location |
|---|---|---|---|---|---|---|---|
| | | | **Assessment 1**<br>Lachlan CMA<br>Lower Slopes IBRA Subregion<br>KP 449– 466.5 | **Assessment 2**<br>Central West CMA<br>Lower Slopes IBRA Subregion<br>KP 466– 509 | **Assessment 3**<br>Central West CMA<br>Bogan Macquarie IBRA Subregion<br>KP 508.5– 555.5 | | |
| bluegrass<br>*Dichanthium setosum* | V | V | × | × | ✓ | December - May | Targeted threatened flora searches in suitable habitat undertaken in January 2016 and May 2016 throughout the Development Site.<br>Opportunistic observations undertaken throughout all Umwelt survey periods. |
| pine donkey orchid<br>*Diuris tricolor* | V | - | ✓ | ✓ | ✓ | September - October | Targeted threatened flora searches in suitable habitat undertaken in October 2014 throughout the Development Site.<br>Opportunistic observations undertaken throughout all Umwelt survey periods. |

| Common Name<br>*Scientific Name* | TSC Status | EPBC Status | Location by CMA/IBRA Subregion and KP | | | Required Survey Period^ | Survey Technique, Timing and Location |
|---|---|---|---|---|---|---|---|
| | | | **Assessment 1**<br>Lachlan CMA<br>Lower Slopes IBRA Subregion<br>KP 449– 466.5 | **Assessment 2**<br>Central West CMA<br>Lower Slopes IBRA Subregion<br>KP 466– 509 | **Assessment 3**<br>Central West CMA<br>Bogan Macquarie IBRA Subregion<br>KP 508.5– 555.5 | | |
| spike-rush<br>*Eleocharis obicis* | V | V | ✓ | ✓ | × | All year | Targeted threatened flora searches in suitable habitat undertaken in October 2014, January 2016 and May 2016 throughout the Development Site.<br>Opportunistic observations undertaken throughout all Umwelt survey periods. |
| spiny peppercress<br>*Lepidium aschersonii* | V | V | ✓ | ✓ | × | September - May | Targeted threatened flora searches in suitable habitat undertaken in October 2014, January 2016 and May 2016 throughout the Development Site.<br>Opportunistic observations undertaken throughout all Umwelt survey periods. |

| Common Name<br>*Scientific Name* | TSC Status | EPBC Status | Location by CMA/IBRA Subregion and KP | | | Required Survey Period^ | Survey Technique, Timing and Location |
|---|---|---|---|---|---|---|---|
| | | | **Assessment 1**<br>Lachlan CMA<br>Lower Slopes IBRA Subregion<br>KP 449– 466.5 | **Assessment 2**<br>Central West CMA<br>Lower Slopes IBRA Subregion<br>KP 466– 509 | **Assessment 3**<br>Central West CMA<br>Bogan Macquarie IBRA Subregion<br>KP 508.5– 555.5 | | |
| winged peppercress<br>*Lepidium monoplocoides* | E | E | ✓ | ✓ | × | November - February | Targeted threatened flora searches in suitable habitat undertaken in January 2016 throughout the Development Site.<br>Opportunistic observations undertaken throughout all Umwelt survey periods. |
| hoary sunray<br>*Leucochrysum albicans* var. *tricolor* | - | E | ✓ | ✓ | ✓ | All year | Targeted threatened flora searches in suitable habitat undertaken in October 2014, January 2016 and May 2016 throughout the Development Site.<br>Opportunistic observations undertaken throughout all Umwelt survey periods. |

| Common Name<br>*Scientific Name* | TSC Status | EPBC Status | Location by CMA/IBRA Subregion and KP | | | Required Survey Period^ | Survey Technique, Timing and Location |
|---|---|---|---|---|---|---|---|
| | | | **Assessment 1**<br>Lachlan CMA<br>Lower Slopes IBRA Subregion<br>KP 449– 466.5 | **Assessment 2**<br>Central West CMA<br>Lower Slopes IBRA Subregion<br>KP 466– 509 | **Assessment 3**<br>Central West CMA<br>Bogan Macquarie IBRA Subregion<br>KP 508.5– 555.5 | | |
| Austral pillwort<br>*Pilularia novae-hollandiae* | E | - | ✓ | ✓ | × | All year | Targeted threatened flora searches in suitable habitat undertaken in October 2014, January 2016 and May 2016 throughout the Development Site.<br>Opportunistic observations undertaken throughout all Umwelt survey periods. |
| slender darling-pea<br>*Swainsona murrayana* | V | V | ✓ | ✓ | ✓ | September - February | Targeted threatened flora searches in suitable habitat undertaken in October 2014 and January 2016 throughout the Development Site.<br>Opportunistic observations undertaken throughout all Umwelt survey periods. |

| Common Name<br>*Scientific Name* | TSC Status | EPBC Status | Location by CMA/IBRA Subregion and KP | | | Required Survey Period^ | Survey Technique, Timing and Location |
|---|---|---|---|---|---|---|---|
| | | | **Assessment 1**<br>Lachlan CMA<br>Lower Slopes IBRA Subregion<br>KP 449– 466.5 | **Assessment 2**<br>Central West CMA<br>Lower Slopes IBRA Subregion<br>KP 466– 509 | **Assessment 3**<br>Central West CMA<br>Bogan Macquarie IBRA Subregion<br>KP 508.5– 555.5 | | |
| small purple-pea<br>*Swainsona recta* | E | E | × | × | ✓ | September – October (Lachlan CMA)<br>September – November (Central West CMA) | Targeted threatened flora searches in suitable habitat undertaken in October 2014 throughout the Development Site.<br>Opportunistic observations undertaken throughout all Umwelt survey periods. |
| silky Swainson-pea<br>*Swainsona sericea* | V | - | ✓ | × | × | September - December | Targeted threatened flora searches in suitable habitat undertaken in October 2014 throughout the Development Site.<br>Opportunistic observations undertaken throughout all Umwelt survey periods. |

| Common Name<br>*Scientific Name* | TSC Status | EPBC Status | Location by CMA/IBRA Subregion and KP | | | Required Survey Period^ | Survey Technique, Timing and Location |
|---|---|---|---|---|---|---|---|
| | | | **Assessment 1**<br>Lachlan CMA<br>Lower Slopes IBRA Subregion<br>KP 449– 466.5 | **Assessment 2**<br>Central West CMA<br>Lower Slopes IBRA Subregion<br>KP 466– 509 | **Assessment 3**<br>Central West CMA<br>Bogan Macquarie IBRA Subregion<br>KP 508.5– 555.5 | | |
| red darling pea<br>*Swainsona plagiotropis* | V | V | × | × | ✓ | August - September | While targeted threatened flora searches were undertaken outside the required survey period for the species as per the TSPD, the species is known to flower in September and October with fruiting occurring by late November (Tonkinson and Robertson 2010).<br>Targeted threatened flora searches in suitable habitat were undertaken in October 2014 throughout the Development Site and it is considered that this species would have been detectable at this time.<br>Opportunistic observations were also undertaken throughout all Umwelt survey periods. |

| Common Name<br>*Scientific Name* | TSC Status | EPBC Status | Location by CMA/IBRA Subregion and KP | | | Required Survey Period^ | Survey Technique, Timing and Location |
|---|---|---|---|---|---|---|---|
| | | | **Assessment 1**<br>Lachlan CMA<br>Lower Slopes IBRA Subregion<br>KP 449– 466.5 | **Assessment 2**<br>Central West CMA<br>Lower Slopes IBRA Subregion<br>KP 466– 509 | **Assessment 3**<br>Central West CMA<br>Bogan Macquarie IBRA Subregion<br>KP 508.5– 555.5 | | |
| Ausfeld's wattle<br>*Acacia ausfeldii* | V | - | ✓ | × | × | August-October | Targeted threatened flora searches in suitable habitat undertaken in October 2014 throughout the Development Site.<br>Opportunistic observations undertaken throughout all Umwelt survey periods. |
| *Tylophora linearis* | V | E | ✓ | ✓ | × | September - May | Targeted threatened flora searches in suitable habitat undertaken in October 2014, January 2016 and May 2016 throughout the Development Site.<br>Opportunistic observations undertaken throughout all Umwelt survey periods. |

^ Months that surveys are required according to the Threatened Species Profile Database for the Lachlan and/or Central West CMA (searched May 2016).

### 2.4.3 Species-credit Fauna Surveys

Species-credit fauna surveys were undertaken over 13 days and two survey periods, being:

- 27 – 31 July 2015 and
- 28 November – 5 December 2015.

A preliminary list of species-credit fauna species with potential to occur in the Development Site was generated during the literature review, completion of database searches and review of the TSPD. Searches of the TSPD were undertaken by the applicable IBRA subregions (Lower Slopes and Bogan-Macquarie) and CMA regions (Lachlan and Central West).

**Table 2.4** identifies the species-credit fauna species that were considered to potentially occur in the Development Site and that required targeted surveys. Further, while the swift parrot is classified as an ecosystem-credit species that does not require targeted survey in accordance with the FBA, targeted surveys for this species were undertaken within the Development Site due to its co-listing as a threatened species under the EPBC Act. Survey techniques, timing and location are as per the description for the regent honeyeater.

Targeted surveys were undertaken for the species listed in **Table 2.4** and included a range of survey techniques including targeted searches, Anabat recorders, call playback and spotlighting. During the survey period, opportunistic sightings and bird calls of targeted species were also noted during walking or travelling through a site in a hi-rail vehicle (i.e. on the rail line). The seasonal survey requirements for all species-credit fauna species with the potential to occur within the Development Site were met during the July, November and December 2015 survey periods. The details of the targeted surveys are discussed in **Sections 2.4.3.1** to **2.4.3.11** below and specific survey locations are shown on Figures A1-A36 of **Appendix A**.

**Table 2.4 Species-credit Fauna Species Requiring Targeted Survey**

| Common Name<br>*Scientific Name* | TSC Status | EPBC Status | Location by CMA/IBRA Subregion and KP | | | Required Survey Period^ | Survey Technique, Timing and Location |
|---|---|---|---|---|---|---|---|
| | | | **Assessment 1**<br>Lachlan CMA<br>Lower Slopes IBRA Subregion<br>KP 449– 466.5 | **Assessment 2**<br>Central West CMA<br>Lower Slopes IBRA Subregion<br>KP 466– 509 | **Assessment 3**<br>Central West CMA<br>Bogan Macquarie IBRA Subregion<br>KP 508.5– 555.5 | | |
| pale-headed snake<br>*Hoplocephalus bitorquatus* | V | - | × | × | ✓ | October – April | Spotlighting surveys in suitable habitat undertaken in November-December 2015 at sites 3, 4, 5, 5a, 6 and 7.<br>Opportunistic observations undertaken throughout all Umwelt survey periods.<br>Refer to **Section 2.4.3.1** for further detail. |
| cotton pygmy-goose<br>*Nettapus coromandelianus* | E | - | × | × | ✓ | All year | Diurnal bird surveys undertaken in November-December 2015 at sites 5a, 6 and 7.<br>Opportunistic observations undertaken throughout all Umwelt survey periods.<br>Refer to **Section 2.4.3.2** for further detail. |

| Common Name<br>*Scientific Name* | TSC Status | EPBC Status | Location by CMA/IBRA Subregion and KP | | | Required Survey Period^ | Survey Technique, Timing and Location |
|---|---|---|---|---|---|---|---|
| | | | **Assessment 1**<br>Lachlan CMA<br>Lower Slopes IBRA Subregion<br>KP 449– 466.5 | **Assessment 2**<br>Central West CMA<br>Lower Slopes IBRA Subregion<br>KP 466– 509 | **Assessment 3**<br>Central West CMA<br>Bogan Macquarie IBRA Subregion<br>KP 508.5– 555.5 | | |
| black-necked stork<br>*Ephippiorhynchus asiaticus* | E | - | × | × | ✓ | All year | Diurnal bird surveys undertaken in November-December 2015 at sites 5a, 6 and 7.<br>Opportunistic observations undertaken throughout all Umwelt survey periods.<br>Refer to **Section 2.4.3.2** for further detail. |
| Australasian bittern<br>*Botaurus poiciloptilus* | E | E | × | × | ✓ | All year | Opportunistic observations undertaken throughout all Umwelt survey periods.<br>No suitable habitat identified within the Development Site for targeted surveys.<br>Refer to **Section 2.4.3.3** for further detail. |

| Common Name<br>*Scientific Name* | TSC Status | EPBC Status | Location by CMA/IBRA Subregion and KP | | | Required Survey Period^ | Survey Technique, Timing and Location |
|---|---|---|---|---|---|---|---|
| | | | **Assessment 1**<br>Lachlan CMA<br>Lower Slopes IBRA Subregion<br>KP 449– 466.5 | **Assessment 2**<br>Central West CMA<br>Lower Slopes IBRA Subregion<br>KP 466– 509 | **Assessment 3**<br>Central West CMA<br>Bogan Macquarie IBRA Subregion<br>KP 508.5– 555.5 | | |
| black-breasted buzzard<br>*Hamirostra melanosternon* | V | - | × | × | ✓ | All year | Diurnal bird surveys undertaken in November-December 2015 at sites 5a, 6 and 7.<br>Opportunistic observations throughout the survey.<br>Refer to **Section 2.4.3.2** for further detail. |
| red-backed button-quail<br>*Turnix maculosus* | V | - | × | × | ✓ | All year | Diurnal bird surveys undertaken in November-December 2015 at sites 5a, 6 and 7.<br>Opportunistic observations undertaken throughout all Umwelt survey periods.<br>Refer to **Section 2.4.3.2** for further detail. |

| Common Name<br>*Scientific Name* | TSC Status | EPBC Status | Location by CMA/IBRA Subregion and KP | | | Required Survey Period^ | Survey Technique, Timing and Location |
|---|---|---|---|---|---|---|---|
| | | | **Assessment 1**<br>Lachlan CMA<br>Lower Slopes IBRA Subregion<br>KP 449– 466.5 | **Assessment 2**<br>Central West CMA<br>Lower Slopes IBRA Subregion<br>KP 466– 509 | **Assessment 3**<br>Central West CMA<br>Bogan Macquarie IBRA Subregion<br>KP 508.5– 555.5 | | |
| grey falcon<br>*Falco hypoleucos* | E | - | × | ✓ | ✓ | All year | Diurnal bird surveys undertaken in November-December 2015 at sites 3, 4, 5, 5a, 6 and 7.<br>Opportunistic observations undertaken throughout all Umwelt survey periods.<br>Refer to **Section 2.4.3.2** for further detail. |
| barking owl<br>*Ninox connivens*<br>(breeding habitat only) | V | - | × | ✓ | ✓ | September – December | Call playback, spotlighting and stag/hollow watching surveys undertaken in November-December 2015 at sites 3, 4, 5, 5a, 6 and 7.<br>Opportunistic observations undertaken throughout all Umwelt survey periods.<br>Refer to **Section 2.4.3.4** for further detail. |

| Common Name<br>*Scientific Name* | TSC Status | EPBC Status | Location by CMA/IBRA Subregion and KP | | | Required Survey Period^ | Survey Technique, Timing and Location |
|---|---|---|---|---|---|---|---|
| | | | **Assessment 1**<br>Lachlan CMA<br>Lower Slopes IBRA Subregion<br>KP 449– 466.5 | **Assessment 2**<br>Central West CMA<br>Lower Slopes IBRA Subregion<br>KP 466– 509 | **Assessment 3**<br>Central West CMA<br>Bogan Macquarie IBRA Subregion<br>KP 508.5– 555.5 | | |
| superb parrot<br>*Polytelis swainsonii*<br>(breeding habitat only) | V | V | ✓ | ✓ | ✓ | September – December | Diurnal bird surveys undertaken in November-December 2015 at sites 3, 4, 5, 5a, 6 and 7.<br>Tree hollows were recorded on a GPS and hollows that could potentially provide suitable habitat were watched for activity across all survey sites.<br>Opportunistic observations undertaken throughout all Umwelt survey periods.<br>Refer to **Section 2.4.3.5** for further detail. |

| Common Name<br>*Scientific Name* | TSC Status | EPBC Status | Location by CMA/IBRA Subregion and KP | | | Required Survey Period^ | Survey Technique, Timing and Location |
|---|---|---|---|---|---|---|---|
| | | | **Assessment 1**<br>Lachlan CMA<br>Lower Slopes IBRA Subregion<br>KP 449– 466.5 | **Assessment 2**<br>Central West CMA<br>Lower Slopes IBRA Subregion<br>KP 466– 509 | **Assessment 3**<br>Central West CMA<br>Bogan Macquarie IBRA Subregion<br>KP 508.5– 555.5 | | |
| brush-tailed phascogale<br>*Phascogale tapoatafa* | V | - | × | × | ✓ | All year | Spotlighting surveys in suitable habitat undertaken in November-December 2015 at sites 5a, 6 and 7.<br>Opportunistic observations undertaken throughout all Umwelt survey periods.<br>Refer to **Section 2.4.3.6** for further detail. |
| eastern pygmy possum<br>*Cercartetus nanus* | V | - | × | ✓ | ✓ | September – April | Spotlighting surveys in suitable habitat undertaken in November-December 2015 at sites 3, 4, 5, 5a, 6 and 7.<br>Opportunistic observations undertaken throughout all Umwelt survey periods.<br>Refer to **Section 2.4.3.6** for further detail. |

| Common Name<br>*Scientific Name* | TSC Status | EPBC Status | Location by CMA/IBRA Subregion and KP | | | Required Survey Period^ | Survey Technique, Timing and Location |
|---|---|---|---|---|---|---|---|
| | | | **Assessment 1**<br>Lachlan CMA<br>Lower Slopes IBRA Subregion<br>KP 449– 466.5 | **Assessment 2**<br>Central West CMA<br>Lower Slopes IBRA Subregion<br>KP 466– 509 | **Assessment 3**<br>Central West CMA<br>Bogan Macquarie IBRA Subregion<br>KP 508.5– 555.5 | | |
| squirrel glider<br>*Petaurus norfolcensis* | V | - | × | ✓ | × | All year | Spotlighting surveys in suitable habitat undertaken in November-December 2015 at sites 3, 4, 5, 5a, 6 and 7.<br>Opportunistic observations undertaken throughout all Umwelt survey periods.<br>Refer to **Section 2.4.3.6** for further detail. |

| Common Name<br>*Scientific Name* | TSC Status | EPBC Status | Location by CMA/IBRA Subregion and KP | | | Required Survey Period^ | Survey Technique, Timing and Location |
|---|---|---|---|---|---|---|---|
| | | | **Assessment 1**<br>Lachlan CMA<br>Lower Slopes IBRA Subregion<br>KP 449– 466.5 | **Assessment 2**<br>Central West CMA<br>Lower Slopes IBRA Subregion<br>KP 466– 509 | **Assessment 3**<br>Central West CMA<br>Bogan Macquarie IBRA Subregion<br>KP 508.5– 555.5 | | |
| koala<br>*Phascolarctos cinereus* | V | V | ✓ | ✓ | ✓ | All year | Spotlighting surveys in suitable habitat undertaken in November-December 2015 at sites 1, 2, 3, 5, 5a, 6 and 7.<br>Spot Assessment Technique (SAT) surveys in suitable habitat undertaken in November-December 2015 at sites 1, 2, 3, 5, 5a, 6 and 7.<br>Opportunistic observations undertaken throughout all Umwelt survey periods.<br>Refer to **Section 2.4.3.7** for further detail. |

| Common Name<br>*Scientific Name* | TSC Status | EPBC Status | Location by CMA/IBRA Subregion and KP | | | Required Survey Period^ | Survey Technique, Timing and Location |
|---|---|---|---|---|---|---|---|
| | | | **Assessment 1**<br>Lachlan CMA<br>Lower Slopes IBRA Subregion<br>KP 449– 466.5 | **Assessment 2**<br>Central West CMA<br>Lower Slopes IBRA Subregion<br>KP 466– 509 | **Assessment 3**<br>Central West CMA<br>Bogan Macquarie IBRA Subregion<br>KP 508.5– 555.5 | | |
| grey-headed flying-fox<br>*Pteropus poliocephalus* | | | × | ✓ | ✓ | September – April | Spotlighting surveys in suitable habitat undertaken in November-December 2015 at sites 3, 4, 5, 5a, 6 and 7.<br>Opportunistic observations undertaken throughout all Umwelt survey periods.<br>Refer to **Section 2.4.3.8** for further detail. |
| large-eared pied bat<br>*Chalinolobus dwyeri*<br>(breeding habitat only) | V | V | × | ✓ | × | September - April | Echolocation surveys using SD1 Anabat Recorders undertaken in November-December 2015 at sites 3, 4 and 5.<br>Refer to **Section 2.4.3.9** for further detail. |

| Common Name<br>*Scientific Name* | TSC Status | EPBC Status | Location by CMA/IBRA Subregion and KP | | | Required Survey Period^ | Survey Technique, Timing and Location |
|---|---|---|---|---|---|---|---|
| | | | **Assessment 1**<br>Lachlan CMA<br>Lower Slopes IBRA Subregion<br>KP 449– 466.5 | **Assessment 2**<br>Central West CMA<br>Lower Slopes IBRA Subregion<br>KP 466– 509 | **Assessment 3**<br>Central West CMA<br>Bogan Macquarie IBRA Subregion<br>KP 508.5– 555.5 | | |
| Sloane's froglet<br>*Crinia sloanei* | V | - | ✓ | ✓ | ✓ | June-August | Targeted diurnal searches in July 2015 in suitable habitat across 51 locations across the Development Site.<br>Spotlighting and call playback surveys undertaken in July 2015 in suitable habitat across 19 locations across the Development Site.<br>Opportunistic observations undertaken throughout all Umwelt survey periods.<br>Refer to **Section 2.4.3.10** for further detail. |

| Common Name<br>*Scientific Name* | TSC Status | EPBC Status | Location by CMA/IBRA Subregion and KP | | | Required Survey Period^ | Survey Technique, Timing and Location |
|---|---|---|---|---|---|---|---|
| | | | **Assessment 1**<br>Lachlan CMA<br>Lower Slopes IBRA Subregion<br>KP 449– 466.5 | **Assessment 2**<br>Central West CMA<br>Lower Slopes IBRA Subregion<br>KP 466– 509 | **Assessment 3**<br>Central West CMA<br>Bogan Macquarie IBRA Subregion<br>KP 508.5– 555.5 | | |
| regent honeyeater<br>*Anthochaera phrygia* | CE | CE | ✓ | × | × | All year | Targeted call playback and bird surveys in July 2015 at sites 1 and 2.<br>Opportunistic observations undertaken throughout all Umwelt survey periods.<br>Refer to **Section 2.4.3.11** for further detail. |

^ Months that surveys are required according to the Threatened Species Profile Database for the Lachlan and/or Central West CMA (searched May 2016).

#### 2.4.3.1 Pale-headed Snake Surveys

The pale-headed snake was targeted by conducting nocturnal spotlighting surveys over two nights for up to 30 minutes or the entire survey site, whichever occurred first, in November and December 2015. Both the ground and trees were searched for the presence of this species focusing on potential suitable habitat in live and dead trees, under loose bark, and fallen timber. Spotlighting was completed using 30 watt Lightforce hand-held spotlights and head torch. Spotlighting was undertaken generally between 9.00 pm and 2.00 am, commencing approximately one hour after dusk. In addition, opportunistic spotlighting was undertaken from a slow-moving hi-rail vehicle while travelling between fauna survey locations at night.

Spotlighting surveys targeting pale-headed snake were conducted at Sites 3, 4, 5, 5a, 6 and 7 within the Development Site (refer to Figures A8, A12, A17, A26, A34 and A36 **Appendix A**).

Opportunistic observations were also recorded throughout the survey period.

#### 2.4.3.2 Diurnal Bird Surveys for the Cotton Pygmy-goose, Black-necked Stork, Black-breasted Buzzard, Red-backed Button-quail and Grey Falcon

Diurnal bird surveys were conducted for cotton pygmy-goose, black-necked stork, black-breasted buzzard and red-backed button-quail and grey falcon on two separate days across each of the survey sites in November and December 2015. Bird surveys were conducted at various times of the day, primarily early to mid-morning and mid to late afternoon. Surveys targeted likely habitat for each species such as aerial observations for birds of prey (grey falcon and black-breasted buzzard) and wetland habitats for waterfowl (cotton pygmy goose, black-necked stork). Each survey consisted of a slow walking transect within the survey site for 20 minutes.

Diurnal bird surveys were undertaken for cotton pygmy-goose, black-necked stork, black-breasted buzzard and red-backed button-quail at Sites 5a, 6 and 7 within the Development Site. Grey falcon surveys were undertaken at Sites 3, 4, 5, 5a, 6 and 7 (refer to Figures A8, A12, A17, A26, A34 and A36 in **Appendix A**).

Bird species were identified from characteristic calls and by observation using binoculars with magnification up to 10x. Opportunistic observations were also recorded throughout the survey period.

#### 2.4.3.3 Australasian Bittern Survey

Due to the specific habitat requirements of the Australasian bittern (emergent aquatic vegetation such as *Phragmites*, *Typha*, *Eleocharis* in freshwater and brackish wetlands), only one site was identified from aerial photographic interpretation to be surveyed, being Site 7. However, at the time of the survey in November and December 2015, due to the lack of reedy vegetation present at this site, no potential habit was identified and no targeted survey was conducted.

Opportunistic observations were also recorded throughout the survey period.

#### 2.4.3.4 Barking Owl Breeding Habitat Surveys

The barking owl is a species-credit species for breeding habitat only in the Central West CMA (KP 446 km – 555.5 km). It is an ecosystem-credit species in the Lachlan CMA where the remainder of the Development Site occurs. For the barking owl, breeding habitat includes living or dead trees with hollows of more than 20 cm in diameter that are located more than 4 metres above the ground. This habitat was surveyed by undertaking targeted hollow tree surveys across the Development Site in November and December 2015. Any suitable trees that were located were marked as a GPS waypoint, and the number of hollows and tree species recorded along with a photo of the tree. Selected stag trees were watched at twilight for any owl

activity. Nocturnal spotlighting for owls was conducted over two nights for up to 30 minutes or the entire survey site, whichever occurred first. In addition, call playback for the barking owl was undertaken for five minutes at each site prior to spotlighting. Spotlighting was either completed on foot and/or from the hi-rail vehicle depending on the size of the site using 30 watt Lightforce hand-held spotlights and head torch. Spotlighting was undertaken generally between 9.00 pm and 2.00 am, commencing approximately one hour after dusk. In addition, opportunistic spotlighting was undertaken from a slow-moving hi-rail vehicle while travelling between fauna survey locations at night.

Specific barking owl breeding habitat surveys were conducted at Sites 3, 4, 5, 5a, 6 and 7 (refer to Figures A8, A12, A17, A26, A34 and A36 in **Appendix A**). Opportunistic observations were also recorded throughout the survey period.

#### 2.4.3.5 Superb Parrot Breeding Habitat Surveys

The superb parrot is a species-credit species for breeding habitat only in both the Lachlan and Central West CMAs. Breeding habitat for the superb parrot includes hollows more than 60 mm in diameter that are located more than 4 metres above ground. This habitat was surveyed by undertaking targeted hollow tree surveys across the Development Site in November and December 2015. Any suitable trees that were located were marked as a GPS waypoint, and the number of hollows and tree species were recorded along with a photo of the tree. Selected suitable habitat trees were watched for at least an hour, in the morning where possible for any superb parrot activity.

Superb parrot breeding habitat surveys were conducted at Sites 1, 2, 3, 4, 5, 5a, 6 and 7 (refer to Figures A4, A6, A8, A12, A17, A26, A34 and A36 in **Appendix A**). Any additional trees that were not located within the survey site but were within the Development Site were also surveyed.

Opportunistic observations were also recorded throughout the survey period.

#### 2.4.3.6 Brush-tailed Phascogale, Eastern Pygmy Possum and Squirrel Glider Surveys

Nocturnal spotlighting searches for brush-tailed phascogale, eastern pygmy possum and squirrel glider were conducted over two nights for up to 30 minutes or the entire survey site, whichever occurred first in November and December 2015. Spotlighting was either completed on foot and/or from the hi-rail vehicle depending on the size of the site using 30 watt Lightforce hand-held spotlights and head torch. Spotlighting was undertaken generally between 9.00 pm and 2.00 am, commencing approximately one hour after dusk. In addition, opportunistic spotlighting was undertaken from a slow-moving hi-rail vehicle while travelling between fauna survey locations at night.

Spotlighting surveys for the eastern pygmy possum and squirrel glider were conducted at Sites 3, 4, 5, 5a, 6 and 7. While the brush-tailed phascogale was surveyed at Sites 5a, 6 and 7 (refer to Figures A8, A12, A17, A26, A34 and A36 in **Appendix A**).

Opportunistic observations were also recorded throughout the survey period.

#### 2.4.3.7 Koala Surveys

The koala was targeted by undertaking spot assessment technique (SAT) and nocturnal spotlighting in November and December 2015. The koala SAT was undertaken in eucalypt dominated sites only as per the technique outlined in Phillips and Callaghan (2011). If a scat or koala was located a GPS location, photo and sex of the individual was recorded (where applicable). Koala SAT surveys were conducted at all fauna survey sites except Site 4 due to no trees occurring within the Development Site at this site (refer to Figures A4, A6, A8, A17, A26, A34 and A36 in **Appendix A**).

Nocturnal spotlighting searches for the koala were conducted over two nights for up to 30 minutes or the entire survey site, whichever occurred first. Spotlighting was either completed on foot and/or from the hi-rail vehicle depending on the size of the site using 30 watt Lightforce hand-held spotlights and head torch. Spotlighting was undertaken generally between 9.00 pm and 2.00 am, commencing approximately one hour after dusk. In addition, opportunistic spotlighting was undertaken from a slow-moving hi-rail vehicle while travelling between fauna survey locations at night. Spotlighting surveys for koala were conducted at all sites except Site 4 due to no trees occurring within the Development Site boundary at this site (refer to Figures A4, A6, A8, A17, A26, A34 and A36 in **Appendix A**).

Opportunistic observations were also recorded throughout the survey period.

#### 2.4.3.8 Grey-headed Flying-fox Survey

The grey-headed flying-fox was targeted using nocturnal spotlighting surveys in November and December 2015. Spotlighting for this species was conducted over two nights for up to 30 minutes or the entire survey site, whichever occurred first. Spotlighting was either completed on foot and/or from the hi-rail vehicle depending on the size of the site using 30 watt Lightforce hand-held spotlights and head torch. Spotlighting was undertaken generally between 9.00 pm and 2.00 am, commencing approximately one hour after dusk. In addition, opportunistic spotlighting was undertaken from a slow-moving hi-rail vehicle while travelling between fauna survey locations at night.

The grey-headed flying-fox surveys were conducted at Sites 3, 4, 5, 5a, 6 and 7 (refer to Figures A8, A12, A17, A26 and A36 in **Appendix A**).

Opportunistic observations were also recorded throughout the survey period.

#### 2.4.3.9 Large-eared Pied Bat Breeding Habitat Surveys

The large-eared pied bat is a species-credit species for breeding habitat only in the Central West CMA (KP 446 km – 555.5 km). The species was targeted by undertaking echolocation surveys using Anabat SD1 recorders in November and December 2015. At each site, the Anabat was positioned at an approximate 30 degree angle one metre above the ground in waterproof housing. Each detector was positioned towards potential micro-bat flight paths or over waterbodies to increase the likelihood of detecting micro-bat species. The Anabat was programmed to start recording from one hour before sunset to one hour after sunrise for at least two nights per site. Area searches for potential breeding habitat which comprises sandstone caves was also undertaken within the Development Site.

As part of the ecological constraint investigation, targeted inspections of timber, steel and concrete bridges were undertaken in September 2014 (Umwelt 2014). Inspections included using a head torch to check any cavities and expansion joints for fauna species and an Anabat was used to record the echolocation calls of micro-bats. The Anabat was directed at cavities within the bridges and set to record after lightly knocking the bridge structure to elicit a response from any potential micro-bat species.

All micro-bat species Anabat recordings were identified by Anna McConville of Echo Ecology Pty Limited (a recognised expert in the identification of micro-bat calls). Each call sequence (‘pass’) was assigned to one of five categories, according to the confidence with which an identification could be made, being definite, probable, possible, species group or unknown. For the purposes of this assessment, definite and probable levels of confidence were treated as positive identifications. All species recorded as Possible during call analysis were also considered as probable in accordance with the precautionary principle.

Anabat recorders were set at Sites 3, 4 and 5 (refer to Figures A8, A12 and A17 in **Appendix A**).

#### 2.4.3.10 Sloane's Froglet Surveys

Diurnal searches for Sloane's froglet were conducted in 51 locations across the Development Site in July 2015 targeting land within 50 metres of ephemeral wetlands or periodically inundated areas within grasslands and disturbed environments. During the search, likely micro-habitats were examined including around waterbodies, beneath rocks, around culverts, and areas of inundation. Each survey consisted of approximately 15-30 minutes for one person, depending on the size and complexity of the habitat.

Nocturnal spotlighting surveys, each consisting of 30 minute person hours over one night, were also undertaken in 19 locations across the Development Site. Each survey consisted of a 5 minute period of call playback for the species followed by 25 minutes of spotlighting. Spotlighting was conducted on foot using a head torch. Spotlighting was undertaken generally between 6:00 pm and 1:00 am, commencing approximately one hour after dusk and targeted relevant habitat features identified during the diurnal surveys, such as farm dams, riparian zones, culverts and areas of inundation.

Opportunistic observations were also recorded throughout the survey period.

#### 2.4.3.11 Regent Honeyeater Surveys

Targeted regent honeyeater surveys were undertaken across two days in July 2015. Each survey consisted of a 5 minute period of call playback for the species followed by 20 minutes of searching, which consisted of a slow walking transect within a two hectare area within suitable vegetation types. Surveys were undertaken during early to mid-morning and mid to late afternoon. Bird species were identified from characteristic calls and by observation using binoculars with magnification up to 10 x.

Targeted regent honeyeater surveys were undertaken at Sites 1 and 2 (refer to Figures A4 and A6 in **Appendix A**).

Diurnal bird surveys were undertaken at each fauna survey site within the Development Site and searches for the this species were also undertaken, despite the November and December 2015 and January 2016 surveys being outside the period that the species is likely to occur in the Development Site. Diurnal bird surveys were undertaken at sites, 1, 2, 3, 4, 5, 5a, 6 and 7 (refer to Figures A4, A6, A8, A12, A17, A26, A34 and A36 in **Appendix A**).

Bird species were identified from characteristic calls and by observation using binoculars with magnification up to 10x. Opportunistic observations were also recorded throughout the survey period.

Opportunistic observations were also recorded throughout the survey period.

# 3.0 Results

## 3.1 Landscape Value

As outlined in **Section 2.1**, while the FBA Assessment has been split into three assessments to cover the different CMAs and IBRA subregions, the landscape assessment was undertaken holistically across the entire Development Site as per consultation with OEH.

### 3.1.1 Landscape Features

The 550 metre buffer area from the centre line of the Development Site contains some prominent landscape features including 5th order streams and a range of Mitchell landscapes. This area also covers multiple IBRA Bioregions, IBRA Subregions and CMAs.

Landscape features that were included in the determination of the connectivity value scores for the Development Site are outlined in **Table 3.1** below.

**Table 3.1 Landscape Features in the Development Site**

| Landscape Feature | Development Site |
|---|---|
| **Mitchell Landscapes** | Bimbi Plains<br>Bogan Alluvial Plains<br>Boggy Cowal Alluvial Plains<br>Boggy Cowal Channels and Floodplains<br>Goonumbla Hills<br>Narromine Hills |
| **Rivers, Streams, Estuaries** | 5th order streams:<br>• Burrill Creek<br>• Ten Mile Creek<br>• Burrabadine Creek<br>4th order streams:<br>• Bulldog Creek<br>• Gundong Creek<br>• Tomingley Creek<br>• Bradys Cowal<br>• Backwater Cowal |
| **Wetlands** | • Bradys Cowal<br>• Backwater Cowal |
| **Native Vegetation (in buffer area)** | 1002 hectares |
| **Connecting Links** | Regionally Significant Biodiversity Link (refer to **Section 3.1.2.3**). |

## 3.1.2 Landscape Value Scores

### 3.1.2.1 Per cent Native Vegetation Cover

**Table 3.2** details the per cent native woody vegetation cover before and after the proposed disturbance in the Development Footprint and the native vegetation per cent class entered into the BioBanking Calculator as per Table 16 of Appendix 5 of the FBA (OEH 2014a).

**Table 3.2 Native Vegetation Cover in Buffer Area**

| | Pre-Development | | | Post-Development | | |
|---|---|---|---|---|---|---|
| | Area of Native Veg (ha) | Native Veg Cover (%) | Native Veg Per cent Class | Area of Native Veg (ha) | Native Veg Cover (%) | Native Veg Per cent Class |
| Development Site | 1002 | 7.86 | 6-10 | 967 | 7.59 | 6-10 |

### 3.1.2.2 Area to Perimeter Ratio

The area to perimeter ratio for the development site was calculated as 0, in accordance with the FBA methodology (refer to Appendix 5 Assessing Landscape Value for Linear Shaped Developments, or Multiple Fragmentation Impacts).

### 3.1.2.3 Connectivity Value

Determining the connectivity value score is derived from identifying the highest scoring connecting link to be impacted by the proposal as per Table 17 of Appendix 5 of the FBA (OEH 2014a).

The highest connecting links occurring within the Development Site are three 5$^{th}$ order streams being Burrill Creek, Ten Mile Creek and Burrabadine Creek (in Assessment 2), crossing the Development Site at KP 479.5, 493.5 and 503.5, respectively. A range of 4$^{th}$ order streams also occur in the north of the Development Site (in Assessment 3).

No State significant biodiversity links were identified within a plan approved by the Chief Executive of OEH and no 6$^{th}$ order or higher streams or important wetlands occur within the Development Site. The closest 6$^{th}$ order stream, being the Bogan River, occurs approximately 3.5 kilometres to the west of the Development Site near Peak Hill, outside the buffer area.

Details of the connectivity value scores applicable for entry to the BBCC are shown in bold in **Table 3.3** below.

**Table 3.3 Highest Value Connecting Links**

| Highest Category of Connecting Link | Connectivity Score | Definition | Description |
|---|---|---|---|
| **Regionally Significant Biodiversity Link** | **10** | An area identified by the assessor as being part of a regionally significant biodiversity link in a plan approved by the Chief Executive of OEH<br>OR | Not identified |
| | | **A riparian buffer 20m either side of a 4th or 5th order stream**<br>OR | **5th order streams:**<br>• **Burrill Creek**<br>• **Ten Mile Creek**<br>• **Burrabadine Creek**<br>**4th order streams:**<br>• **Bulldog Creek**<br>• **Gundong Creek**<br>• **Tomingley Creek**<br>• **Bradys Cowal**<br>• **Backwater Cowal** |
| | | A riparian buffer 30m around a regionally significant wetland | Not identified |
| | | A riparian buffer 30m around a regionally significant wetland | Not identified |

Note: Connectivity score is based on definition in bold text.

### 3.1.2.4 Patch Size

**Table 3.4** below details the parameters that determined the Patch Size score as per Table 18 of Appendix 5 of the FBA (OEH 2014a).

**Table 3.4 Patch Size Score Parameters**

| Mitchell Landscape | Patch Size | Patch Size Score |
|---|---|---|
| Bimbi Plains | 564.0 | 12.5 |
| Bogan Alluvial Plains | 1001.0 | 12.5 |
| Boggy Cowal Alluvial Plains | 1001.0 | 12.5 |
| Boggy Cowal Channels and Floodplains | 26.0 | 5.0 |
| Goonumbla Hills | 1001.0 | 12.5 |
| Narromine Hills | 1001.0 | 12.5 |

#### 3.1.2.5 Landscape Value Score

The landscape value score for the Development Site is 21.20, as calculated by the BBCC.

## 3.2 Native Vegetation within the Development Site

### 3.2.1 Biometric Vegetation Types and Vegetation Zones

Surveys of the Development Site identified nine PCTs across 15 condition classes being:

- PCT26 (CW205, LA212) Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion
    - *Moderate to Good Condition*
- PCT36 (CW183, LA193) River Red Gum tall to very tall open forest / woodland wetland on rivers on floodplains mainly in the Darling Riverine Plains Bioregion
    - *Moderate to Good Condition*
    - *Low_Regeneration Condition*
- PCT55 (CW104, LA105) Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions
    - *Moderate to Good Condition*
    - *Moderate to Good_DNG Condition*
- PCT70 (CW220, LA223) White Cypress Pine woodland on sandy loams in central NSW wheatbelt
    - *Moderate to Good Condition*
- PCT76 (CW145, LA154) Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions
    - *Moderate to Good Condition*
    - *Moderate to Good_DNG Condition*
- PCT244 (CW172, LA178) Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt)
    - *Moderate to Good Condition*
    - *Moderate to Good_DNG Condition*
- PCT201 (CW138, LA145) Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion
    - *Moderate to Good Condition*

- PCT267 (CW213, LA218) White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion
    - *Moderate to Good Condition*
    - *Moderate to Good_DNG Condition*
- PCT276 (CW226, LA226) Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion
    - *Moderate to Good Condition*
    - *Moderate to Good_DNG Condition*

These PCTs were aligned with types described as part of the VIS Classification Database (OEH 2016c). The PCTs were then categorised into 15 vegetation zones (refer to **Figures A1** to **A36** in **Appendix A**). The composition of these vegetation zones is outlined in **Sections 3.2.1.1** to **3.2.1.15** below and a flora species list for all plots surveyed is included in **Appendix B**.

### 3.2.1.1 Vegetation Zone 1 – CW205, LA212– Weeping Myall Open Woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion – Moderate to Good Condition

| **PCT Name** | **Weeping Myall Open Woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion** | |
|---|---|---|
| **Condition** | **Moderate to Good** | |
| **PCT Number** | 26 |  |
| **BVT Number** | CW205, LA212 | |
| **Formation** | Semi-arid Woodlands (Grassy sub-formation) | |
| **Class** | Riverine Plain Woodlands | |
| **No. Plots/transects** | Three (P13, P23 and P32) | |
| **Total Area in Development Site (ha)** | 3.47 | |
| **General Description** | This vegetation zone occurs as several small remnant or regenerating patches throughout the Development Site predominantly persisting on red-brown clay soils. There is limited connectivity between patches due to the heavily disturbed nature of the rail corridor due to historic clearing, infrastructure maintenance, mowing and weed spraying regimes as well as adjacent land uses. | |
| **Floristic Description** | This community is an open woodland with an upper storey solely dominated by weeping myall (*Acacia pendula*). Some patches also contained mistletoe (*Amyema quandang*), a hemiparasitic native occurring almost exclusively on species of Acacia. The shrub layer is generally absent, except for young suckering weeping myall (*Acacia pendula*) less than 1 metre in height. The understorey is typically sparse and species depauperate, dominated by | |

| PCT Name | Weeping Myall Open Woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion |
|---|---|
| | native grasses, chenopods and forbs. Native grasses include wallaby grasses (*Rytidosperma fulvum*), fairy grass (*Sporobolus caroli*), native millet (*Panicum decompositum*), ringed wallaby grass (*Austrodanthonia caespitosa*), common wheatgrass (*Elymus scaber*) and curly windmill grass (*Enteropogon acicularis*). Chenopods include small-leaf bluebush (*Maireana microphylla*), creeping saltbush (*Atriplex semibaccata*), ruby saltbush (*Enchylaena tomentosa*) and climbing saltbush (*Einadia nutans*). Native forbs generally include *Vittadinia cervicularis*, caustic weed (*Chamaesyce drummondii*) and quena (*Solanum esuriale*). Non-native species occur sporadically and include bearded oats (*Avena barbata*), urochloa grass (*Urochloa panicoides*), paspalum (*Paspalum dilatatum*) and flaxleaf fleabane (*Conyza bonariensis*). |
| **Structure** | Upper – 6-15m/10-40%<br>Midstorey – 1-5m/0-5%<br>Lower – <0.5m/40-60% |
| **TSC Act Status** | This vegetation zone is consistent with the *Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South western Slopes bioregions EEC* listed under the TSC Act (refer to **Appendix D**). |
| **EPBC Act Status** | A total of 0.99 hectares of this vegetation zone is consistent with *Weeping Myall Woodlands* listed as an EEC under the EPBC Act. The remaining 2.48 hectares of this zone does not meet minimum EPBC listing criteria due to small patch sizes in the Development Site (refer to **Appendix D**). |

### 3.2.1.2 Vegetation Zone 2 – CW183, LA193 River Red Gum tall to very tall open forest / woodland wetland on rivers on floodplains mainly in the Darling Riverine Plains Bioregion– Moderate to Good Condition

| PCT Name | River Red Gum tall to very tall open forest / woodland wetland on rivers on floodplains mainly in the Darling Riverine Plains Bioregion | |
|---|---|---|
| **Condition** | **Moderate to Good** | |
| **PCT Number** | 36 |  |
| **BVT Number** | CW183; LA193 | |
| **Formation** | Forested Wetlands | |
| **Class** | Inland Riverine Forests | |
| **No. Plots/transects** | One (P48) | |
| **Total Area in Development Site (ha)** | 0.87 | |

| PCT Name | River Red Gum tall to very tall open forest / woodland wetland on rivers on floodplains mainly in the Darling Riverine Plains Bioregion |
|---|---|
| Condition | Moderate to Good |
| General Description | This vegetation zone occurs as one distinct patch within the Development Site. These patches are bisected by the existing rail and persist in the riparian zone along Burrill Creek near Peak Hill. This community is found on alluvial soils. |
| Floristic Description | This community is dominated by mature river red gum (*Eucalyptus camaldulensis*). The shrub layer is generally absent, except for very sparse occurrences of green wattle (*Acacia deanei*). Native ground species include couch (*Cynodon dactylon*), red grass (*Bothriochloa macra*), curly windmill grass (*Enteropogon acicularis*), nardoo (*Marsilea* sp.), *Juncus* sp., variable glycine (*Glycine tabacina*), climbing saltbush (*Einadia nutans*) and kidney weed (*Dichondra repens*). Non-native herbs and forbs include paspalum (*Paspalum dilatatum*) and spear thistle (*Cirsium vulgare*). The community is less disturbed than the adjoining regenerating river red gum community. |
| Structure | Upper – 15m/25% Midstorey – 3m/2%<br>Lower – 0.5m/50% |
| TSC Act Status | This vegetation zone does not conform to a TEC listed under the TSC Act. |
| EPBC Act Status | This vegetation zone does not conform to a TEC listed under the EPBC Act. |

### 3.2.1.3 Vegetation Zone 3 – CW183, LA193 River Red Gum tall to very tall open forest / woodland wetland on rivers on floodplains mainly in the Darling Riverine Plains Bioregion – Low Condition (Regeneration)

| PCT Name | River Red Gum tall to very tall open forest / woodland wetland on rivers on floodplains mainly in the Darling Riverine Plains Bioregion | |
|---|---|---|
| Condition | Low | |
| PCT Number | 36 |  |
| BVT Number | CW183; LA193 | |
| Formation | Forested Wetlands | |
| Class | Inland Riverine Forests | |
| No. Plots/transects | One (P05) | |
| Total Area in Development Site (ha) | 0.62 | |
| General Description | This vegetation zone occurs as two distinct patches within the Development Site. These patches are bisected by the existing rail and persist in the riparian zone along Burrill Creek near Peak Hill. This community is found on alluvial soils with a heavily disturbed understorey. | |

| PCT Name | River Red Gum tall to very tall open forest / woodland wetland on rivers on floodplains mainly in the Darling Riverine Plains Bioregion |
|---|---|
| Condition | Low |
| Floristic Description | This community is dominated by regenerating river red gum (*Eucalyptus camaldulensis*) with a predominantly sparse, non-native understorey dominated by paspalum (*Paspalum dilatatum*). Native grasses occur sporadically and are limited to early spring grass (*Eriochloa pseudoacrotricha*), windmill grass (*Chloris truncata*), weeping lovegrass (*Eragrostis parviflora*) and couch (*Cynodon dactylon*). Native herbs and forbs include corrugated sida (*Sida corrugata*), lesser joyweed (*Alternanthera denticulata*), quena (*Solanum esuriale*), creeping knotweed (*Persicaria prostrata*) and kidney weed (*Dichondra repens*). Non-native herbs and forbs include red-flowered mallow (*Modiola caroliniana*), slender celery (*Cyclospermum leptophyllum*), purpletop (*Verbena bonariensis*), flaxleaf fleabane (*Conyza bonariensis*), spear thistle (*Cirsium vulgare*) and haresfoot clover (*Trifolium arvense*). |
| Structure | Upper – not present<br>Midstorey – 0.5-1.5m/0-5%<br>Lower – <1m/30% |
| TSC Act Status | This vegetation zone does not conform to a TEC listed under the TSC Act. |
| EPBC Act Status | This vegetation zone does not conform to a TEC listed under the EPBC Act. |

### 3.2.1.4 Vegetation Zone 4 – CW104, LA105– Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions – Moderate to Good Condition

| PCT Name | Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions | |
|---|---|---|
| Condition | Moderate to Good | |
| PCT Number | 55 |  |
| BVT Number | CW104; LA105 | |
| Formation | Semi-arid Woodlands (Grassy sub-formation) | |
| Class | North-west Floodplain Woodlands | |
| No. Plots/transects | One (P26) | |
| Total Area in Development Site (ha) | 1.12 | |
| General Description | This vegetation zone primarily occurs between the KP 518.5 km and 519.5 km on the clay soils associated with Tomingley Creek. The community is well-connected with vegetation beyond the Development Site despite disturbance from adjacent land uses. | |

| PCT Name | Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions |
|---|---|
| Condition | Moderate to Good |
| Floristic Description | This open woodland community is dominated by belah (*Casuarina cristata*) with bimble box (*Eucalyptus populnea* subsp. *bimbil*) occurring as a sub-dominant species in some patches. The mid-storey is sparse and species depauperate, limited to regenerating belah (*Casuarina cristata*), wilga (*Geijera parviflora*), *Senna artemisioides* and the Weed of National Significance (WoNS) African boxthorn (*Lycium ferocissimum*). The ground layer is generally dense with leaf litter and is dominated by small clumps of Queensland bluegrass (*Dichanthium sericeum* subsp. *sericeum*), button grass (*Dactyloctenium radulans*), early spring grass (*Eriochloa pseudoacrotricha*), wallaby grass (*Rytidosperma fulva*) and curly windmill grass (*Enteropogon acicularis*). Non-native grasses primarily include Rhodes grass (*Chloris gayana*), bearded oats (*Avena sativa*) and urochloa grass (*Urochloa panicoides*). Native chenopods and forbs include climbing saltbush (*Einadia nutans*), corrugated sida (*Sida corrugata*), tarvine (*Boerhavia dominii*), quena (*Solanum esuriale*) and lesser joyweed (*Alternanthera dentidulata*). Non-native forbs such as cobbler's pegs (*Bidens pilosa*) and flaxleaf fleabane (*Conyza bonariensis*) are also common. |
| Structure | Upper – 2-8m/5-15%<br>Midstorey – 0.5-2m/1-5%<br>Lower – <1m/20-35% |
| TSC Act Status | This vegetation zone does not conform to a TEC listed under the TSC Act. |
| EPBC Act Status | This vegetation zone does not conform to a TEC listed under the EPBC Act. |

### 3.2.1.5 Vegetation Zone 5 – CW104, LA105– Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions – Moderate to Good Condition – Derived Native Grassland

| PCT Name | Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions | |
|---|---|---|
| Condition | Moderate to Good | |
| PCT Number | 55 |  |
| BVT Number | CW104; LA105 | |
| Formation | Semi-arid Woodlands (Grassy sub-formation) | |
| Class | North-west Floodplain Woodlands | |
| No. Plots/transects | Three (P14, P15 and P33) | |
| Total Area in Development Site (ha) | 7.12 | |

| PCT Name | Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions |
|---|---|
| Condition | Moderate to Good |
| General Description | This vegetation zone primarily occurs between KP 518.5km and 519.5km on the clay soils associated with Tomingley Creek. The community is derived native grassland of vegetation zone 4. |
| Floristic Description | This community comprises a derived native grassland dominated by Queensland bluegrass (*Dichanthium sericeum* subsp. *sericeum*). The upper storey is generally absent, limited to regenerating belah (*Casuarina cristata*). Other native species typically occurring include grasses such as curly windmill grass (*Enteropogon acicularis*), fairy grass (*Sporobolus caroli*), yanganbil (*Austrostipa bigeniculata*) and native millet (*Panicum decompositum*). Non-native species include rhodes grass (*Chloris gayana*), flaxleaf fleabane (*Conyza bonariensis*), urochloa grass (*Urochloa panicoides*) and *Hypericum* sp. |
| Structure | Upper – 15m/0-5%<br>Midstorey – 3-6m/1-5%<br>Lower – <1m/20-35% |
| TSC Act Status | This vegetation zone does not conform to a TEC listed under the TSC Act. |
| EPBC Act Status | This vegetation zone does not conform to a TEC listed under the EPBC Act. |

### 3.2.1.6 Vegetation Zone 6 – CW220, LA223– White Cypress Pine woodland on sandy loams in central NSW wheatbelt – Moderate to Good Condition

| PCT Name | White Cypress Pine woodland on sandy loams in central NSW wheatbelt | |
|---|---|---|
| Condition | Moderate to Good | |
| PCT Number | 70 |  |
| BVT Number | CW220, LA223 | |
| Formation | Grassy Woodlands | |
| Class | Floodplain Transition Woodlands | |
| No. Plots/transects | One (P38) | |
| Total Area in Development Site (ha) | 1.95 | |
| General Description | This vegetation zone mostly occurs as a linear patch between KP 522km and 524.5km. The community occupies red clay soils and shares similarities with the upper storey characteristics of vegetation zone 9, except that the understorey is more sparse and the | |

| PCT Name | White Cypress Pine woodland on sandy loams in central NSW wheatbelt |
|---|---|
| Condition | Moderate to Good |
| | upper storey is dominated by white cypress pine (*Callitris glaucophylla*) with bimble box (*Eucalyptus populnea* ssp. *bimbil*) occurring sporadically. |
| Floristic Description | This open woodland is dominated by white cypress pine (*Callitris glaucophylla*) with bimble box (*Eucalyptus populnea* subsp. *bimbil*) occurring sporadically. The midstorey varies from absent to sparse, comprising scattered wilga (*Geijera parviflora*) and green wattle (*Acacia deanei*). The ground layer is sparsely dominated by native grasses such as *Panicum* spp. And red grass (*Bothriochloa macra*), along with the exotic grass species bearded oats (*Avena barbata*), paspalum (*Paspalum dilatatum*) and urochloa grass (*Urochloa panicoides*). Native chenopods and forbs such as wingless bluebush (*Maireana enchylaenoides*), quena (*Solanum esuriale*), swamp dock (*Rumex brownii*) and fuzzweed (*Vittadinia cuneata*) occur sporadically. The most common non-native forbs are coffee senna (*Senna occidentalis*), flaxleaf fleabane (*Conyza bonariensis*) and *Lepidium africanum*. |
| Structure | Upper – 10m/15-45%<br>Midstorey – 0-5m/0-5%<br>Lower – <0.5m/30-60% |
| TSC Act Status | This vegetation zone does not conform to a TEC listed under the TSC Act. |
| EPBC Act Status | This vegetation zone does not conform to a TEC listed under the EPBC Act. |

### 3.2.1.7 Vegetation Zone 7 – CW145, LA154 Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions– Moderate to Good Condition

| PCT Name | Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions | |
|---|---|---|
| Condition | Moderate to Good | |
| PCT Number | 76 |  |
| BVT Number | CW145; LA154 | |
| Formation | Grassy Woodlands | |
| Class | Floodplain Transition Woodlands | |
| No. Plots/transects | Seven (P01, P02, P12, P16, P25, P30 and P31) | |
| Total Area in Development Site (ha) | 10.13 | |

| PCT Name | Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions |
|---|---|
| General Description | This vegetation zone occurs as several disturbed remnant patches throughout the Development Site. The largest patch of this community exists in the southern portion of the Development Site near Parkes. The community typically occupies red to brown clay soils. |
| Floristic Description | This community is a tall open woodland to 25 metres high dominated by western grey box (*Eucalyptus microcarpa*). Some patches of this community contain white cypress pine (*Callitris glaucophylla*), yellow box (*Eucalyptus melliodora*) and/or bimble box (*Eucalyptus populnea* subsp. *bimbil*) subdominant to western grey box (*Eucalyptus microcarpa*). The midstorey is generally absent or sparse, comprising western rosewood (*Alectryon oleifolius*), western boobialla (*Myoporum montanum*), wilga (*Geijera parviflora*), cooba (*Acacia salicina*), green wattle (*Acacia deanei*), dropping wattle (*Acacia difformis*) and sticky hop-bush (*Dodonaea viscosa*). The understorey is characteristically grassy and is dominated by both native and non-native grasses. Dominant native grasses include speargrass (*Austrostipa scabra*), bunch wiregrass (*Aristida behriana*), Yanganbil (*Austrostipa bigeniculata*), wallaby grass (*Rytidosperma fulva*), tall chloris (*Chloris ventricosa*), Queensland bluegrass (*Dichanthium sericeum* subsp. *sericeum*), red grass (*Bothriochloa macra*), paddock lovegrass (*Eragrostis leptostachya*) and knottybutt grass (*Paspalidium constrictum*). Common exotic grasses include bearded oats (*Avena barbata*), urochloa grass (*Urochloa panicoides*), Rhodes grass (*Chloris gayana*) and stinkgrass (*Eragrostis cilianensis*). Native herbs, forbs and chenopods include corrugated sida (*Sida corrugata*), yellow burr-daisy (*Calotis lappulacea*), purble burr-daisy (*Calotis cuneifolia*), rough fuzzweed (*Vittadinia pterochaeta*) and climbing saltbush (*Einadia nutans*). |
| Structure | Upper – 15-20m/5-20%<br>Midstorey – 0.5-5m/1-5%<br>Lower – <1m/15-70% |
| TSC Act Status | A total of 7.33 hectares of this vegetation zone in the NSW South Western Slopes bioregion is consistent with *Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions EEC* listed under the TSC Act. The remaining area of this zone occurs in the Darling Riverine Plains bioregion and does not meet the scientific determination for the TEC (refer to **Appendix D**). |
| EPBC Act Status | A total of 9.44 hectares of this vegetation zone is consistent with *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC* listed under the EPBC Act. The remainder of this zone does not meet minimum EPBC listing criteria due to due to small patch sizes in the Development Site (refer to **Appendix D**). |

### 3.2.1.8 Vegetation Zone 8 – CW145, LA154 Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions– Moderate to Good Condition – Derived Native Grassland

| | | |
|---|---|---|
| **PCT Name** | **Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions** | |
| **Condition** | **Moderate to Good** | |
| **PCT Number** | 76 |  |
| **BVT Number** | CW145; LA154 | |
| **Formation** | Grassy Woodlands | |
| **Class** | Floodplain Transition Woodlands | |
| **No. Plots/transects** | Four (P03, P04, P07 and P36) | |
| **Total Area in Development Site (ha)** | 32.06 | |
| **General Description** | This vegetation zone occurs adjacent to Western Grey Box tall Grassy Woodland patches within the Development Site and lacks a canopy due to historic clearing. The community is generally heavily disturbed due to surrounding land uses. | |
| **Floristic Description** | This community comprises a derived native grassland of Zone 7 Western Grey Box tall Grassy Woodland where the upper storey has mostly been cleared. The midstorey is generally absent with a variable understorey dominated by Queensland bluegrass (*Dichanthium sericeum* subsp. *sericeum*), wallaby grass (*Rytidosperma fulva*), windmill grass (*Chloris truncata*), curly windmill grass (*Enteropogon acicularis*), early spring grass (*Eriochloa pseudoacrotricha*) and red grass (*Bothriochloa macra*). Native forbs and herbs are limited and occur sporadically, including corrugated sida (*Sida corrugata*), pink bindweed (*Convolvulus erubescens*) and fuzzweed (*Vittadinia* spp.). Non-native grasses, forbs and herbs commonly include haresfoot clover (*Trifolium arvense*), star thistle (*Centaurea calcitrapa*), spear thistle (*Cirsium vulgare*), potato weed (*Heliotropium europaeum*), Patterson's curse (*Echium plantagineum*) and common peppercress (*Lepidium africanum*). | |
| **Structure** | Upper – 0m/0%<br>Midstorey – 0m/0%<br>Lower – <0.5m/30-75% | |
| **TSC Act Status** | This entire vegetation zone occurs in the NSW South Western Slopes bioregion and is consistent with *Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions EEC* listed under the TSC Act. The remaining area of this zone occurs in the Darling Riverine Plains bioregion and therefore does not meet the scientific determination for the TEC (refer to **Appendix D**). | |
| **EPBC Act Status** | This vegetation zone is consistent with *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia* EEC listed under the EPBC Act (refer to **Appendix D**). | |

### 3.2.1.9 Vegetation Zone 9 – CW172, LA178 – Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt) – Moderate to Good Condition

| PCT Name | Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt) | |
|---|---|---|
| Condition | Moderate to Good | |
| PCT Number | 244 |  |
| BVT Number | CW172; LA178 | |
| Formation | Grassy Woodlands | |
| Class | Floodplain Transition Woodlands | |
| No. Plots/transects | Seven (P06, P17, P18, P20, P24, P27 and P29) | |
| Total Area in Development Site (ha) | 3.38 | |
| General Description | This vegetation zone occurs as several small remnant or regenerating patches throughout the Development Site on red-brown clay soils. Although widespread across the Development Site, patches are relatively isolated due to historic clearing. | |
| Floristic Description | This community comprises a sparse woodland dominated by Bimble Box (*Eucalyptus populnea* subsp. *bimbil*). Other tree species include white cypress pine (*Callitris glaucophylla*) and kurrajong (*Brachychiton populneus*). The midstorey is generally very sparse and includes wilga (*Geijera parviflora*) and *Senna artemisioides*. The understorey is heavily disturbed and is dominated by a mix of native and exotic species. Dominant native grasses include Queensland bluegrass (*Dichanthium sericeum* subsp. *sericeum*), speargrass (*Austrostipa scabra*), bunch wiregrass (*Aristida behriana*) and wallaby grass (*Rytidosperma fulva*). Chenopods such as climbing saltbush (*Einadia nutans*), small-leaf bluebush (*Maireana microphylla*), galvinized burr (*Sclerolaena birchii*) and creeping saltbush (*Atriplex semibaccata*) are also present in the understorey along with herbs and forbs such as corrugated sida (*Sida corrugata*) and variable glycine (*Glycine tabacina*). Non-native forbs and herbs include cobblers pegs (*Bidens pilosa*) and flaxleaf fleabane (*Conyza bonariensis*). Common exotic grasses include Rhodes grass (*Chloris gayana*) and bearded oats (*Avena barbata*). African boxthorn (*Lycium ferocissimum*), a WoNS, occurs in this community. | |
| Structure | Upper – 3-6m/10-40%<br>Midstorey – 0.5-1m/0-5%<br>Lower – <1m/40-50% | |
| TSC Act Status | This vegetation zone does not conform to a TEC listed under the TSC Act. | |
| EPBC Act Status | This vegetation zone does not conform to a TEC listed under the EPBC Act. | |

### 3.2.1.10 Vegetation Zone 10 – CW171, LA177– Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt) –Moderate to Good Condition – Derived Native Grassland

| PCT Name | Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt) | |
|---|---|---|
| **Condition** | **Moderate to Good – Derived Native Grassland** | |
| **PCT Number** | 244 |  |
| **BVT Number** | CW172; LA178 | |
| **Formation** | Grassy Woodlands | |
| **Class** | Floodplain Transition Woodlands | |
| **No. Plots/transects** | Three (P28, P43 and P44) | |
| **Total Area in Development Site (ha)** | 14.45 | |
| **General Description** | This vegetation zone occurs adjacent to Poplar Box Grassy Woodland patches within the Development Site however typically lacks a significant canopy due to historic clearing. The community is generally heavily disturbed due to surrounding land uses. | |
| **Floristic Description** | This community is a derived native grassland form of Zone 9 Poplar Box Grassy Woodland where the upper storey has mostly been cleared. The midstorey is generally absent, however some patches contain western silver wattle (*Acacia deanei*). The ground layer is typically dominated by kangaroo grass (*Themeda triandra*), *wallaby* grass (*Rytidosperma fulva*), windmill grass (*Chloris truncata*), curly windmill grass (*Enteropogon acicularis*), early spring grass (*Eriochloa pseudoacrotricha*) and red grass (*Bothriochloa macra*). Native forbs and herbs are limited and occur sporadically and typically include corrugated sida (*Sida corrugata*), *Wahlenbergia* sp., common everlasting (*Chrysocephalum apiculatum*) and *Vittadinia* sp. Non-native grasses, forbs and herbs commonly include haresfoot clover (*Trifolium arvense*), star thistle (*Centaurea calcitrapa*), spear thistle (*Cirsium vulgare*), potato weed (*Heliotropium europaeum*), Patterson's curse (*Echium plantagineum*), Rhodes grass (*Chloris gayana*) and common peppercress (*Lepidium africanum*). | |
| **Structure** | Upper – 0m/0%<br>Midstorey – 0.5-4m/0-5%<br>Lower – <0.5m/40-70% | |
| **TSC Act Status** | This vegetation zone does not conform to a TEC listed under the TSC Act. | |
| **EPBC Act Status** | This vegetation zone does not conform to a TEC listed under the EPBC Act. | |

### 3.2.1.11 Vegetation Zone 11 – CW138, LA145 Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion– Moderate to Good Condition

| PCT Name | Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion | |
|---|---|---|
| Condition | Moderate to Good | |
| PCT Number | 201 |  |
| BVT Number | CW138; LA145 | |
| Formation | Grassy Woodlands | |
| Class | Western Slopes Grassy Woodlands | |
| No. Plots/transects | Two (P09 and P10) | |
| Total Area in Development Site (ha) | 1.88 | |
| General Description | This vegetation zone occurs as small remnant patches within the Development Site. The community occupies clay soils and persists on slight depressions of the Development Site. Patches of this community within the Development Site occur are isolated likely due to historic clearing. | |
| Floristic Description | This open woodland community has a sparse upper storey dominated by fuzzy box (*Eucalyptus conica*). In some patches yellow box (*Eucalyptus melliodora*) and/or grey box (*Eucalyptus microcarpa*) may also be present as associate canopy species. The midstorey is generally sparse or absent but when present is dominated by wilga (*Geijera parviflora*). The ground layer is typically dominated by native grasses including wallaby grass (*Rytidosperma fulva*), kangaroo grass (*Themeda triandra*), purple wiregrass (*Aristida ramosa*), slender panic (*Paspalidium gracile*) and common wheatgrass (*Elymus scaber*). Native forbs include corrugated sida (*Sida corrugata*), tarvine (*Boerhavia dominii*), yellow burr-daisy (*Calotis lappulacea*) and emu-foot (*Cullen tenax*). Common exotic species include haresfoot clover (*Trifolium arvense*), skeleton weed (*Chondrilla juncea*) and oats (*Avena sativa*). | |
| Structure | Upper – 3-6m/10-40%<br>Midstorey – 0.5-1m/0-5%<br>Lower – <1m/40-50% | |
| TSC Act Status | This vegetation zone is consistent with the *Fuzzy Box Woodland on alluvial soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions EEC* listed under the TSC Act (refer to **Appendix D**). | |
| EPBC Act Status | This vegetation zone does not conform to a TEC listed under the EPBC Act. | |

### 3.2.1.12 Vegetation Zone 12 – CW213, LA218– White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion – Moderate to Good Condition

| | |
|---|---|
| **PCT Name** | **White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion** |
| **Condition** | **Moderate to Good** |
| **PCT Number** | 267 |
| **BVT Number** | CW220; LA223 |
| **Formation** | Grassy Woodlands |
| **Class** | Western Slopes Grassy Woodlands |
| **No. Plots/transects** | Two (P11 and P40) |
| **Total Area in Development Site (ha)** | 3.24 |

| | |
|---|---|
| **General Description** | This vegetation zone occupies the low rises and gentle slopes within the Development Site. The understorey of this community is predominantly native with few non-native species present. Recruitment of white box (*Eucalyptus albens*) is also occurring within this vegetation zone. |
| **Floristic Description** | This open woodland is dominated by white box (*Eucalyptus albens*) with a sparse midstorey dominated by wilga (*Geijera parviflora*) and western silver wattle (*Acacia decora*). In some patches grey box (*Eucalyptus* microcarpa) and/or white cypress pine (*Callitris glaucophylla*) is also present. The understorey is mid-dense and dominated by native grasses including speargrass (*Austrostipa scabra*), common wheatgrass (*Elymus scaber*), curly windmill grass (*Enteropogon acicularis*) and slender nineawn (*Enneapogon gracilis*). Other dominant native understorey species include pink tongues (*Rostellularia adscendens*), amulla (*Eremophila debilis*), *Lomandra filiformis*, variable glycine (*Glycine* tabacina), blueberry lily (*Dianella revoluta*) and common everlasting (*Chrysocephalum apiculatum*). Non-native understorey species was limited to white horehound (*Marrubium vulgare*). |
| **Structure** | Upper – 10-15m/10-45%<br>Midstorey – 1-8m/5-40%<br>Lower – <1m/30-65% |
| **TSC Act Status** | This vegetation zone is consistent with *White Box Yellow Box Blakely's Red Gum Woodland EEC* listed under the TSC Act (refer to **Appendix D**). |
| **EPBC Act Status** | A total of 1.1 hectares of this vegetation zone is consistent with *White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC* listed under the EPBC Act (refer to **Appendix D**). |

### 3.2.1.13 Vegetation Zone 13 – CW213, LA218– White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion– Moderate to Good Condition – Derived Native Grassland

| | | |
|---|---|---|
| **PCT Name** | **White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion** | |
| **Condition** | **Moderate to Good – Derived Native Grassland** | |
| **PCT Number** | 267 |  |
| **BVT Number** | CW213; LA218 | |
| **Formation** | Grassy Woodlands | |
| **Class** | Western Slopes Grassy Woodlands | |
| **No. Plots/transects** | One (P41) | |
| **Total Area in Development Site (ha)** | 0.57 | |
| **General Description** | This vegetation zone occupies the low rise and gentle slopes within the Development Site. This vegetation zone occurs adjacent to Zone 13 White Box - White Cypress Pine - Western Grey Box Woodland within the Development Site and lacks a canopy due to historic clearing. The community is generally heavily disturbed due to surrounding land uses. | |
| **Floristic Description** | This community is a derived native grassland form of Zone 13 White Box - White Cypress Pine - Western Grey Box Woodland where the upper storey has mostly been cleared. The midstorey is generally absent except for scattered silver wattle (*Acacia decora*) and wilga (*Geijera parviflora*). The ground layer varies from mid-dense to dense and is dominated by native grasses such as common wheatgrass (*Elymus scaber*) and cup grass (*Eriochloa crebra*). The dominant non-native grasses are confined to bearded oats (*Avena barbata*). Native chenopods and forbs include berry saltbush (*Einadia hastata*), small-leaf bluebush (*Maireana microphylla*), amulla (*Eremophila debilis*), yellow burr-daisy (*Calotis lappulacea*) and *Vittadinia* sp. Non-native species present include stagger weed (*Stachys arvensis*), common verbena (*Verbena officinalis*) and *Verbena incompta*. | |
| **Structure** | Upper – 0m/0%<br>Midstorey – 0.5m/<1%<br>Lower – <0.5m/95% | |
| **TSC Act Status** | This vegetation zone is consistent with *White Box Yellow Box Blakely's Red Gum Woodland EEC* listed under the TSC Act (refer to **Appendix D**). | |
| **EPBC Act Status** | This vegetation zone is consistent with *White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC* listed under the EPBC Act (refer to **Appendix D**). | |

### 3.2.1.14 Vegetation Zone 14 – CW226, LA226– Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion– Moderate to Good Condition

| | | |
|---|---|---|
| **PCT Name** | **Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion** | |
| **Condition** | **Moderate to Good** | |
| **PCT Number** | 276 |  |
| **BVT Number** | CW226; LA226 | |
| **Formation** | Grassy Woodlands | |
| **Class** | Western Slopes Grassy Woodlands | |
| **No. Plots/transects** | Three (P34, P39 and P47) | |
| **Total Area in Development Site (ha)** | 7.16 | |
| **General Description** | This vegetation zone occupies the alluvial plains and low hills on clay-loam soils within the Development Site. Patches of this community within the Development Site occur as isolated remnants. | |
| **Floristic Description** | This open grassy woodland is dominated by yellow box (*Eucalyptus melliodora*), with kurrajong (*Brachychiton populneus*), bimble box (*Eucalyptus populnea* subsp. *bimbil*) and white cypress pine (*Callitris glaucophylla*) occurring in some patches. The midstorey is generally absent however the ground layer is characteristically dense and dominated by native grasses, including red grass (*Bothriochloa macra*), curly windmill grass (*Enteropogon acicularis*) and speargrass (*Austrostipa scabra*). Native chenopods, forbs and herbs occur sporadically and include wingless fissure-weed (*Maireana enchylaenoides*), small-leaf bluebush (*Maireana microphylla*), yellow burr-daisy (*Calotis lappulacea*), blue flax-lily (*Dianella longifolia*), amulla (*Eremophila debilis*) and *Vittadinia* sp. Exotic species include common peppercress (*Lepidium africanum*), mintweed (*Salvia reflexa*), saffron thistle (*Carthamus lanatus*) and the WoNS, African boxthorn (*Lycium ferocissimum*). | |
| **Structure** | Upper – 15-20m/15-20%<br>Midstorey – 0m/0%<br>Lower – <0.5m/80-85% | |
| **TSC Act Status** | This vegetation zone is consistent with *White Box Yellow Box Blakely's Red Gum Woodland EEC* listed under the TSC Act (refer to **Appendix D**). | |
| **EPBC Act Status** | This vegetation zone is consistent with *White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC* listed under the EPBC Act (refer to **Appendix D**). | |

### 3.2.1.15 Vegetation Zone 15 – CW226, LA226– Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion– Moderate to Good Condition – Derived Native Grassland

| PCT Name | Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion | |
|---|---|---|
| **Condition** | **Moderate to Good_DNG** | |
| **PCT Number** | 276 |  |
| **BVT Number** | CW226, LA226 | |
| **Formation** | Grassy Woodlands | |
| **Class** | Western Slopes Grassy Woodlands | |
| **No. Plots/transects** | Three (P35, P37 and P42) | |
| **Total Area in Development Site (ha)** | 13.96 | |
| **General Description** | This vegetation zone occupies the alluvial plains and low hills on clay-loam soils within the Development Site adjacent to patches of Zone 14 Yellow Box Grassy Tall Woodland. Patches of this community within the Development Site occur as isolated remnants. | |
| **Floristic Description** | This community is a derived native grassland form of Zone 14 Yellow Box Grassy Tall Woodland where the upper storey has mostly been cleared. The midstorey is generally absent except for regenerating yellow box (*Eucalyptus melliodora*). The ground layer is characteristically dense and dominated by native grasses including common wheatgrass (*Elymus scaber*), curly windmill grass (*Enteropogon acicularis*) and wallaby grasses (*Rytidosperma* sp.). Other dominant native ground layer species include *Dysphania pumilio,* amulla (*Eremophila debilis*), small-leaf bluebush *(Maireana microphylla), Vittadinia* sp. and corrugated sida (*Sida corrugata*). Non-native species include common peppercress (*Lepidium africanum*), stagger weed (*Stachys arvensis*), Buchan weed (*Hirschfeldia incana*) and *Verbena* sp. | |
| **Structure** | Upper – 0m/0%<br>Midstorey – 0.5m/<1%<br>Lower – <0.5m/70-98% | |
| **TSC Act Status** | This vegetation zone is consistent with *White Box Yellow Box Blakely's Red Gum Woodland EEC* listed under the TSC Act (refer to **Appendix D**). | |
| **EPBC Act Status** | This vegetation zone is consistent with *White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC* listed under the EPBC Act (refer to **Appendix D**). | |

#### 3.2.1.16 Cleared/Non-native Vegetation

Cleared/non-native vegetation occupies majority of the rail corridor within the Development Site. The community is dominated by non-native species and is frequently subjected to disturbances from surrounding land uses, weed spraying and frequent mowing regimes.

This community is characterised by a predominantly dense understorey of non-native grasses, forbs and herbs. Dominant grasses typically include paspalum (*Paspalum dilatatum*), bearded oats (*Avena barbata*) and urochloa grass (*Urochloa panicoides*). Coffee senna (*Senna occidentalis*) is frequently present in the midstorey. Dominant non-native forbs and herbs include Patterson's curse (*Echium plantagineum*), red-flowered mallow (*Modiola caroliniana*), cobbler's pegs (*Bidens pilosa*), saffron thistle (*Carthamus lanatus*) and flaxleaf fleabane (*Conyza bonariensis*). Native species occur sporadically and occur in low abundances. Native species encountered include rough fuzzweed (*Vittadinia pterochaeta*), pink bindweed (*Convolvulus erubescens*) and quena (*Solanum esuriale*).

Cleared/non-native vegetation in the Development Site does not meet the definition of 'native vegetation' under the *Native Vegetation Act 2003* and therefore could not be aligned with a BVT or vegetation zone and is excluded from further assessment as per Section 9.5 of the FBA (OEH 2014a).

### 3.2.2 Current Site Value

**Table 3.5** below details the current site value scores for each of the vegetation zones in the Development Site. The raw site condition attribute data for each of the vegetation zones is provided in **Appendix C**.

**Table 3.5 Vegetation Zone Site Value Scores**

| Veg Zone | PCT Name | Current Site Value Score | | |
|---|---|---|---|---|
| | | **Assessment 1**<br>Lachlan CMA/Lower Slopes Subregion | **Assessment 2**<br>Central West CMA/Lower Slopes Subregion | **Assessment 3**<br>Central West CMA/Bogan-Macquarie Subregion |
| 1 | PCT26 (CW205, LA212) Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion<br>*Moderate to Good* | Not present | 54.67 | 54.67 |
| 2 | PCT36 (CW183, LA193) River Red Gum tall to very tall open forest / woodland wetland on rivers on floodplains mainly in the Darling Riverine Plains Bioregion<br>*Moderate to Good* | Not present | 64.06 | Not present |
| 3 | PCT36 (CW183, LA193) River Red Gum tall to very tall open forest / woodland wetland on rivers on floodplains mainly in the Darling Riverine Plains Bioregion<br>*Low_Regeneration* | Not present | 30.21 | Not present |

| Veg Zone | PCT Name | Current Site Value Score | | |
|---|---|---|---|---|
| | | Assessment 1<br>Lachlan CMA/Lower Slopes Subregion | Assessment 2<br>Central West CMA/Lower Slopes Subregion | Assessment 3<br>Central West CMA/Bogan-Macquarie Subregion |
| 4 | PCT55 (CW104, LA105) Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions<br>*Moderate to Good* | Not present | Not present | 62.00 |
| 5 | PCT55 (CW104, LA105) Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions<br>*Moderate to Good_DNG* | Not present | 56.67 | 56.67 |
| 6 | PCT70 (CW220, LA223) White Cypress Pine woodland on sandy loams in central NSW wheatbelt<br>*Moderate to Good* | 28.12 | 28.12 | 28.12 |
| 7 | PCT76 (CW145, LA154) Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions<br>*Moderate to Good* | 66.49 | 66.49 | 66.49 |
| 8 | PCT76 (CW145, LA154) Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions<br>*Moderate to Good_DNG* | 24.48 | 24.48 | Not present |
| 9 | PCT244 (CW172, LA178) Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt)<br>*Moderate to Good* | Not present | 67.19 | 67.19 |
| 10 | PCT244 (CW172, LA178) Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt)<br>*Moderate to Good_DNG* | Not present | Not present | 31.77 |
| 11 | PCT201 (CW138, LA145) Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion<br>*Moderate to Good* | Not present | 55.33 | 55.33 |

| Veg Zone | PCT Name | Current Site Value Score | | |
|---|---|---|---|---|
| | | Assessment 1<br>Lachlan CMA/Lower Slopes Subregion | Assessment 2<br>Central West CMA/Lower Slopes Subregion | Assessment 3<br>Central West CMA/Bogan-Macquarie Subregion |
| 12 | PCT267 (CW213, LA218) White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion<br>*Moderate to Good* | 67.56 | 56.89 | Not present |
| 13 | PCT267 (CW213, LA218) White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion<br>*Moderate to Good_DNG* | 39.33 | 39.33 | Not present |
| 14 | PCT276 (CW226, LA226) Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion<br>*Moderate to Good* | 90.67 | 84 | Not present |
| 15 | PCT276 (CW226, LA226) Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion<br>*Moderate to Good_DNG* | 38.00 | 38.00 | Not present |

### 3.2.3 Threatened Ecological Communities

Eight of the vegetation zones described above and mapped within the Development Site conform to State and Commonwealth listed TECs, comprising:

- Weeping Myall Woodlands:
    - *Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South western Slopes bioregions EEC* under the TSC Act.
    - *Weeping Myall Woodlands EEC* under the EPBC Act
- Inland Grey Box Woodlands and Derived Native Grasslands:
    - *Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions EEC* under the TSC Act
    - *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC* under the EPBC Act

- Fuzzy Box Woodlands:
    - *Fuzzy Box Woodland on alluvial Soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions EEC* under the TSC Act
- White Box Woodlands and Derived Native Grasslands:
    - *White Box Yellow Box – Blakely's Red Gum Woodland EEC* under the TSC Act
    - *White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC* under the EPBC Act.

Analysis of consistency with the scientific determinations for each TEC was undertaken, with consideration of the advice provided by the NSW Scientific Committee and/or the Commonwealth Threatened Species Scientific Committee guidelines for interpreting listings for species, populations and ecological communities under the TSC Act and EPBC Act respectively. The vegetation zones described in Section 3.2.1 conform to the listing advice provided for each of the TECs, except where minimum patch sizes are required or when the TEC is excluded on the basis of bioregion. Detailed analysis of the vegetation zones with respect to the NSW Scientific Committee and/or the Commonwealth Threatened Species Scientific Committee determinations is provided in **Appendix D**.

## 3.3 Threatened Species within the Development Site

### 3.3.1 Ecosystem-credit Species

#### 3.3.1.1 Predicted Species

**Table 3.6** below outlines the ecosystem-credit species predicted to occur by the BioBanking Calculator and whether they were recorded within the Development Site during the surveys undertaken for this assessment. The superb parrot was not part of the list generated by the BioBanking Credit Calculator and was therefore not included in Table 3.6. It is noted that as EPBC Act listed species that were predicted could potentially occur in the proposal site on the basis of professional opinion, targeted surveys were undertaken for this species. Consequently, the superb parrot was recorded during surveys and is therefore discussed in **Section 3.3.1.2** as it is an ecosystem-credit species in relation to foraging habitat.

**Table 3.6 Predicted Ecosystem-credit Species**

| Species Name | TSC Act | EPBC Act | Predicted in the BBCC | | | Threatened Species Offset Multiplier | Recorded within the Development Footprint |
|---|---|---|---|---|---|---|---|
| | | | Assessment 1<br>Lachlan CMA<br>Lower Slopes IBRA Subregion<br>KP 449 – 466.5 | Assessment 2<br>Central West CMA<br>Lower Slopes IBRA Subregion<br>KP 466 – 509 | Assessment 3<br>Central West CMA<br>Bogan Macquarie IBRA Subregion<br>KP 508.5 – 555.5 | | |
| Australian bustard<br>*Ardeotis australis* | E | - | × | ✓ | × | 2.6 | No |
| Australian painted snipe<br>*Rostratula australis* | E | E | × | × | ✓ | 1.3 | No |
| barking owl<br>*Ninox connivens* | V | - | ✓ | × | × | 3.0 | No |
| black-chinned honeyeater<br>*Melithreptus gularis* subsp. *gularis* | V | - | ✓ | ✓ | ✓ | 1.3 | No |
| brolga<br>*Grus rubicunda* | V | - | × | ✓ | ✓ | 1.3 | No |
| brown treecreeper<br>*Climacteris picumnus* subsp. *victoriae* | V | - | ✓ | ✓ | ✓ | 2.0 | No |
| bush stone curlew<br>*Burhinus grallarius* | E | - | ✓ | ✓ | ✓ | 2.6 | No |
| Corben's long-eared bat<br>*Nyctophilus corbeni* | V | V | ✓ | ✓ | ✓ | 2.1 | No |

| Species Name | TSC Act | EPBC Act | Predicted in the BBCC | | | Threatened Species Offset Multiplier | Recorded within the Development Footprint |
|---|---|---|---|---|---|---|---|
| | | | Assessment 1<br>Lachlan CMA<br>Lower Slopes IBRA Subregion<br>KP 449 – 466.5 | Assessment 2<br>Central West CMA<br>Lower Slopes IBRA Subregion<br>KP 466 – 509 | Assessment 3<br>Central West CMA<br>Bogan Macquarie IBRA Subregion<br>KP 508.5 – 555.5 | | |
| diamond firetail<br>*Stagonopleura guttata* | V | - | ✓ | ✓ | ✓ | 1.3 | No |
| flame robin<br>*Petroica phoenicea* | V | - | ✓ | ✓ | ✓ | 1.3 | No |
| freckled duck<br>*Stictonetta naevosa* | V | - | × | × | ✓ | 1.3 | No |
| gang-gang cockatoo<br>*Callocephalon fimbriatum* | V | - | ✓ | × | × | 2.0 | No |
| Gilbert's whistler<br>*Pachycephala inornata* | V | - | ✓ | × | ✓ | 1.3 | No |
| glossy black-cockatoo<br>*Calyptorhynchus lathami* | V | - | × | ✓ | ✓ | 1.8 | No |
| grey-crowned babbler<br>*Pomatostomus temporalis* subsp. *Temporalis* | V | - | ✓ | ✓ | ✓ | 1.3 | Yes |
| hooded robin<br>*Melanodryas cucullata* subsp. *cucullata* | V | - | ✓ | ✓ | ✓ | 1.7 | No |

| Species Name | TSC Act | EPBC Act | Predicted in the BBCC | | | Threatened Species Offset Multiplier | Recorded within the Development Footprint |
|---|---|---|---|---|---|---|---|
| | | | **Assessment 1**<br>Lachlan CMA<br>Lower Slopes IBRA Subregion<br>KP 449 – 466.5 | **Assessment 2**<br>Central West CMA<br>Lower Slopes IBRA Subregion<br>KP 466 – 509 | **Assessment 3**<br>Central West CMA<br>Bogan Macquarie IBRA Subregion<br>KP 508.5 – 555.5 | | |
| Kultarr<br>*Antechinomys laniger* | E | - | × | ✓ | × | 2.6 | No |
| little eagle<br>*Hieraaetus morphnoides* | V | - | ✓ | ✓ | ✓ | 1.4 | No |
| little lorikeet<br>*Glossopsitta pusilla* | V | - | ✓ | × | × | 1.8 | No |
| little pied bat<br>*Chalinolobus picatus* | V | - | ✓ | ✓ | ✓ | 2.1 | No |
| magpie goose<br>*Anseranas semipalmata* | V | - | × | × | ✓ | 1.3 | No |
| major Mitchell's cockatoo<br>*Lophochroa leadbeateri* | V | - | ✓ | ✓ | ✓ | 1.9 | No |
| masked owl<br>*Tyto novaehollandiae* | V | - | × | ✓ | ✓ | 3.0 | No |
| painted honeyeater<br>*Grantiella picta* | V | V | ✓ | ✓ | ✓ | 1.3 | No |

| Species Name | TSC Act | EPBC Act | Predicted in the BBCC | | | Threatened Species Offset Multiplier | Recorded within the Development Footprint |
|---|---|---|---|---|---|---|---|
| | | | Assessment 1<br>Lachlan CMA<br>Lower Slopes IBRA Subregion<br>KP 449 – 466.5 | Assessment 2<br>Central West CMA<br>Lower Slopes IBRA Subregion<br>KP 466 – 509 | Assessment 3<br>Central West CMA<br>Bogan Macquarie IBRA Subregion<br>KP 508.5 – 555.5 | | |
| pied honeyeater<br>*Certhionyx variegates* | V | - | × | ✓ | × | 1.3 | No |
| red-tailed black-cockatoo<br>*Calyptorhynchus banksii* subsp. *samueli* | V | - | × | ✓ | × | 1.8 | No |
| scarlet robin<br>*Petroica boodang* | V | - | ✓ | ✓ | ✓ | 1.3 | No |
| speckled warbler<br>*Chthonicola sagittata* | V | - | ✓ | ✓ | ✓ | 2.6 | No |
| spotted harrier<br>*Circus assimilis* | V | - | ✓ | ✓ | ✓ | 1.4 | No |
| spotted-tailed quoll<br>*Dasyurus maculates* | V | E | ✓ | ✓ | ✓ | 2.6 | No |
| square-tailed kite<br>*Lophoictinia isura* | V | - | ✓ | ✓ | ✓ | 1.4 | No |
| stripe-faced dunnart<br>*Sminthopsis macroura* | V | - | × | ✓ | ✓ | 2.6 | No |

| Species Name | TSC Act | EPBC Act | Predicted in the BBCC | | | Threatened Species Offset Multiplier | Recorded within the Development Footprint |
|---|---|---|---|---|---|---|---|
| | | | **Assessment 1**<br>Lachlan CMA<br>Lower Slopes IBRA Subregion<br>KP 449 – 466.5 | **Assessment 2**<br>Central West CMA<br>Lower Slopes IBRA Subregion<br>KP 466 – 509 | **Assessment 3**<br>Central West CMA<br>Bogan Macquarie IBRA Subregion<br>KP 508.5 – 555.5 | | |
| swift parrot<br>*Lathamus discolour* | E | CE | ✓ | × | × | 1.3 | No |
| turquoise parrot<br>*Neophema pulchella* | V | - | ✓ | ✓ | ✓ | 1.8 | No |
| varied sittella<br>*Daphoenositta chrysoptera* | V | - | ✓ | ✓ | ✓ | 1.3 | No |
| yellow-bellied sheathtail-bat<br>*Saccolaimus flaviventris* | V | - | ✓ | ✓ | ✓ | 2.2 | No |

### 3.3.1.2 Survey Results

Two ecosystem – credit species were recorded in the Development Site during the surveys undertaken for this assessment. These were the:

- superb parrot (*Polytelis swainsonii*)
- grey-crowned babbler (*Pomatostomus temporalis temporalis*).

As noted in **Section 3.3.1.1,** foraging habitat for the superb parrot was not predicted to occur by the biobanking credit calculator, however surveys targeting this species were undertaken as part of the assessment due to the identification of potential foraging habitat and its co-listing as a threatened species under the EPBC Act.

No other records of ecosystem-credit species are known to occur within the Development Site. A discussion relating to these two species is provided below and a full fauna species list from the surveys undertaken is included in **Appendix E**.

**Superb parrot – *Polytelis swainsonii***

The superb parrot is listed as vulnerable under the TSC and EPBC Acts. This species is found in NSW and northern Victoria, where it occurs on the inland slopes of the Great Divide and on adjacent plains, especially along the major river-systems; vagrants have also been recorded in southern Queensland.

The superb parrot was recorded on two occasions within the Development Site during the surveys undertaken for this assessment.

- Two individuals were opportunistically recorded flying over rail line while Umwelt ecologists were undertaking targeted flora surveys in October 2014. The species was recorded around KP 495.5 (refer to Figure A18 in **Appendix A**).
- Four individuals were opportunistically recorded flying overhead while Umwelt ecologists were undertaking vegetation surveys in May 2016 at two locations within the Development Site. The species was recorded around KP 497 and 523 (refer to Figures A18 and A26 in **Appendix A**).

The superb parrot is an ecosystem species for habitat other than breeding habitat (i.e. foraging habitat). In the Southwest Slopes Bioregion, the superb parrot forages in box-gum woodlands dominated by white box, yellow box and Blakely's red gum (Webster 1988).

This species is also discussed in the species-credit context in relation to breeding habitat in **Section 3.3.2.3**.

**Grey-crowned babbler – *Pomatostomus temporalis temporalis***

The grey-crowned babbler (eastern sub-species) is listed as vulnerable under the TSC Act. This species occurs within Queensland, NSW and Victoria. Within NSW, this species occurs on the western slopes of the Great Dividing Range.

The grey-crowned babbler was recorded on six occasions within the Development Site during the surveys undertaken for this assessment:

- Four individuals were sighted during the targeted threatened flora surveys in October 2014 at approximately KP 524 (refer to Figure A27 in **Appendix A**)

- Three individuals were sighted during the targeted threatened flora surveys in October 2014 at approximately KP 493.5 (refer to Figure A17 in **Appendix A**)
- An unknown number of individuals were heard calling at Site 4 on 30 November 2015 while conducting a bird survey at approximately KP 479.3 (refer to Figure A12 in **Appendix A**)
- Five individuals were sighted during a bird survey at Site 6 conducted on 30 November 2015 at approximately KP 546.7 (refer to Figure A34 in **Appendix A**)
- Five individuals were sighted and heard during a bird survey conducted at Site 3 on 1 December 2015 (refer to Figure A8 in **Appendix A**)
- An unknown number of individuals were heard calling outside the Development Site in proximity to Site 5 on 30 November 2015 after the 20 minute bird survey was completed (refer to Figure A18 in **Appendix A**).

## 3.3.2 Species-credit Species

### 3.3.2.1 Geographic and Habitat Features

Eight geographic and habitat features (refer to **Table 3.7**) that match habitats identified during surveys in the Development Site were selected in the BBCC. The remainder of the geographic and habitat features identified by the BBCC do not occur within the Development Site and were filtered out of the subsequent steps of the assessment.

**Table 3.7 Geographic and Habitat Features in the Development Site**

| Geographic/Habitat Feature | Relevant Species-credit Species |
|---|---|
| land containing a forb-rich grassy groundlayer | small purple-pea (*Swainsona recta*) |
| on ridges of gilgai clays | spiny peppercress (*Lepidium aschersonii*) |
| land containing seasonally damp or waterlogged sites | winged peppercress (*Lepidium monoplocoides*) |
| periodically waterlogged sites (including table drains and farm dams) | spike rush (*Eleocharis obicis*)<br>Austral pilwort (*Pilularia novae-hollandiae*) |
| land within 100m of riparian woodland on inland rivers containing mature living eucalypts or isolated paddock trees overhanging water or dry watercourses | grey falcon (*Falco hypoleucos*) |
| land within 40m of riparian woodland on inlands watercourses/waterholes containing dead or dying eucalypts | black-breasted buzzard (*Hamirostra melanosternon*) |
| land containing escarpments, cliffs, caves, deep crevices, old mine shafts or tunnels | large-eared pied bat (*Chalinolobus dwyeri*) |
| land within 500 metres of identified breeding habitat | Sloane's froglet (*Crinia sloanei*) |

#### 3.3.2.2 Predicted Species

**Table 3.8** below outlines the species-credit species predicted to occur by the BBCC and whether they are considered to occur in the Development Site. **Table 3.8** also includes species not predicted by the BBCC, but specifically surveyed for in accordance with the literature review and methods outlined in **Section 2.0**.

**Table 3.8 Predicted Species-credit Species**

| Species Name | Predicted in the BBCC | | | Impacted by the Proposal^ | Justification |
|---|---|---|---|---|---|
| | **Assessment 1**<br>Lachlan CMA<br>Lower Slopes IBRA Subregion<br>KP 449 – 466.5 | **Assessment 2**<br>Central West CMA<br>Lower Slopes IBRA Subregion<br>KP 466 – 509 | **Assessment 3**<br>Central West CMA<br>Bogan Macquarie IBRA Subregion<br>KP 508.5 – 555.5 | | |
| *Austrostipa wakoolica*<br>(Endangered – TSC and EPBC Acts) | × | ✓ | × | No | *Austrostipa wakoolica* was not recorded within the Development Site despite thorough vegetation surveys undertaken in accordance with the seasonal requirements for this species. The habitats within the Development Site are generally highly disturbed and in low condition due to surrounding agricultural practices and disturbance from the rail corridor. The closest record of the species occurs approximately 5 km to the east of the Development Site between Parkes and Bogan Gate (OEH 2016d). This species is not likely to occur in the Development Site and will not be impacted by the proposal. |
| *Austrostipa metatoris*<br>(Vulnerable – TSC and EPBC Acts) | ✓ | × | × | No | *Austrostipa metatoris* was not recorded within the Development Site despite thorough vegetation surveys undertaken in accordance with the seasonal requirements for this species. The habitats within the Development Site are generally highly disturbed and in low condition due to surrounding agricultural practices and disturbance from the rail corridor. The closest record of the species occurs approximately 100 km to the east of the Development Site at Condobolin (OEH 2016d). This species is not likely to occur in the Development Site and will not be impacted by the proposal. |

| Species Name | Predicted in the BBCC | | | Impacted by the Proposal^ | Justification |
|---|---|---|---|---|---|
| | **Assessment 1**<br>Lachlan CMA<br>Lower Slopes IBRA Subregion<br>KP 449 – 466.5 | **Assessment 2**<br>Central West CMA<br>Lower Slopes IBRA Subregion<br>KP 466 – 509 | **Assessment 3**<br>Central West CMA<br>Bogan Macquarie IBRA Subregion<br>KP 508.5 – 555.5 | | |
| bluegrass<br>*Dichanthium setosum*<br>(Vulnerable – TSC and EPBC Acts) | × | × | × | No | Bluegrass was not recorded within the Development Site despite thorough vegetation surveys undertaken in accordance with the seasonal requirements for this species. The habitats within the Development Site are generally highly disturbed and in low condition due to surrounding agricultural practices and disturbance from the rail corridor. The closest most recent record of the species occurs approximately 2 km from the northern edge of the Development Site at Narromine (OEH 2016d). This species is not likely to occur in the Development Site and will not be impacted by the proposal. |
| Ausfeld's wattle<br>*Acacia ausfeldii*<br>(Vulnerable – TSC Act) | ✓ | × | × | No | Ausfeld's wattle was not recorded within the Development Site despite thorough vegetation surveys undertaken in accordance with the seasonal requirements for this species. The habitats within the Development Site are generally highly disturbed and in low condition due to surrounding agricultural practices and disturbance from the rail corridor. The closest record of the species occurs approximately 70 km east of Narromine (OEH 2016d). This species is not likely to occur in the Development Site and will not be impacted by the proposal. |

| Species Name | Predicted in the BBCC | | | Impacted by the Proposal^ | Justification |
|---|---|---|---|---|---|
| | **Assessment 1**<br>Lachlan CMA<br>Lower Slopes IBRA Subregion<br>KP 449 – 466.5 | **Assessment 2**<br>Central West CMA<br>Lower Slopes IBRA Subregion<br>KP 466 – 509 | **Assessment 3**<br>Central West CMA<br>Bogan Macquarie IBRA Subregion<br>KP 508.5 – 555.5 | | |
| pine donkey orchid<br>*Diuris tricolor*<br>(Vulnerable – TSC Act) | ✓ | ✓ | ✓ | No | Pine donkey orchid was not recorded within the Development Site despite thorough vegetation surveys undertaken in accordance with the seasonal requirements for this species. The habitats within the Development Site are generally highly disturbed and in low condition due to surrounding agricultural practices and disturbance from the rail corridor. The closest most recent record of the species occurs approximately 7 km to the west of the Development Site (OEH 2016d). Extensive survey work in the locality has been undertaken and no populations have been found in the Development Site. This species is not likely to occur in the Development Site and will not be impacted by the proposal. |
| spike-rush<br>*Eleocharis obicis*<br>(Vulnerable – TSC Act) | ✓ | × | × | No | The spike rush was not recorded within the Development Site despite thorough vegetation surveys undertaken in accordance with the seasonal requirements for this species. The habitats within the Development Site are generally highly disturbed and in low condition due to surrounding agricultural practices and disturbance from the rail corridor. The closest record of the species occurs approximately 100 km to the west of the Development Site between Condobolin and Euabalong (OEH 2016d). This species is not likely to occur in the Development Site and will not be impacted by the proposal. |

| Species Name | Predicted in the BBCC | | | Impacted by the Proposal^ | Justification |
|---|---|---|---|---|---|
| | **Assessment 1**<br>Lachlan CMA<br>Lower Slopes IBRA Subregion<br>KP 449 – 466.5 | **Assessment 2**<br>Central West CMA<br>Lower Slopes IBRA Subregion<br>KP 466 – 509 | **Assessment 3**<br>Central West CMA<br>Bogan Macquarie IBRA Subregion<br>KP 508.5 – 555.5 | | |
| spiny peppercress<br>*Lepidium aschersonii*<br>(Vulnerable – TSC and EPBC Acts) | ✓ | × | × | No | Spiny peppercress was not recorded within the Development Site despite thorough vegetation surveys undertaken in accordance with the seasonal requirements for this species. The habitats within the Development Site are generally highly disturbed and in low condition due to surrounding agricultural practices and disturbance from the rail corridor. The closest record of the species occurs approximately 50 km to the north of the Development Site near Eumungerie (OEH 2016d). This species is not likely to occur in the Development Site and will not be impacted by the proposal. |
| winged peppercress<br>*Lepidium monoplocoides*<br>(Endangered – TSC and EPBC Acts) | ✓ | × | × | No | Winged peppercress was not recorded within the Development Site despite thorough vegetation surveys undertaken in accordance with the seasonal requirements for this species. The habitats within the Development Site are generally highly disturbed and in low condition due to surrounding agricultural practices and disturbance from the rail corridor. The closest record of the species occurs approximately 120 km to the west of the Development Site between Condobolin and Euabalong (OEH 2016d). This species is not likely to occur in the Development Site and will not be impacted by the proposal. |

| Species Name | Predicted in the BBCC | | | Impacted by the Proposal^ | Justification |
|---|---|---|---|---|---|
| | **Assessment 1**<br>Lachlan CMA<br>Lower Slopes IBRA Subregion<br>KP 449 – 466.5 | **Assessment 2**<br>Central West CMA<br>Lower Slopes IBRA Subregion<br>KP 466 – 509 | **Assessment 3**<br>Central West CMA<br>Bogan Macquarie IBRA Subregion<br>KP 508.5 – 555.5 | | |
| hoary sunray<br>*Leucochrysum albicans* var. *tricolor*<br>(Endangered – EPBC Act) | × | × | × | No | Hoary sunray was not recorded within the Development Site despite thorough vegetation surveys undertaken in accordance with the seasonal requirements for this species. The habitats within the Development Site are generally highly disturbed and in low condition due to surrounding agricultural practices and disturbance from the rail corridor. The closest record of the species occurs approximately 120 km to the east of the Development Site near Hill End (OEH 2016d). This species is not likely to occur in the Development Site and will not be impacted by the proposal. |
| Austral pillwort<br>*Pilularia novae-hollandiae*<br>(Endangered – TSC Act) | ✓ | × | × | No | Austral pillwort was not recorded within Development Site despite thorough vegetation surveys undertaken in accordance with the seasonal requirements for this species. The habitats within the Development Site are generally highly disturbed and in low condition due to surrounding agricultural practices and disturbance from the rail corridor. The closest record of the species occurs approximately 100 km to the west of the Development Site near Condobolin (OEH 2016d). This species is not likely to occur in the Development Site and will not be impacted by the proposal. |

| Species Name | Predicted in the BBCC | | | Impacted by the Proposal^ | Justification |
|---|---|---|---|---|---|
| | **Assessment 1**<br>Lachlan CMA<br>Lower Slopes IBRA Subregion<br>KP 449 – 466.5 | **Assessment 2**<br>Central West CMA<br>Lower Slopes IBRA Subregion<br>KP 466 – 509 | **Assessment 3**<br>Central West CMA<br>Bogan Macquarie IBRA Subregion<br>KP 508.5 – 555.5 | | |
| slender darling pea<br>*Swainsona murrayana*<br>(Vulnerable – TSC and EPBC Acts) | ✓ | ✓ | ✓ | No | Slender darling pea was not recorded within the Development Site despite thorough vegetation surveys undertaken in accordance with the seasonal requirements for this species. The habitats within the Development Site are generally highly disturbed and in low condition due to surrounding agricultural practices and disturbance from the rail corridor. The closest most recent record of the species occurs approximately 30 km to the north of the Development Site (OEH 2016d). Extensive survey work in the locality has been undertaken and no populations have been found in the Development Site. This species is not likely to occur in the Development Site and will not be impacted by the proposal. |
| small purple-pea<br>*Swainsona recta*<br>(Endangered – TSC and EPBC Acts) | × | × | ✓ | No | Small purple-pea was not recorded within the Development Site despite thorough vegetation surveys undertaken in accordance with the seasonal requirements for this species. The habitats within the Development Site are generally highly disturbed and in low condition due to surrounding agricultural practices and disturbance from the rail corridor. The closest most recent record of the species occurs approximately 30 km to the north-west of the Development Site near Trangie (OEH 2016d). Extensive survey work in the locality has been undertaken and no populations have been found in the Development Site. This species is not likely to occur in the Development Site and will not be impacted by the proposal. |

| Species Name | Predicted in the BBCC | | | Impacted by the Proposal^ | Justification |
|---|---|---|---|---|---|
| | **Assessment 1**<br>Lachlan CMA<br>Lower Slopes IBRA Subregion<br>KP 449 – 466.5 | **Assessment 2**<br>Central West CMA<br>Lower Slopes IBRA Subregion<br>KP 466 – 509 | **Assessment 3**<br>Central West CMA<br>Bogan Macquarie IBRA Subregion<br>KP 508.5 – 555.5 | | |
| silky Swainson-pea<br>*Swainsona sericea*<br>(Vulnerable – TSC Act) | × | × | × | No | Silky Swainson-pea was not recorded within the Development Site despite thorough vegetation surveys undertaken in accordance with the seasonal requirements for this species. The habitats within the Development Site are generally highly disturbed and in low condition due to surrounding agricultural practices and disturbance from the rail corridor. The two closest records of the species occur approximately 4 km to the south-east of the Development Site at Parkes, and approximately 25 km to the east of the Development Site; these records are from 1970 and 1947, respectively (OEH 2016d). Extensive survey work in the locality has been undertaken and no populations have been found in the Development Site. This species is not likely to occur in the Development Site and will not be impacted by the proposal. |
| red darling pea<br>*Swainsona plagiotropis*<br>(Vulnerable – TSC and EPBC Acts) | × | × | ✓ | No | Red darling pea was not recorded within the Development Site despite thorough vegetation surveys undertaken during the known flowering time for this species. The habitats within the Development Site are generally highly disturbed and in low condition due to surrounding agricultural practices and disturbance from the rail corridor. The closest record of the species occurs approximately 100 km to the northwest of the Development Site near Warren (OEH 2016d). This species is not likely to occur in the Development Site and will not be impacted by the proposal. |

| Species Name | Predicted in the BBCC | | | Impacted by the Proposal^ | Justification |
|---|---|---|---|---|---|
| | **Assessment 1**<br>Lachlan CMA<br>Lower Slopes IBRA Subregion<br>KP 449 – 466.5 | **Assessment 2**<br>Central West CMA<br>Lower Slopes IBRA Subregion<br>KP 466 – 509 | **Assessment 3**<br>Central West CMA<br>Bogan Macquarie IBRA Subregion<br>KP 508.5 – 555.5 | | |
| *Tylophora linearis*<br>(Vulnerable – TSC Act and Endangered EPBC Act) | ✓ | ✓ | × | No | *Tylophora linearis* was not recorded within the Development Site despite thorough vegetation surveys undertaken in accordance with the seasonal requirements for this species. The habitats within the Development Site are generally highly disturbed and in low condition due to surrounding agricultural practices and disturbance from the rail corridor. The closest record of the species occurs approximately 10 km to the east of the Development Site within Goobang National Park (OEH 2016d). This species is not likely to occur in the Development Site and will not be impacted by the proposal. |
| pale-headed snake<br>*Hoplocephalus bitorquatus*<br>(Vulnerable – TSC Act) | × | × | × | No | Pale-headed snake was not recorded within the Development Site despite thorough fauna surveys undertaken in accordance with the seasonal requirements for this species. Although there were occasional wooded areas within the Development Site, these habitats were isolated and fragmented by agricultural lands. The closest record of the species occurs approximately 200 km to the north-east of the Development Site within Pilliga State Forest (OEH 2016d). This species is not likely to occur in the Development Site and will not be impacted by the proposal. |

| Species Name | Predicted in the BBCC | | | Impacted by the Proposal^ | Justification |
|---|---|---|---|---|---|
| | **Assessment 1**<br>Lachlan CMA<br>Lower Slopes IBRA Subregion<br>KP 449 – 466.5 | **Assessment 2**<br>Central West CMA<br>Lower Slopes IBRA Subregion<br>KP 466 – 509 | **Assessment 3**<br>Central West CMA<br>Bogan Macquarie IBRA Subregion<br>KP 508.5 – 555.5 | | |
| cotton pygmy-goose<br>*Nettapus coromandelianus*<br>(Endangered – TSC Act) | × | × | × | No | Cotton pygmy-goose was not recorded within the Development Site despite thorough fauna surveys undertaken in accordance with the seasonal requirements for this species. The closest record of the species occurs approximately 200 km to the north-west of the Development Site within the Macquarie Marshes Nature Reserve (OEH 2016d). The Development Site does not intersect any freshwater lakes or lagoons that provide the required habitat for the species. This species is not likely to occur in the Development Site and will not be impacted by the proposal. |
| black-necked stork<br>*Ephippiorhynchus asiaticus*<br>(Endangered – TSC Act) | × | × | × | No | Black-necked stock was not recorded within the Development Site despite thorough fauna surveys undertaken in accordance with the seasonal requirements for this species. The closest record of the species occurs approximately 50 km to the west of the Development Site along the Bogan River near Dandaloo (OEH 2016d). The Development Site does not intersect any floodplain wetlands that are required habitat for the species. This species is not likely to occur in the Development Site and will not be impacted by the proposal. |

| Species Name | Predicted in the BBCC | | | Impacted by the Proposal^ | Justification |
|---|---|---|---|---|---|
| | **Assessment 1**<br>Lachlan CMA<br>Lower Slopes IBRA Subregion<br>KP 449 – 466.5 | **Assessment 2**<br>Central West CMA<br>Lower Slopes IBRA Subregion<br>KP 466 – 509 | **Assessment 3**<br>Central West CMA<br>Bogan Macquarie IBRA Subregion<br>KP 508.5 – 555.5 | | |
| Australasian bittern<br>*Botaurus poiciloptilus*<br>(Endangered – TSC and EPBC Acts) | × | ✓ | × | No | Australasian bittern was not recorded within the Development Site despite thorough fauna surveys undertaken in accordance with the seasonal requirements for this species. The closest record of the species occurs approximately 30 km to the north of the Development Site along the Macquarie River north of Narromine (OEH 2016d). The Development Site does not contain any permanent freshwater wetlands with tall, dense fringing vegetation, which is required habitat for the species. This species is not likely to occur in the Development Site and will not be impacted by the proposal. |
| black-breasted buzzard<br>*Hamirostra melanosternon*<br>(Vulnerable – TSC Act) | × | ✓ | ✓ | No | Black-breasted buzzard was not recorded within the Development Site despite thorough fauna surveys undertaken in accordance with the seasonal requirements for this species. The closest record of the species occurs approximately 80 km to the east of the Development Site near Wellington (OEH 2016d). This species is not likely to occur in the Development Site and will not be impacted by the proposal. |

| Species Name | Predicted in the BBCC | | | Impacted by the Proposal^ | Justification |
|---|---|---|---|---|---|
| | **Assessment 1**<br>Lachlan CMA<br>Lower Slopes IBRA Subregion<br>KP 449 – 466.5 | **Assessment 2**<br>Central West CMA<br>Lower Slopes IBRA Subregion<br>KP 466 – 509 | **Assessment 3**<br>Central West CMA<br>Bogan Macquarie IBRA Subregion<br>KP 508.5 – 555.5 | | |
| red-backed button-quail<br>*Turnix maculosus*<br>(Vulnerable – TSC Act) | × | × | ✓ | No | Red-backed button-quail was not recorded within the Development Site despite thorough fauna surveys undertaken in accordance with the seasonal requirements for this species. The closest record of the species occurs approximately 300 km to the south-east of the Development Site within Blue Mountains National Park (OEH 2016d). This species is not likely to occur in the Development Site and will not be impacted by the proposal. |
| grey falcon<br>*Falco hypoleucus*<br>(Endangered – TSC Act) | ✓ | ✓ | ✓ | No | Grey falcon was not recorded within the Development Site despite thorough fauna surveys undertaken in accordance with the seasonal requirements for this species. The closest record of the species occurs approximately 80 km to the north-east of the Development Site near Breelong National Park (OEH 2016d). This species is not likely to occur in the Development Site and will not be impacted by the proposal. |
| barking owl<br>*Ninox connivens*<br>(breeding habitat only)<br>(Vulnerable – TSC Act) | × | × | × | No | Barking owl was not recorded within the Development Site despite thorough fauna surveys undertaken in accordance with the seasonal requirements for this species. The closest record of the species occurs within 300 metres to the east of the Development Site near Peak Hill in 1993 (OEH 2016d). Breeding habitat for this species includes living or dead trees with hollows >20 cm diameter that are > 4 m above the ground (OEH 2016b). 20 hollow-bearing trees that match this description were recorded within the Development Site, however no signs of use |

| Species Name | Predicted in the BBCC | | | Impacted by the Proposal^ | Justification |
|---|---|---|---|---|---|
| | **Assessment 1**<br>Lachlan CMA<br>Lower Slopes IBRA Subregion<br>KP 449 – 466.5 | **Assessment 2**<br>Central West CMA<br>Lower Slopes IBRA Subregion<br>KP 466 – 509 | **Assessment 3**<br>Central West CMA<br>Bogan Macquarie IBRA Subregion<br>KP 508.5 – 555.5 | | |
| | | | | | by owl species (such as white wash and pellets) was recorded at these hollow sites. The habitat within the Development Site is substantially degraded and the most recent record of the species in the local area is greater than 20 years old. This species is not likely to occur in the Development Site and will not be impacted by the proposal. |
| superb parrot<br>*Polytelis swainsonii*<br>(breeding habitat only)<br>(Vulnerable – TSC and EPBC Acts) | × | × | × | No | Superb parrot was recorded on three occasions within the Development Site during surveys undertaken for this assessment (refer to **Figures A18** and **A26**). Four individuals were recorded within the Development Site 1-4 km to the south of Peak Hill in May 2016 and two individuals were recorded approximately 25 km north of Peak Hill in October 2014. The species has also been widely recorded between Parkes and Narromine (OEH 2016d). Breeding habitat for this species includes hollows more than 60 mm in diameter that are located more than 4 metres above ground (OEH 2016b). The national recovery plan for the species (Baker-Gabb 2011) identifies Blakely's red gum (*Eucalyptus blakelyii*) as the most important tree species for breeding for this species in the south western slopes bioregion, with most breeding events confined to this tree species. Blakely's red gum was not recorded in the Development Site and therefore breeding habitat is not considered likely to occur. Potential breeding habitat for this species is not likely to be impacted by the proposal. |

| Species Name | Predicted in the BBCC | | | Impacted by the Proposal^ | Justification |
|---|---|---|---|---|---|
| | **Assessment 1**<br>Lachlan CMA<br>Lower Slopes IBRA Subregion<br>KP 449 – 466.5 | **Assessment 2**<br>Central West CMA<br>Lower Slopes IBRA Subregion<br>KP 466 – 509 | **Assessment 3**<br>Central West CMA<br>Bogan Macquarie IBRA Subregion<br>KP 508.5 – 555.5 | | |
| regent honeyeater<br>*Anthochaera phrygia*<br>(Critically Endangered – TSC and EPBC Acts) | ✓ | × | × | No | The regent honeyeater was not recorded within the Development Site despite thorough fauna surveys (including targeted winter bird surveys in 2015) undertaken in accordance with the seasonal requirements for this species. The Development Site contains two known foraging tree species (according to the approved National Recovery Plan (DoE 2016c)). The closest record of the species occurs approximately 30 km to the east of the Development Site near Dubbo (OEH 2016d). The habitat within the Development Site is substantially degraded and the closest record of the species in the local area is approximately 30 km from the Development Site. This species is not likely to occur in the Development Site and will not be impacted by the proposal. |

| Species Name | Predicted in the BBCC | | | Impacted by the Proposal^ | Justification |
|---|---|---|---|---|---|
| | **Assessment 1**<br>Lachlan CMA<br>Lower Slopes IBRA Subregion<br>KP 449 – 466.5 | **Assessment 2**<br>Central West CMA<br>Lower Slopes IBRA Subregion<br>KP 466 – 509 | **Assessment 3**<br>Central West CMA<br>Bogan Macquarie IBRA Subregion<br>KP 508.5 – 555.5 | | |
| brush-tailed phascogale<br>*Phascogale tapoatafa*<br>(Vulnerable – TSC Act) | ✓ | × | ✓ | No | Brush-tailed phascogale was not recorded within the Development Site despite thorough fauna surveys undertaken in accordance with the seasonal requirements for this species. The habitats within the Development Site are generally highly disturbed and in low condition due to surrounding agricultural practices and disturbance from the rail corridor. The closest record of the species occurs approximately 100 km to the east of the Development Site at Condobolin (OEH 2016d). This species is not likely to occur in the Development Site and will not be impacted by the proposal. |
| eastern pygmy-possum<br>*Cercartetus nanus*<br>(Vulnerable – TSC Act) | ✓ | ✓ | × | No | Eastern pygmy possum was not recorded within the Development Site despite thorough fauna surveys undertaken in accordance with the seasonal requirements for this species. The closest record of the species occurs approximately 30 km to the east of the Development Site within Goobang National Park (OEH 2016d). This species is not likely to occur in the Development Site and will not be impacted by the proposal. |

| Species Name | Predicted in the BBCC | | | Impacted by the Proposal^ | Justification |
|---|---|---|---|---|---|
| | **Assessment 1**<br>Lachlan CMA<br>Lower Slopes IBRA Subregion<br>KP 449 – 466.5 | **Assessment 2**<br>Central West CMA<br>Lower Slopes IBRA Subregion<br>KP 466 – 509 | **Assessment 3**<br>Central West CMA<br>Bogan Macquarie IBRA Subregion<br>KP 508.5 – 555.5 | | |
| squirrel glider<br>*Petaurus norfolcensis*<br>(Vulnerable – TSC Act) | ✓ | ✓ | ✓ | No | Squirrel glider was not recorded within the Development Site despite thorough fauna surveys undertaken in accordance with the seasonal requirements for this species. The closest record of the species occurs approximately 10 km to the east of the Development Site within Goobang National Park (OEH 2016d). This species is not likely to occur in the Development Site and will not be impacted by the proposal. |
| koala<br>*Phascolarctos cinereus*<br>(Vulnerable – TSC and EPBC Acts) | ✓ | ✓ | ✓ | Yes | Koala was not recorded within the Development Site despite thorough fauna surveys undertaken in accordance with the seasonal requirements for this species. The Development Site contains six known food tree species for this species (according to Appendix 2 of the Approved Recovery Plan (DECC 2008)) for the Western Slopes and Plains Koala Management Area. Four records of the species occur within 10 km of the Development Site (OEH 2016d). One koala was recorded approximately 500 metres from the Development Site as road kill on the Newell Highway. Another was recorded in remnant vegetation approximately 7 km south of the Development Site, while a third was recorded approximately 3.5 km to the east of the Development Site. Another record occurs approximately 8.5 km to the north-east of the Development Site between Narromine and Narromine East. These were all located in remnant vegetation. The Development Site is considered to contain potential habitat for the species in accordance with the TSPD. |

| Species Name | Predicted in the BBCC | | | Impacted by the Proposal^ | Justification |
|---|---|---|---|---|---|
| | **Assessment 1**<br>Lachlan CMA<br>Lower Slopes IBRA Subregion<br>KP 449 – 466.5 | **Assessment 2**<br>Central West CMA<br>Lower Slopes IBRA Subregion<br>KP 466 – 509 | **Assessment 3**<br>Central West CMA<br>Bogan Macquarie IBRA Subregion<br>KP 508.5 – 555.5 | | |
| | | | | | Further information is provided in **Section 3.3.2.3**. |
| grey-headed flying-fox<br>*Pteropus poliocephalus*<br>(Vulnerable – TSC and EPBC Acts) | × | × | × | No | Grey-headed flying-fox was not recorded within the Development Site despite thorough fauna surveys undertaken in accordance with the seasonal requirements for this species. The closest record of the species occurs approximately 25 km to the east of the Development Site near Dubbo (OEH 2016d) and no camps have been recorded in the locality (DoE 2016b). This species is not likely to occur in the Development Site and will not be impacted by the proposal. |
| large-eared pied bat<br>*Chalinolobus dwyeri*<br>(breeding habitat only)<br>(Vulnerable – TSC and EPBC Acts) | × | ✓ | × | No | Large-eared pied bat was not recorded within the Development Site despite thorough fauna surveys undertaken in accordance with the seasonal requirements for this species. The closest record of the species occurs approximately 50 km to the east of the Development Site near Dubbo (OEH 2016d). Targeted surveys, including Anabat echolocation recording surveys, did not detect the species roosting or moving within the bridges and culverts within the Development Site. Breeding and roosting habitat is not likely to be impacted by the proposal. |
| Sloane's froglet<br>*Crinia sloanei*<br>(Vulnerable – TSC Act) | ✓ | ✓ | ✓ | No | Sloane's froglet was not recorded within the Development Site despite thorough fauna surveys undertaken in accordance with the seasonal requirements for this species. The closest record of the species occurs approximately 20 km to the east of the Development Site within Goobang National Park (OEH 2016d). |

| Species Name | Predicted in the BBCC | | | Impacted by the Proposal^ | Justification |
|---|---|---|---|---|---|
| | **Assessment 1**<br>Lachlan CMA<br>Lower Slopes IBRA Subregion<br>KP 449 – 466.5 | **Assessment 2**<br>Central West CMA<br>Lower Slopes IBRA Subregion<br>KP 466 – 509 | **Assessment 3**<br>Central West CMA<br>Bogan Macquarie IBRA Subregion<br>KP 508.5 – 555.5 | | |
| | | | | | The habitat within the Development Site is substantially degraded and the closest record of the species in the local area is greater than 20 km from the Development Site. This species is not likely to occur in the Development Site and will not be impacted by the proposal. |

^ As entered into the 'Threatened Species Survey Results' tab in the BBCC.

### 3.3.2.3 Survey Results

One species-credit species was recorded in the Development Site during the surveys undertaken for this assessment, being the superb parrot (*Polytelis swainsonii*), however the habitat component for this species for which species credits are generated (breeding habitat) was not identified and is not considered likely to occur. Potential habitat for koala (*Phascolarctos cinereus*) was recorded during the surveys undertaken for this assessment and the species has been recorded in proximity to the Development Site on four occasions indicating that the species may utilise the habitat present in the Development Site as part of a broader home range or as part of a movement corridor across the landscape. The koala is discussed further below.

**Koala - *Phascolarctos cinereus***

The koala is listed as vulnerable under the TSC and EPBC Acts. This species 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.

The koala was not recorded within the Development Site despite thorough fauna surveys undertaken in accordance with the seasonal requirements for this species. The Development Site contains six known food tree species for this species (according to Appendix 2 of the Approved Recovery Plan (DECC 2008)) for the Western Slopes and Plains Koala Management Area, being:

Primary Food Tree Species

- river red gum (*Eucalyptus camaldulensis*)

Secondary Food Tree Species

- bimble box (*Eucalyptus populnea*)
- fuzzy box (*Eucalyptus conica*)
- western grey box (*Eucalyptus microcarpa*)
- yellow box (*Eucalyptus melliodora*)
- white box (*Eucalyptus albens*)

Four records of the species occur within 10 km of the Development Site (OEH 2016d). One koala was recorded approximately 500 metres from the Development Site as road kill on the Newell Highway in 1992 (OEH 2016d). Another was recorded in remnant vegetation approximately 7 km south of the Development Site, while a third was recorded approximately 3.5 km to the east of the Development Site. Another record occurs approximately 8.5 km to the north-east of the Development Site between Narromine and Narromine East. These were all located in remnant vegetation surrounded by extensive agricultural lands. The Development Site is considered to contain likely habitat for the species in accordance with the TSPD.

The predicted habitat for the koala is based on the extent of primary and secondary koala feed trees occurring within discrete vegetation communities within the Development Site (refer to **Table 3.9**). High quality habitat occurs in those communities that contain primary koala food trees, which are known to occur within riparian areas within the Development Site. Secondary koala food trees were recorded as a dominant canopy species in Western Grey Box Tall Grassy Woodland, Poplar Box Grassy Woodland, Fuzzy Box Woodland, White Box - White Cypress Pine - Western Grey Box Woodland and Yellow Box Grassy Tall

Woodland. Primary and secondary food trees are identified for the central west CMA in the NSW Recovery Plan for the Koala (*Phascolarctos cinereus*) (DECC 2008).

Remnant vegetation associated with rivers and creeks are likely to provide important corridors for the species within the highly modified and fragmented landscape in the western slopes and plains Koala Management Area (KMA). Approximately 0.87 hectares of primary koala habitat occurs within the Development Site and approximately 18.01 hectares of moderate quality habitat for the koala that includes one secondary koala food tree species has been mapped.

**Table 3.9 Area of Potential Koala Habitat Mapped within the Development Site**

| Koala Habitat/Vegetation Zone | Area in Development Footprint (ha) |
|---|---|
| **Vegetation Zone Containing Primary Feed Trees** | |
| PCT-36 River Red Gum Tall to very Tall Open Forest / Woodland_Moderate/Good | 0.87 |
| **Vegetation Zone Containing Secondary Feed Trees** | |
| PCT-76 Western Grey Box Tall Grassy Woodland_Moderate/Good | 8.58 |
| PCT-105 Poplar Box Grassy Woodland_Moderate/Good | 1.41 |
| PCT-201 Fuzzy Box Woodland_Moderate/Good | 1.50 |
| PCT-267 White Box - White Cypress Pine - Western Grey Box Woodland_Moderate/Good | 3.12 |
| PCT-276 Yellow Box Grassy Tall Woodland_Moderate/Good | 3.40 |
| **Total** | **18.88** |

### 3.3.2.4 Species Habitat Polygons

A species habitat polygon has been prepared for the koala which is summarised in **Table 3.10** below.

**Table 3.10 Species-credit Species Recorded or Assumed Present at the Development Site**

| Species | Area of Species Polygons (i.e. area of impact) | Able to Withstand Further Loss (according to the TSPD) | |
|---|---|---|---|
| | | Lachlan CMA | Central West CMA |
| koala<br>*Phascolarctos cinereus* | 18.88 ha | N/A | No loss of breeding habitat. No loss of foraging habitat within 500m of breeding habitat. Up to 10% loss of foraging habitat greater than 500m from breeding habitat. |

The species polygons were prepared:

- using the unit of measurement identified for those species in the Threatened Species Profile Database
- including the location of the species or areas likely occupied by the species
- containing the specific habitat feature associated with the species at the Development Site.

Due to the large scale of the proposal species polygons have not been presented in **Appendix A** however, the shape files for these polygons will be submitted to OEH.

# 4.0 Avoidance and Minimisation of Impacts

## 4.1 Avoidance

### 4.1.1 Site Selection

ARTC has commissioned a range of studies to guide the site selection for the proposal. Two major studies have been undertaken in relation to the development of an inland rail route between Melbourne and Brisbane. The first study, completed in 2006, considered potential corridors for the rail line to determine which route would deliver the best economic and financial outcome. This study identified that the 'far western corridor' through Parkes would be the best option.

The Melbourne-Brisbane Inland Rail Alignment Study (ARTC 2010) was finalised in 2010 and was prepared to determine the optimum alignment of the entire route in terms of operational, engineering and environmental factors. At each stage the options were analysed in sufficient detail to enable key decisions to be made and finally narrow the rail corridor options down to a single rail alignment. The successive stages of route analysis included:

- Inland rail route options – identification of a range of available route options. Environmental and land use assessments were undertaken along each route section.
- Identification of the route – evaluation of the route options and preliminary analysis of: Melbourne to Parkes; Parkes to Moree; and Moree to Brisbane.
- Analysis of the route – the route was analysed in terms of capital cost, environmental impacts and journey times as well as its preliminary economic and financial viability. Environmental constraints mapping was produced and survey data was obtained to assist with the alignment development.
- Development of the rail alignment – the rail alignment was developed considering environmental and engineering factors. Environmental risks were eliminated or minimised through consideration of local alternatives and moving the alignment to avoid significant constraints where possible.

For the Parkes to Narromine section of the Inland Rail, the proposed works only include upgrades to existing tracks as opposed to the construction of new track or work in greenfield sites. As a result, the overall disturbance footprint of the proposal is reduced through the use of the existing corridor. As the proposed works occur along or adjacent to the existing track, further positioning works to avoid native vegetation and habitat areas would only be possible in some cases. Conversely, these works would be primarily undertaken in the existing rail corridor that is regularly subject to disturbances relating to the rail corridor and surrounding agricultural activities and with relatively few important biodiversity features and habitats.

In light of this proposal utilising an existing corridor, this report identifies that some of the most significant environmental impacts of the proposal were those associated with vegetation removal required for construction of the railway and track upgrades. Identified impacts associated with the removal of vegetation included effects on threatened species, populations and ecological communities, the fragmentation of wildlife areas and habitats, and severance of wildlife (ARTC 2010).

Further information on proposal alternatives and options is outlined in Chapter 6 of the EIS.

### 4.1.2 Planning Phase

Ecological investigations were also undertaken during the constraints analysis phase to help to determine the potential impacts of the proposal. This facilitated the amendment of the design, where possible, to minimise potential impacts on threatened species, communities and their habitats.

The ecological investigations undertaken by Umwelt (2014) identified a range of key biodiversity constraints between the Parkes to Narromine section of the proposal. These investigations included database and literature reviews and rapid ecological field surveys of the rail corridor that included vegetation assessments, targeted inspections of bridge structures for micro-bats and rapid aquatic assessments. The investigations identified the presence of multiple threatened ecological communities (TECs) under the TSC and EPBC Acts occurring within and adjacent to the rail corridor. Fauna habitats, however, were found to be relatively limited due to the previous and ongoing disturbances within the rail corridor and extensive agricultural lands surrounding the Development Site.

Following these investigations, where works could be relocated outside of native vegetation (such construction compounds) these were to be located in primarily disturbed or exotic landscapes. However, in most cases there was little scope for further avoidance of ecological impacts for the construction of the proposal itself as the location of works is constrained by the location the existing rail line and the existing rail corridor.

Further mitigation measures are described in **Section 4.2** below with the aim of further minimising impacts.

### 4.1.3 Avoidance Summary

**Table 4.1** below outlines a summary of the avoidance measures that have been or will be implemented to minimise the impacts of the proposal.

**Table 4.1 Avoidance Measures**

| Action | Outcome | Timing | Responsibility |
|---|---|---|---|
| The Melbourne-Brisbane Inland Rail Alignment Study | • Identification of a preliminary proposal route<br>• Avoidance of native vegetation and habitat areas, where practicable | Site Selection | ARTC |
| Ecological constraints investigations | • Identification of areas of high conservation value<br>• Relocation of works outside native vegetation and habitat areas, where practicable<br>• Maximising disturbances within areas of low conservation value (exotic grasslands, disturbed areas) | Planning Phase | ARTC |
| Demarcation of areas approved for clearing, where practicable | • Minimisation of accidental clearing/disturbance of surrounding native vegetation | Construction | Construction contractor |

## 4.2 Mitigation Measures

### 4.2.1 Construction Phase

It is recommended that a strategy to mitigate adverse biodiversity impacts is implemented during the construction phase of the proposal. This includes specific measures to manage potential impacts on fauna species in the Development Footprint during vegetation clearing and construction of the proposal. Mitigation measures relative to the construction phase are outlined below and should be further detailed in a Construction Environmental Management Plan (CEMP) prepared for the proposal.

#### 4.2.1.1 Management of Arboreal Species and Habitat

A robust pre-clearance survey and tree-felling procedure should be implemented to minimise the potential for impacts on native fauna species (focusing on threatened species) as a result of the clearing of hollow-bearing trees and to avoid impacts on koalas. These management measures are designed to minimise impacts to hollow-dependent, roosting fauna and koalas.

The pre-clearance survey and tree-felling procedure are described below and should be documented in the CEMP.

**Pre-clearance Surveys**

Pre-clearance surveys should be implemented within areas of woody native vegetation that are to be cleared. Pre-clearance surveys should be undertaken by suitably qualified person and involve the following:

- the demarcation of areas approved for clearing to reduce risk of accidental clearing/disturbance of surrounding native vegetation where practicable
- the likely habitat resources and habitat trees should be identified and marked. Habitat trees are those containing hollows, cracks or fissures and spouts, active nests, dreys or other signs of recent fauna usage. Other habitat features to be identified include fallen timber/hollow logs and burrows
- 
- in areas of koala habitat, visual inspection of trees for koalas prior to clearing.

**Tree-felling Supervision**

Tree clearing should be completed as close to the completion of pre-clearance surveys as practicable to limit the potential for new issues to arise (such as new active nests being built), with the clearing of habitat resources and habitat trees to be supervised by a suitably qualified person or fauna handler after pre-clearance surveys have identified potential threatened species habitat. The suitably qualified person will be licensed by the relevant field survey and ethics authorities to allow for capture, housing, transport and possibly ethical euthanizing of injured fauna. The tree-felling procedure should include the following:

- The felling of non-habitat trees would be completed prior to the felling of habitat trees. All habitat trees would be vigorously shaken with heavy machinery the day prior to clearing. Note that the clearing of non-habitat trees does not require supervision by an ecologist or fauna handler
- On the day of habitat tree felling, the following is to be undertaken:
    - all habitat trees will be subject to a visual inspection to survey for threatened species

- trees previously identified as containing fauna or fauna habitat (such as hollows or nests) will be shaken and then felled, providing no threatened species are identified
- all reasonable attempts will be made to reduce the impact of felling on all fauna species.
- the lowering of hollow-bearing trees will be done as gently as possible with heavy machinery
- if a native fauna species is identified in a habitat tree on the day of felling, the supervising person is to advise the most appropriate method to minimise potential harm. This may include further shaking to encourage the animal to vacate the tree, soft-felling of the tree with the animal in the tree, or measures to capture and relocate the animal to secure habitats
- uninjured animals should be released on the day of capture into nearby suitable adjacent habitat and should not be held for extended periods of time, and
- injured animals will be taken to the nearest veterinary clinic or wildlife carer as soon as possible for assessment and treatment. If required, the suitably qualified person may ethically euthanize fauna.

- Following felling, habitat trees will be inspected for remaining or injured fauna species and to ensure that no hollows are blocked against the ground. This may require the tree to be rolled to ensure adequate access
- All felled habitat trees should remain in place for a least one night to allow any fauna still present to move on, and
- Habitat features identified for translocation or salvage operations should be extracted and stored appropriately.

#### 4.2.1.2 Management of Micro-bat Species and Habitat

**Culvert and Bridge Works Pre-clearance Surveys**

All culverts and bridges that are proposed to be removed should be subject to a pre-clearance survey to determine if they provide habitat for micro-bats.

Where potential habitat is identified, on the day prior to the disturbance of bridges or culverts with the potential to provide roosting habitat for micro-bats, a suitably qualified and experienced ecologist should undertake an inspection of the bridge to search for potential micro-bat roost sites under and within the culvert or bridge. If roosting bats are identified under and/or within the culvert or bridge, the bats should be left undisturbed until dusk. At dusk roosting bats can be captured and released nearby. Following removal or departure of all roosting bats the culvert or bridge crevices should be removed or blocked off (for example cover the entrance with shade cloth) prior to dawn the following morning.

Pre-clearance surveys should record the:

- roosting species (if identifiable)
- count/estimate of the number of roosting individuals
- location and time of relocation (if applicable) or other actions taken to discourage the roosting of micro-bat species under (or in) the culvert or bridge.

#### 4.2.1.3 Weed Control

Weed species could be inadvertently brought into the Development Site with imported materials, or could invade naturally through removal of native vegetation. The increased presence of weed species within the Development Site has the potential to decrease the value of retained vegetation to native species.

The following management measures should be undertaken to minimise the potential impacts and spread of weeds during the construction of the proposal:

- vehicles or equipment being brought onto the Development Site to be involved in ground disturbance activities and/or travelling around the site must be inspected and cleaned prior to commencing work to limit the spread of seeds and plant material between sites
- regular inspections will be undertaken in the Development Site to monitor the spread of weed species
- training of environmental personnel on the identification of target weed species.

Any outbreak of noxious weeds will be controlled and eradicated as required under the *Noxious Weeds Act 1993*, and as required by the Local Land Services and other relevant authorities. Weed control and eradication techniques may include:

- spraying with herbicides
- physical removal e.g. chipping, and/or
- minimisation of area available for weed infestation, through prompt revegetation of bare areas.

#### 4.2.1.4 Sediment and Erosion Control

When work is required within or adjacent to watercourses, appropriate erosion and sediment controls will be put in place in accordance with a soil and water management sub-plan (SWMP) to be developed for the proposal as outlined in the *ARTC Inland Rail – Parkes to Narromine Hydrology and Flooding Assessment* (GHD 2017).

There will also be specific erosion and sedimentation control plans developed throughout all stages of construction.

Designs for works within or near water bodies will be designed to provide for the retention of natural functions and maintenance of fish passage in accordance with NSW Fisheries Guidelines (2004) *Fish Friendly Waterway Crossings* and *Why do fish need to cross the road? Fish passage requirements for waterway crossings*

#### 4.2.1.5 General Biodiversity Mitigation Measures

A range of general biodiversity mitigation measures are recommended across the Development Site during the construction phase to minimise impacts to biodiversity values, including:

- employee education and training including inductions for staff, contractors and visitors to the site will be conducted to inform personnel of the biodiversity issues present at the site and so they know their role and responsibilities in relation to the protection and/or minimisation of impacts to native biodiversity

- areas of biodiversity value outside the Development Footprint will be fenced or signposted, where appropriate, to prevent the unnecessary disturbance during the construction phase
- noise, vibration and dust control as per Chapters 11, 12 and 13 of the EIS.

### 4.2.2 Operational Phase

It is recommended that a strategy to mitigate adverse biodiversity impacts is implemented during the operational phase of the proposal. This includes specific measures to minimise the potential impacts on the biodiversity of the Development Site and the locality.

#### 4.2.2.1 Ongoing Weed Management

As part of regular maintenance of the rail corridor, inspections of the Development Site should be undertaken for weed infestations and to assess the need for control measures in accordance with existing operational management procedures. These inspections will identify any weed infestations, the need for any control measures and the effectiveness of past weed control activities.

As outlined in **Section 4.2.2**, any outbreak of noxious weeds will be controlled and eradicated as required under the *Noxious Weeds Act 1993*, and as required by the Local Land Services and other relevant authorities. Noxious and other undesirable weed species (including WoNS) within the Development Site, such as African boxthorn (*Lycium ferocissimum*), silver-leaved nightshade (*Solanum elaeagnifolium*) and tiger pear (*Opuntia aurantiaca*), will be controlled to an acceptable level, and where possible eliminated. Weed control and eradication techniques may include:

- spraying with herbicides
- physical removal e.g. chipping, or
- minimisation of area available for weed infestation, through prompt revegetation of bare areas.

### 4.2.3 Mitigation Measures Summary

**Table 4.2** below provides a summary of the mitigation measures that are recommended before, during and after construction to minimise the impacts of the proposal.

**Table 4.2 Recommended Mitigation Measures**

| Action | Outcome | Timing | Responsibility |
|---|---|---|---|
| Demarcation of areas approved for clearing where practicable | • Minimisation of accidental clearing/disturbance of surrounding native vegetation | Construction | Construction contractor |
| Pre-clearance surveys | • Reduction of impacts to hollow-dependant fauna species<br>• Minimisation of impacts to koala<br>• Minimisation of impacts to micro-bat species<br>• Identification of habitat resources for translocation or salvage | Construction | Construction contractor |

| Action | Outcome | Timing | Responsibility |
|---|---|---|---|
| Tree-felling and bridge/culvert replacement supervision | • Relocation of captured fauna individuals into nearby suitable secure habitat<br>• Injured fauna individuals taken to a veterinary clinic or wildlife carer<br>• Translocation or salvage of habitat resources | Construction | Construction contractor |
| Weed control | • Minimisation of the spread of weeds within native vegetation (management of noxious weeds) | Construction<br>Operation | Construction contractor<br>ARTC |
| Erosion and sedimentation control | • Minimisation of erosion and sediment laden runoff into adjacent watercourses | Construction<br>Operation | Construction contractor |
| Fencing and impact site delineation | • Prevention of unnecessary disturbance of native vegetation and habitats | Construction | Construction contractor |
| Employee education and training | • Communication to employees on their role and responsibilities as it relates to biodiversity | Construction<br>Operation | Construction contractor<br>ARTC |

## 4.3 Direct Impacts unable to be Avoided

The construction and operation of the proposal will result in a range of direct impacts on biodiversity values within the Development Site. Direct impacts include the loss of native vegetation and fauna habitats as a result of direct and permanent clearance works and track upgrades and the location and extent of direct (permanent) impacts is shown on **Figure 4.1A** to **4.1E**.


Image Source: Google Earth (2013)
Data Source: Geoscience Australia (2009), Parsons Brinckerhoff (2014)

0 5 10 20km
1:500 000

**Legend**

- Development Site
- Temporary Impact Zone
- Permanent Impact Zone
- 550m Buffer Area

FIGURE 4.1

**Development Site Impact Parkes to Narromine**

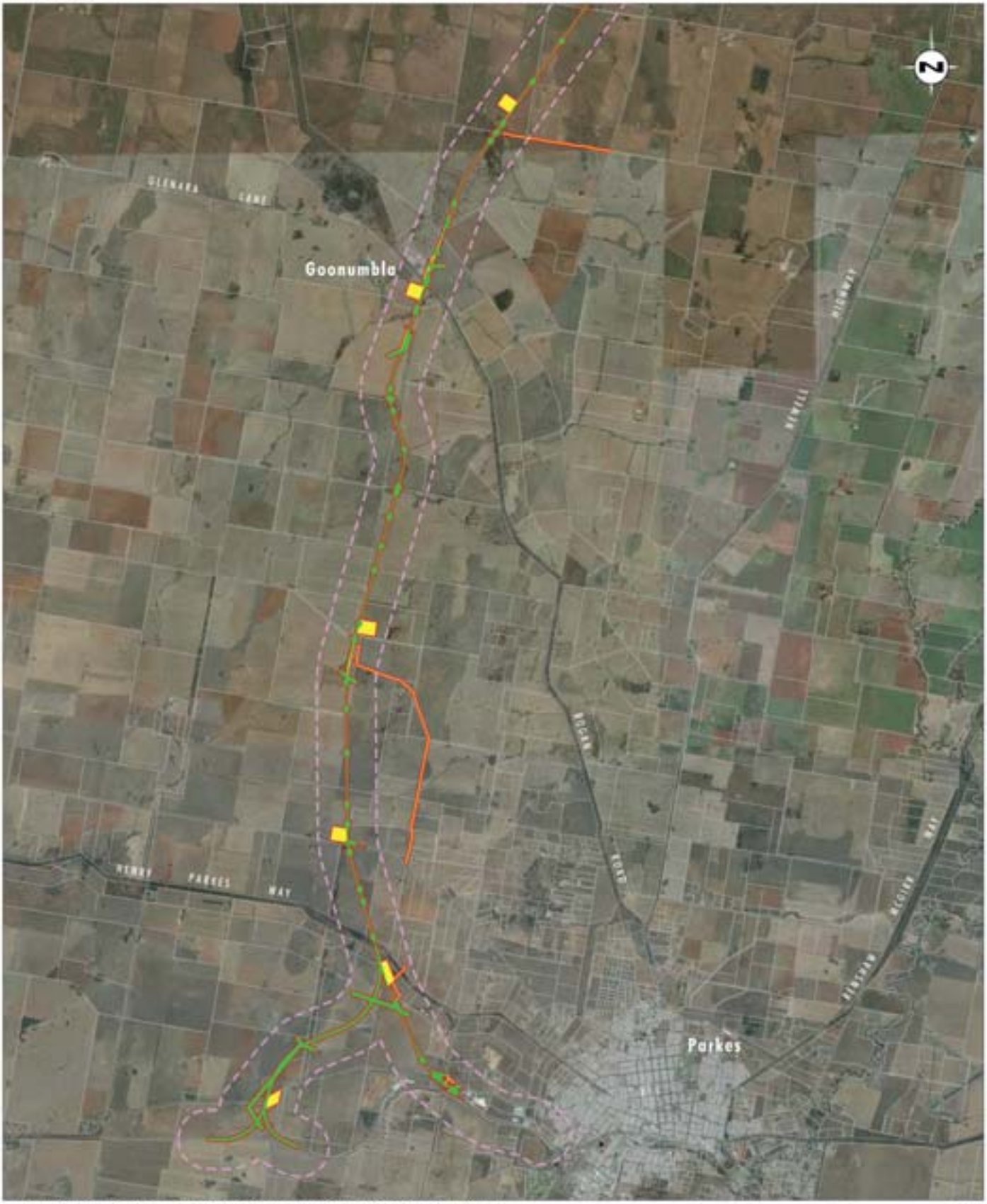


Image Source: Google Earth/CNES/Astrium/DigitalGlobe (Dec 2015)
Data Source: Geoscience Australia (2009), Parsons Brinckerhoff (2014)

0 1.0 2.5 5.0 km
1:100 000

**Legend**

- Development Site
- Temporary Impact Zone
- Permanent Impact Zone
- 550m Buffer Area

FIGURE 4.1A

**Development Site Impact Parkes to Narromine**


Image Source: Google Earth/CNES/Astrium/DigitalGlobe (Dec 2015)
Data Source: Geoscience Australia (2009), Parsons Brinckerhoff (2014)

0 1.0 2.5 5.0km
1:100 000

**Legend**

- Development Site
- Temporary Impact Zone
- Permanent Impact Zone
- 550m Buffer Area

FIGURE 4.1B

**Development Site Impact**
**Parkes to Narromine**


Image Source: Google Earth/CNES/Astrium/DigitalGlobe (Dec 2015)
Data Source: Geoscience Australia (2009), Parsons Brinckerhoff (2014)

0 1.0 2.5 5.0km
1:100 000

**Legend**

- Development Site
- Temporary Impact Zone
- Permanent Impact Zone
- 550m Buffer Area

FIGURE 4.1C

**Development Site Impact Parkes to Narromine**


Image Source: Google Earth/CNES/Astrium/DigitalGlobe (Dec 2015)
Data Source: Geoscience Australia (2009), Parsons Brinckerhoff (2014)

0 1.0 2.5 5.0km
1:100 000

**Legend**

- Development Site
- Temporary Impact Zone
- Permanent Impact Zone
- 550m Buffer Area

FIGURE 4.1D

**Development Site Impact Parkes to Narromine**

File Name (A4): R06/3606_071.dgn
20170501 13.44


Image Source: Google Earth/CNES/Astrium/DigitalGlobe (Dec 2015)
Data Source: Geoscience Australia (2009), Parsons Brinckerhoff (2014)

0 1.0 2.5 5.0 km
1:100 000

**Legend**

- Development Site
- Temporary Impact Zone
- Permanent Impact Zone
- 550m Buffer Area

FIGURE 4.1E

**Development Site Impact Parkes to Narromine**

The proposal would involve upgrading the existing rail line between Parkes and Narromine, including:

- upgrading the existing track and track formation
- replacement of culverts and bridges
- construction of new crossing loops, at Goonumbla, Peak Hill, and Timjelly
- rationalisation and upgrading of level crossings
- curve easing
- constructing the Parkes north west connection.

The following ancillary works would also be undertaken:

- changes to some property access roads and the local road network in some locations as a result of the rationalisation of level crossings
- stormwater drainage works
- upgrading signalling and communications
- establishing or upgrading existing fencing of the rail corridor
- relocation of some services and utilities

Detailed discussion of the works proposed as part of the proposal are included in **Section 1.1**.

**Table 4.3** below outlines the impact associated with the proposal as they were entered into the BBCC, which totals 75.78 hectares of direct impacts to native vegetation communities. Direct impacts have been focused, where possible, outside of native vegetation communities, with 579.71 hectares of cleared/non-native vegetation subject to direct impacts.

Avoidance and mitigation measures associated with minimising the impacts of these direct impacts are discussed in **Sections 4.1**and **4.2** above.

**Table 4.3 Direct and Permanent Impacts of the Proposal on Native Biodiversity Features**

| Ecological Feature | Area within the Development Site (ha) |
|---|---|
| **Plant Community Type** | |
| PCT26 (CW205, LA212) Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion[1]<br>*Moderate to Good* | 3.16 |
| PCT36 (CW183, LA193) River Red Gum tall to very tall open forest / woodland wetland on rivers on floodplains mainly in the Darling Riverine Plains Bioregion<br>*Moderate to Good* | 0.87 |

| Ecological Feature | Area within the Development Site (ha) |
|---|---|
| PCT36 (CW183, LA193) River Red Gum tall to very tall open forest / woodland wetland on rivers on floodplains mainly in the Darling Riverine Plains Bioregion<br>*Low_Regeneration* | 0.62 |
| PCT55 (CW104, LA105) Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions<br>*Moderate to Good* | 0.94 |
| PCT55 (CW104, LA105) Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions<br>*Moderate to Good_DNG* | 6.13 |
| PCT70 (CW220, LA223) White Cypress Pine woodland on sandy loams in central NSW wheatbelt<br>*Moderate to Good* | 1.54 |
| PCT76 (CW145, LA154) Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions[2]<br>*Moderate to Good* | 8.58 |
| PCT76 (CW145, LA154) Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions[3]<br>*Moderate to Good_DNG* | 23.64 |
| PCT244 (CW172, LA178) Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt)<br>*Moderate to Good* | 1.41 |
| PCT244 (CW172, LA178) Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt)<br>*Moderate to Good_DNG* | 1.20 |
| PCT201 (CW138, LA145) Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion[4]<br>*Moderate to Good* | 1.50 |
| PCT267 (CW213, LA218) White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion[5]<br>*Moderate to Good* | 3.12 |
| PCT267 (CW213, LA218) White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion[5]<br>*Moderate to Good_DNG* | 9.35 |
| PCT276 (CW226, LA226) Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion[5]<br>*Moderate to Good* | 3.40 |

| Ecological Feature | Area within the Development Site (ha) |
|---|---|
| PCT276 (CW226, LA226) Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion[5]<br>*Moderate to Good_DNG* | 10.32 |
| **Total** | **75.78** |
| **Species-credit Species Habitats** | |
| Vegetation containing koala feed trees and vegetation types (as per the TSPD) for koala (*Phascolarctos cinereus*) | 18.88 ha |

1. 3.47 ha conforms to *Myall Woodland EEC* under the TSC Act and 0.99 ha conforms to *Weeping Myall Woodlands EEC* under the EPBC Act.
2. 7.33 ha conforms to *Inland Grey Box Woodland EEC* under the TSC Act and 9.44 ha conforms to *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC* under the EPBC Act.
3. Conforms to *Inland Grey Box Woodland EEC* under the TSC Act and *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC* under the EPBC Act.
4. Conforms to *Fuzzy Box Woodland EEC* under the TSC Act.
5. Conforms to *White Box – Yellow Box- Blakeley's Red Gum Woodland EEC* under the TSC Act and *White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland* CEEC under the EPBC Act.

## 4.4 Indirect and Temporary Impacts

### 4.4.1 Indirect Impacts

The proposal is not expected to result in any substantial indirect impacts on the biodiversity values of surrounding lands during the construction or operational phases of the proposal with the proposed controls in place (e.g. erosion and sediment controls, dust controls, noise controls). However, some minor indirect impacts associated with dust, noise, weeds and increased rail movements are likely to occur during the construction and operational phase of the proposal. This is further discussed in the sections below.

#### 4.4.1.1 Dust Impacts

Dust mpacts associated with the proposal are expected to be minor and include dust covering vegetation thereby reducing vegetation health and growth.

Appropriate dust controls would be implemented during the construction phase of the proposal to minimise dust generation and thereby minimise the potential for adverse dust impacts on biodiversity. These would include:

- the minimisation of vegetation clearance where it is not required
- timely rehabilitation of disturbed areas once construction works are complete, and
- dust suppression on access tracks and other construction areas to reduce vehicle generated dust emissions, where required.

With the planned controls in place and considering the nature of the construction program, dust impacts associated with both the consituction and operation phases of the proposal are considered unlikely to result in significant impacts on biodiversity.

#### 4.4.1.2 Noise Impacts

Construction and operational noise impacts have the potential to adversely impact fauna species. Potential impacts include noise disturbing the roosting and foraging behaviour of fauna species and reducing the occupancy of areas of suitable habitat. The proposed increase in rail movement would also increase noise generation along the rail corridor.

The design of the proposal would include measures to minimise the potential for adverse noise impacts. These include:

- the use of physical barriers such as earthen bunds and noise walls, where deemed required to attenuate operational noise, and
- equipment selection and maintenance to manage noise generation.

With the planned controls in place and considering the nature of the likely noise generation of the proposal associated with the consituction and operational phases of the proposal, noise impacts are considered unlikely to result in significant impacts on biodiversity.

#### 4.4.1.3 Increased Train Movements

Increased train movements during the operation of the proposal may result in adverse impacts on locally occurring fauna species, particularly terrestrial mobile species. Grain and freight train numbers are expected to increase from an existing approximate two to three trains per day to up to approximately 17 trains per day by 2040.

The increased train movements have the potential to result in an increase in train strikes on fauna species resulting in injury and death of native fauna. The rail corridor is managed in some places by agricultural fencing, however this is unlikely to impede fauna movement through the Development Site. Furthermore, the inclusion of fauna exclusion fencing to minimise train strike is not desirable due to the likely reduction in fauna movement and connectivity in the broader landscape.

The increase in train movements and train speed as a result of the operation of the proposal is likely to result in greater train strike impacts to terrestrial fauna species. However this impact is considered unlikely to result in the extinction of the local population of any threatened species likely to be affected by the increased train movements.

#### 4.4.1.4 Weed Encroachment

Weed species could be inadvertently brought into the Development Site with imported materials, or could invade naturally through removal of native vegetation. The presence of weed species within the Development Site has the potential to decrease the value of extant vegetation to native species, particularly threatened species. Mitigation measures outlined in **Sections 4.2.1.3** and **4.2.2.1** will minimise the potential for weed encroachment into surrounding areas around the Development Site.

### 4.4.2 Temporary Impacts

The construction of the proposal will result in temporary impacts relating to construction impacts associated with construction facilities such as compounds and temporary access tracks. Native vegetation occurring in these areas is not expected to be fully impacted (i.e. will not be cleared) but will be subject to some disturbance and is expected to recover. While the vegetation and habitats in these areas will be impacted in the short term, it is considered that these areas will regenerate following the completion of the construction phase of the proposal. As a result, these temporary impacts have not been included in the BBCC assessment. The location and extent of temporary impacts is shown on **Figure 4.1A** to **4.1E**.

To facilitate the regeneration of temporary impact locations, a rehabilitation strategy will be prepared as part of the CEMP.

Temporary impacts on native vegetation communities are outlined in **Table 4.4** below and total 35.26 hectares. Temporary impacts have been focused, where possible, outside of native vegetation communities, with 231.99 hectares of cleared/non-native vegetation subject to temporary impacts. It should be noted that while some temporary impacts occur in areas outside derived native grassland communities, no trees or shrubs in these areas will be cleared as a result of these impacts. As a result, temporary impacts will not affect any species-credit species habitats.

**Table 4.4 Temporary Impacts of the Proposal on Native Vegetation**

| Biometric Vegetation Type | Area within the Development Site (ha) |
|---|---|
| PCT26 (CW205, LA212) Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion<br>*Moderate to Good* | 0.31 |
| PCT36 (CW183, LA193) River Red Gum tall to very tall open forest / woodland wetland on rivers on floodplains mainly in the Darling Riverine Plains Bioregion<br>*Moderate to Good* | 0 |
| PCT36 (CW183, LA193) River Red Gum tall to very tall open forest / woodland wetland on rivers on floodplains mainly in the Darling Riverine Plains Bioregion<br>*Low_Regeneration* | 0 |
| PCT55 (CW104, LA105) Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions<br>*Moderate to Good* | 0.18 |
| PCT55 (CW104, LA105) Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions<br>*Moderate to Good_DNG* | 0.99 |
| PCT70 (CW220, LA223) White Cypress Pine woodland on sandy loams in central NSW wheatbelt<br>*Moderate to Good* | 0.41 |

| Biometric Vegetation Type | Area within the Development Site (ha) |
|---|---|
| PCT76 (CW145, LA154) Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions<br>*Moderate to Good* | 1.55 |
| PCT76 (CW145, LA154) Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions<br>*Moderate to Good_DNG* | 8.59 |
| PCT244 (CW172, LA178) Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt)<br>*Moderate to Good* | 1.97 |
| PCT244 (CW172, LA178) Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt)<br>*Moderate to Good_DNG* | 13.25 |
| PCT201 (CW138, LA145) Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion<br>*Moderate to Good* | 0.38 |
| PCT267 (CW213, LA218) White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion<br>*Moderate to Good* | 0.12 |
| PCT267 (CW213, LA218) White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion<br>*Moderate to Good_DNG* | 0.11 |
| PCT276 (CW226, LA226) Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion<br>*Moderate to Good* | 3.76 |
| PCT276 (CW226, LA226) Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion<br>*Moderate to Good_DNG* | 3.64 |
| **Total** | **35.26** |

# 5.0 Impact Summary

## 5.1 Impacts Not Requiring Further Assessment

Impacts not requiring further assessment under the FBA include areas of land without native vegetation. The Development Site contains 655.49 hectares of cleared land/non-native vegetation that will be removed as a result of the proposal that does not meet the definition of 'native vegetation' under the *Native Vegetation Act 2003*. This impact does not require further assessment under the FBA.

Due to the large scale of the proposal, a map of areas not requiring further assessment has not been presented in the report, however the shape files for these areas will be submitted to OEH.

## 5.2 Impacts Not Requiring Offset

Impacts on native vegetation not requiring offsets under the FBA include native vegetation that has a site value score of less than 17 and are not identified as an endangered or critically endangered ecological community, and/or associated with threatened species habitat (as represented by ecosystem credits).

Impacts on species and populations not requiring offsets under the FBA include threatened species habitat associated with a PCT that has a site value score of less than 17 or species or populations that are not threatened and do not form part of a EEC or CEEC.

A range of non-threatened flora and fauna species were recorded within the Development Site during the surveys undertaken for this assessment. These species do not require offsets under the FBA. As no PCTs within the Development Footprint have a site value score of less than 17 and are predicted to be habitat for threatened ecosystem species, all will require offsetting as discussed in **Section 5.3**.

## 5.3 PCTs and Threatened Species Requiring Offset

A range of PCTs, ecosystem-credit species and species-credit species were found to require offsetting as discussed in the sections below.

### 5.3.1 Ecosystem Credits

**Table 5.1** outlines the ecosystem-credit species requiring offset as a result of the proposal. These species are offset through the retirement of ecosystem credits (see Table 5.2) and do not generate individual offsetting requirements. The highest threatened species offset multiplier determines the credit requirements for the vegetation zones these species are predicted to occur in.

**Table 5.1 Ecosystem-credit species requiring offset as a result of the proposal**

| Common Name | Species Name | Threatened Species Offset Multiplier |
|---|---|---|
| barking owl | *Ninox connivens* | 3.0 |
| masked owl | *Tyto novaehollandiae* | 3.0 |
| Australian bustard | *Ardeotis australis* | 2.6 |

| Common Name | Species Name | Threatened Species Offset Multiplier |
|---|---|---|
| bush stone curlew | *Burhinus grallarius* | 2.6 |
| Kultarr | *Antechinomys laniger* | 2.6 |
| speckled warbler | *Chthonicola sagittata* | 2.6 |
| spotted-tailed quoll | *Dasyurus maculatus* | 2.6 |
| stripe-faced dunnart | *Sminthopsis macroura* | 2.6 |
| yellow-bellied sheathtail-bat | *Saccolaimus flaviventris* | 2.2 |
| Corben's long-eared bat | *Nyctophilus corbeni* | 2.1 |
| little pied bat | *Chalinolobus picatus* | 2.1 |
| brown treecreeper | *Climacteris picumnus* subsp. *Victoriae* | 2.0 |
| gang-gang cockatoo | *Callocephalon fimbriatum* | 2.0 |
| major Mitchell's cockatoo | *Lophochroa leadbeateri* | 1.9 |
| glossy black-cockatoo | *Calyptorhynchus lathami* | 1.8 |
| little lorikeet | *Glossopsitta pusilla* | 1.8 |
| red-tailed black-cockatoo | *Calyptorhynchus banksii* subsp. *samueli* | 1.8 |
| turquoise parrot | *Neophema pulchella* | 1.8 |
| hooded robin | *Melanodryas cucullata* subsp. *cucullata* | 1.7 |
| little eagle | *Hieraaetus morphnoides* | 1.4 |
| spotted harrier | *Circus assimilis* | 1.4 |
| square-tailed kite | *Lophoictinia isura* | 1.4 |
| Australian painted snipe | *Rostratula australis* | 1.3 |
| black-chinned honeyeater | *Melithreptus gularis* subsp. *Gularis* | 1.3 |
| brolga | *Grus rubicunda* | 1.3 |
| diamond firetail | *Stagonopleura guttata* | 1.3 |
| flame robin | *Petroica phoenicea* | 1.3 |
| freckled duck | *Stictonetta naevosa* | 1.3 |
| Gilbert's whistler | *Pachycephala inornata* | 1.3 |

| Common Name | Species Name | Threatened Species Offset Multiplier |
|---|---|---|
| grey-crowned babbler | *Pomatostomus temporalis* subsp. *temporalis* | 1.3 |
| magpie goose | *Anseranas semipalmata* | 1.3 |
| painted honeyeater | *Grantiella picta* | 1.3 |
| pied honeyeater | *Certhionyx variegatus* | 1.3 |
| scarlet robin | *Petroica boodang* | 1.3 |
| swift parrot | *Lathamus discolor* | 1.3 |
| varied sittella | *Daphoenositta chrysoptera* | 1.3 |

**Table 5.2** below outlines the PCTs to be impacted as a result of the proposal and the ecosystem credits required to offset those impacts. Maps of these PCTs are presented in **Appendix A**. The full Credit Calculator reports are included in **Appendix F**.

**Table 5.2 Plant Community Types Requiring Offset and the Total Ecosystem Credits Required**

| Vegeta -tion Zone | Plant Community Type | Total Area to be Impacted (ha) | Highest Threatened Species Offset Multiplier | Total Ecosystem Credits Required |
|---|---|---|---|---|
| 1 | PCT26 (CW205, LA212) Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion<br>*Moderate to Good* | 3.16 | 3.0 | 146 |
| 2 | PCT36 (CW183, LA193) River Red Gum tall to very tall open forest / woodland wetland on rivers on floodplains mainly in the Darling Riverine Plains Bioregion<br>*Moderate to Good* | 0.87 | 3.0 | 46 |
| 3 | PCT36 (CW183, LA193) River Red Gum tall to very tall open forest / woodland wetland on rivers on floodplains mainly in the Darling Riverine Plains Bioregion<br>*Low_Regeneration* | 0.62 | 3.0 | 8 |
| 4 | PCT55 (CW104, LA105) Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions<br>*Moderate to Good* | 0.94 | 3.0 | 49 |
| 5 | PCT55 (CW104, LA105) Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions<br>*Moderate to Good_DNG* | 6.12 | 3.0 | 293 |
| 6 | PCT70 (CW220, LA223) White Cypress Pine woodland on sandy loams in central NSW wheatbelt<br>*Moderate to Good* | 1.54 | 2.6 | 38 |
| 7 | PCT76 (CW145, LA154) Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions<br>*Moderate to Good* | 8.58 | 3.0 | 473 |

| Vegeta -tion Zone | Plant Community Type | Total Area to be Impacted (ha) | Highest Threatened Species Offset Multiplier | Total Ecosystem Credits Required |
|---|---|---|---|---|
| 8 | PCT76 (CW145, LA154) Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions<br>*Moderate to Good_DNG* | 23.48 | 3.0 | 556 |
| 9 | PCT244 (CW172, LA178) Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt)<br>*Moderate to Good* | 1.41 | 3.0 | 79 |
| 10 | PCT244 (CW172, LA178) Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt)<br>*Moderate to Good_DNG* | 1.20 | 3.0 | 35 |
| 11 | PCT201 (CW138, LA145) Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion<br>*Moderate to Good* | 1.50 | 3.0 | 70 |
| 12 | PCT267 (CW213, LA218) White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion<br>*Moderate to Good* | 3.12 | 3.0 | 169 |
| 13 | PCT267 (CW213, LA218) White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion<br>*Moderate to Good_DNG* | 0.46 | 3.0 | 16 |
| 14 | PCT276 (CW226, LA226) Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion<br>*Moderate to Good* | 3.40 | 3.0 | 235 |

| Vegeta -tion Zone | Plant Community Type | Total Area to be Impacted (ha) | Highest Threatened Species Offset Multiplier | Total Ecosystem Credits Required |
|---|---|---|---|---|
| 15 | PCT276 (CW226, LA226) Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion<br>*Moderate to Good_DNG* | 10.32 | 3.0 | 348 |
| **TOTAL** | | **66.72** | - | **2,561** |

### 5.3.2 Species Credits

**Table 5.3** below outlines the species-credit species to be impacted as a result of the proposal and the species credits required to offset those impacts. A full Credit Calculator report is included in **Appendix F**.

Due to the large scale of the proposal, species polygons have not been presented in **Appendix A**, however the shape files for these polygons will be submitted to OEH.

**Table 5.3 Species-credit Species Requiring Offset and the Species Credits Required**

| Common Name | Species Name | Threatened Species Offset Multiplier | Species Credits Required |
|---|---|---|---|
| koala | *Phascolarctos cinereus* | 2.6 | 491 |

## 5.4 Impacts on Biodiversity that Require Further Consideration

Under the FBA, certain impacts on biodiversity values may require further consideration by the consent authority. These are impacts that are considered to be complicated or severe and include:

- impacts on landscape features, being:
    - impacts that will reduce the width of vegetation in the riparian buffer zone bordering significant streams and rivers, important wetlands or estuarine areas, or
    - impacts that will prevent species movement along corridors that have been identified as providing significant biodiversity linkages across the state, and
- impacts on native vegetation that are likely to cause the extinction of an EEC/CEEC from an IBRA subregion or significantly reduce its viability, and
- impacts on critical habitat or on threatened species or populations that are likely to cause the extinction of a species or population from an IBRA subregion or significantly reduce its viability.

The proposal will not have an impact on any biodiversity features that would result in one or more of the above severe impacts.

Despite this, a range of threatened species and communities have been identified in OEH's submission of the SEARs that require further consideration. These are outlined in **Sections 5.4.1** and **5.4.2** below.

### 5.4.1 Impacts on Native Vegetation that Require Further Consideration

The following TECs were specifically identified in the SEARs as requiring further consideration in the BAR:

- *Fuzzy Box Woodland on alluvial Soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions* – EEC under the TSC Act.
- *White Box Yellow Box Blakely's Red Gum Woodland* – EEC under the TSC Act and CEEC under the EPBC Act.

- *Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions* - EEC under the TSC and EPBC Acts.

- *Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions*- EEC under the TSC and EPBC Acts.

**Table 5.4** below provides further information for the threatened ecological communities identified in the SEARs as requiring further consideration as per Section 9.2.4 of the FBA (OEH 2014a).

**Table 5.4 Impacts on Native Vegetation that Require Further Consideration as per the SEARs**

| *Fuzzy Box Woodland EEC* under the TSC Act | *White Box Yellow Box Blakely's Red Gum Woodland EEC* under the TSC Act and CEEC under the EPBC Act | *Myall Woodland EEC* under the TSC Act and *Weeping Myall Woodlands EEC* under the EPBC Act | *Inland Grey Box Woodland EEC* under the TSC Act and *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and DNG EEC* under the EPBC Act |
|---|---|---|---|
| **(a) the area and condition of the CEEC or EEC to be impacted directly and indirectly by the proposed development** | | | |
| • 1.88 hectares (1.50 ha permanent disturbance and 0.38 ha temporary disturbance) to be directly impacted by the proposal.<br>• This EEC occurs in small patches within the Development Site in Moderate to Good condition with a predominately native groundcover with occurrences of some exotic species likely due to existing disturbances in the rail corridor (refer to (refer to **Section 3.2.1.11**). | • 24.93 hectares (17.28 ha permanent disturbance and 7.63 ha temporary disturbance) of *White Box Yellow Box Blakely's Red Gum Woodland EEC* to be directly impacted by the proposal.<br>• 22.79 hectares (15.11 ha permanent disturbance and 7.63 ha temporary disturbance) of *White Box Yellow Box Blakely's Red Gum Woodland CEEC* to be directly impacted by the proposal.<br>• These TECs occur as several remnant patches within the Development Site in woodland and derived native grassland condition. Derived native grassland areas are devoid of canopy species likely due to historic clearing. Both condition classes are predominately native with minimal occurrences of exotic plant species (refer to **Sections 3.2.1.12** to **3.2.1.15**). | • 3.47 hectares (3.16 ha permanent disturbance and 0.31 ha temporary disturbance) of *Myall Woodland EEC* under the TSC Act to be directly impacted by the proposal.<br>• 0.99 hectares (all to be permanently disturbed) of *Weeping Myall Woodlands EEC* under the EPBC Act to be directly impacted by the proposal.<br>• These TECs occur as several small remnant or regenerating patches within the Development Site in Moderate to Good condition. There are varying levels of disturbance in these EECs due to the heavily disturbed rail corridor, historic clearing, infrastructure maintenance, mowing and weed spraying regimes as well as adjacent land uses (refer to **Section 3.2.1.1**). | • 39.39 hectares (30.29 ha permanent disturbance and 9.1 ha temporary disturbance) of *Inland Grey Box Woodland EEC* under the TSC Act to be directly impacted by the proposal.<br>• 41.51 (31.37 ha permanent disturbance and 10.14 ha temporary disturbance) hectares of *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and DNG EEC* under the EPBC Act to be directly impacted by the proposal.<br>• These TECs occur as several disturbed patches within the Development Site in woodland and derived native grassland condition. Derived native grassland areas are devoid of canopy species likely due to historic clearing. Both condition types are predominately native with some occurrences of exotic plant species (refer to **Sections 3.2.1.7** and **3.2.1.8**). |

| *Fuzzy Box Woodland EEC* under the TSC Act | *White Box Yellow Box Blakely's Red Gum Woodland EEC* under the TSC Act and CEEC under the EPBC Act | *Myall Woodland EEC* under the TSC Act and *Weeping Myall Woodlands EEC* under the EPBC Act | *Inland Grey Box Woodland EEC* under the TSC Act and *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and DNG EEC* under the EPBC Act |
|---|---|---|---|
| **(b) the extent and overall condition of the CEEC or EEC within an area of 1000 ha and then 10,000 ha surrounding the proposed development footprint.** | | | |
| According to the regional vegetation map Reconstructed and Extant Distribution of Native Vegetation in the Central West and Lachlan Catchment (DEC 2006) no vegetation communities equivalent to this EEC occur within a 1000 ha or 10,000 ha buffer area surrounding the Development Site. | According to the regional vegetation map Reconstructed and Extant Distribution of Native Vegetation in the Central West and Lachlan Catchment (DEC 2006) the vegetation communities Yellow Box Woodland and White Box – White Cypress Pine Woodland (both likely equivalent to the EEC/CEEC listings) mapped surrounding the Development Sites, comprising:<br>• 4 ha in 1000 ha buffer area.<br>• 94 hectares in the 10,000 ha buffer area.<br>It is noted that this regional mapping only includes the woodland form of the EEC/CEEC and not the derived native grassland component.<br>The remnant patches of this EEC/CEEC are generally scattered isolated occurrences in a largely agricultural landscape. The small and narrow patch sizes represent remnants with large edge affects and are likely to be in moderately disturbed condition. | According to the regional vegetation map Reconstructed and Extant Distribution of Native Vegetation in the Central West and Lachlan Catchment (DEC 2006) no vegetation communities equivalent to these EECs occur within a 1000 ha or 10,000 ha buffer area surrounding the Development Site. | According to the regional vegetation map Reconstructed and Extant Distribution of Native Vegetation in the Central West and Lachlan Catchment (DEC 2006) the vegetation community Inland Grey Box Woodland which is likely equivalent to these EECs was mapped surrounding the Development Sites, comprising:<br>• 17 ha in 1000 ha buffer area.<br>• 209 ha in the 10,000 ha buffer area.<br>It is noted that this regional mapping only includes the woodland form of these EECs and not the derived native grassland component.<br>The remnant patches of these EECs are generally scattered isolated occurrences in a largely agricultural landscape. The small and narrow patch sizes represent remnants with large edge affects and are likely to be in moderately disturbed condition. |
| **(c) an estimate of the extant area and overall condition of the CEEC or EEC remaining in the IBRA subregion after the impact of the proposed development has been taken into consideration** | | | |

| *Fuzzy Box Woodland EEC* under the TSC Act | *White Box Yellow Box Blakely's Red Gum Woodland EEC* under the TSC Act and CEEC under the EPBC Act | *Myall Woodland EEC* under the TSC Act and *Weeping Myall Woodlands EEC* under the EPBC Act | *Inland Grey Box Woodland EEC* under the TSC Act and *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and DNG EEC* under the EPBC Act |
|---|---|---|---|
| • Current mapping and literature does not provide an accurate estimate of the extant area of this TEC in the Lower Slopes and Bogan-Macquarie IBRA subregions.<br>• Less than 5% of *Fuzzy Box Woodland EEC* is estimated to remain compared to pre-European times due to past clearing.<br>• It is expected that the overall condition of *Fuzzy Box Woodland EEC* in the Lower Slopes and Bogan-Macquarie IBRA subregions is likely to be fragmented and subject to disturbances such as grazing and weed invasion.<br>• The impact of 1.88 hectares of this TEC represents a negligible reduction of the community across its national extent. | • Current mapping and literature does not provide an accurate estimate of the extant area of these TECs in the Lower Slopes and Bogan-Macquarie IBRA subregions.<br>• The estimated total current NSW extent of the *White Box Yellow Box Blakely's Red Gum Woodland EEC* under the TSC Act is approximately 4% of the pre-1750 extent in the South Western Slopes bioregion (DECCW 2010).<br>• The estimated total current national extent of the *White Box Yellow Box Blakely's Red Gum Woodland CEEC* under the EPBC Act is 416 325 hectares (TSSC 2006).<br>• It is expected that the overall condition of these TECs in the Lower Slopes and Bogan-Macquarie IBRA subregions would range from relatively good to highly degraded, and subject to disturbances such as grazing and weed invasion.<br>• The impact of 22.79 hectares of this community represents a reduction of approximately 0.005% of the community across its national extent. | • Current mapping and literature does not provide an accurate estimate of the extant area of these TECs in the Lower Slopes and Bogan-Macquarie IBRA subregions.<br>• Both the current and pre-European national extent of the ecological community are poorly known (TSSC 2008). Weeping Myall Woodlands have declined from an original extent in NSW of between 1,900, 000 ha and 3,300,000 ha to a current extent of between 190,000 ha and 330,000 ha.<br>• It is expected that the overall condition of these EECs in the Lower Slopes and Bogan-Macquarie IBRA subregions would range from small fragmented areas of good condition to highly degraded, and subject to disturbances such as overgrazing, weed invasion and pest outbreaks.<br>• The impact of up to 3.47 hectares of these TECs represents an extremely minor reduction of the community across its NSW extent. | • Current mapping and literature does not provide an accurate estimate of the extant area of these TECs in the Lower Slopes and Bogan-Macquarie IBRA subregions.<br>• A cumulative assessment of regional values in NSW indicates an overall decline of 85% from 1,532 000 ha to 236,000 ha.<br>• It is expected that the overall condition of these EECs in the Lower Slopes and Bogan-Macquarie IBRA subregions would range from relatively good to highly degraded, with remnants often containing an intact canopy but with the shrub and/or groundcovers degraded through grazing and pasture modification.<br>• The impact of up to 39.39 hectares (TSC Act) and 41.51 (EPBC Act) of this community represents a reduction of approximately 0.02% of the community across its NSW extent. |

| *Fuzzy Box Woodland EEC* under the TSC Act | *White Box Yellow Box Blakely's Red Gum Woodland EEC* under the TSC Act and CEEC under the EPBC Act | *Myall Woodland EEC* under the TSC Act and *Weeping Myall Woodlands EEC* under the EPBC Act | *Inland Grey Box Woodland EEC* under the TSC Act and *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and DNG EEC* under the EPBC Act |
|---|---|---|---|
| **(d) the development proposal's impact on:**<br>***(i) abiotic factors critical to the long-term survival of the CEEC or EEC. For example, will the impact lead to a reduction of groundwater levels or substantial alteration of surface water patterns?*** | | | |
| The proposal would be unlikely to adversely modify or destroy abiotic factors necessary for the long-term survival of these TECs in the locality. | | | |
| ***(ii) characteristic and functionally important species through impacts such as, but not limited to, inappropriate fire/flooding regimes, removal of understorey species or harvesting of plants*** | | | |
| The proposal will result in the removal of areas of *Fuzzy Box Woodland EEC* within the Development Site as described in the sections above. Where this disturbance will occur, the proposal will remove characteristic and functionally important species to the EEC. These include, but are not limited to, fuzzy box (*Eucalyptus conica*) and native groundcover species.<br>The proposal would be unlikely to impact these characteristic and functionally important species for this EEC outside the Development Site in the wider locality. | The proposal will result in the removal of areas of these TECs within the Development Site as described in the sections above. Where this disturbance will occur, the proposal will remove characteristic and functionally important species to the EEC. These include, but are not limited to, white box (*Eucalyptus albens*), yellow box (*Eucalyptus melliodora*) and a range of important native groundcover species as per the Species List for the EPBC Act Policy Statement (DEH 2006).<br>The proposal would be unlikely to impact these characteristic and functionally important species for this EEC outside the Development Site in the wider locality. | The proposal will result in the removal of areas of these TECs within the Development Site as described in the sections above. Where this disturbance will occur, the proposal will remove characteristic and functionally important species to the EEC. These include, but are not limited to, weeping myall (*Acacia pendula*) and native shrub and groundcover species.<br>The proposal would be unlikely to impact these characteristic and functionally important species for this EEC outside the Development Site in the wider locality. | The proposal will result in the removal of areas of these TECs within the Development Site as described in the sections above. Where this disturbance will occur, the proposal will remove characteristic and functionally important species to the EEC. These include, but are not limited to, grey box (*Eucalyptus microcarpa*) and native groundcover species.<br>The proposal would be unlikely to impact these characteristic and functionally important species for this EEC outside the Development Site in the wider locality. |

| *Fuzzy Box Woodland EEC* under the TSC Act | *White Box Yellow Box Blakely's Red Gum Woodland EEC* under the TSC Act and CEEC under the EPBC Act | *Myall Woodland EEC* under the TSC Act and *Weeping Myall Woodlands EEC* under the EPBC Act | *Inland Grey Box Woodland EEC* under the TSC Act and *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and DNG EEC* under the EPBC Act |
|---|---|---|---|
| ***(iii) the quality and integrity of an occurrence of the CEEC or EEC through threats and indirect impacts including, but not limited to, assisting invasive flora and fauna species to become established or causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants which may harm or inhibit growth of species in the CEEC or EEC.*** | | | |
| Weed invasion is one of the key mechanisms and indicators of degradation of this EEC. Weeds are known to be common in areas of *Fuzzy Box Woodland EEC* (NSWSC 2004). Although this EEC within the Development Site contains a predominantly native understorey, all sites recorded include some exotic groundcover species. The rail corridor is currently subject to the invasion of weed species. There is potential for the proposal to cause edge effects into these TECs surrounding the Development Site and facilitate the spread of invasive weed species.<br><br>The proposal is not expected to cause regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the surrounding extent of the EEC. | Weed invasion is one of the key mechanisms and indicators of degradation of these TECs. Weeds have invaded most of the remaining areas of the original pre-1750 extent of *Box Yellow Box Blakely's Red Gum Woodland EEC/CEEC*. Although these TECs within the Development Site contain a predominantly native understorey, all sites include some exotic groundcover. The rail corridor is currently subject to the invasion of weed species. There is potential for the proposal to cause edge effects into these TECs surrounding the Development Site and facilitate the spread of invasive weed species.<br><br>The proposal is not expected to cause regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the surrounding extent of these TECs. | Weed invasion is one of the key mechanisms and indicators of degradation of these TECs. These TECs are threatened by clearing and fragmentation associated with cropping, overgrazing by feral and domestic animals, pest outbreaks and weed invasion (NSWSC 2005). Although these TECs within the Development Site contain a predominantly native understorey, all sites include some exotic groundcover. The rail corridor is currently subject to the invasion of weed species. There is potential for the proposal to cause edge effects into these TECs surrounding the Development Site and facilitate the spread of invasive weed species.<br><br>The proposal is not expected to cause regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the surrounding extent of these TECs. | Weed invasion is one of the key mechanisms and indicators of degradation of these TECs. Weeds have invaded most of the remaining areas of the original pre-1750 extent of *Inland Grey Box Woodland EEC/CEEC*. Although these TECs within the Development Site contain a predominantly native understorey, all sites include some exotic groundcover. The rail corridor is currently subject to the invasion of weed species. There is potential for the proposal to cause edge effects into these TECs surrounding the Development Site and facilitate the spread of invasive weed species.<br><br>The proposal is not expected to cause regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the surrounding extent of these TECs. |

| *Fuzzy Box Woodland EEC* under the TSC Act | *White Box Yellow Box Blakely's Red Gum Woodland EEC* under the TSC Act and CEEC under the EPBC Act | *Myall Woodland EEC* under the TSC Act and *Weeping Myall Woodlands EEC* under the EPBC Act | *Inland Grey Box Woodland EEC* under the TSC Act and *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and DNG EEC* under the EPBC Act |
|---|---|---|---|
| **(e) direct or indirect fragmentation and isolation of an important area of the CEEC or EEC.** | | | |
| It is not considered that any of these TECs in the Development Site consists of an important area of the EEC as defined by the FBA (OEH 2014a). An important area comprises an area of the CEEC or EEC that is necessary for the entities' long-term persistence and recovery. This may include areas identified in recovery plans, and/or an area large in comparison to other stands of the CEEC or EEC or occurrences of the CEEC or EEC at the limit of the community's range. The occurrence of the EEC within the Development Site is unlikely to be necessary for the EEC's long-term persistence and recovery. These areas occur as already fragmented and disturbed patches within the rail corridor and do not constitute a large area in comparison with other stands of the EEC.<br><br>While the proposal will result in an increase in the level of fragmentation of this EEC at the local scale, the level of increase is considered negligible given the already highly fragmented nature of this EEC across the Development Site and region. | | | |
| **(f) the measures proposed to contribute to the recovery of the CEEC or EEC in the IBRA subregion.** | | | |
| As part of the proposal, a Biodiversity Offset Strategy will be prepared in accordance with the NSW *Biodiversity Offsets Policy for Major Projects* (OEH 2014a). This will require the identification of suitable land-based or non-land based offsets as outlined in this Policy.<br><br>In the case of land-based offsets, these may be located in the same or any adjoining IBRA subregion in which the development occurs. The establishment of a BioBank site, as per BBAM (2014b), will include specific management actions that must be carried out to maintain and improve these communities at the BioBank Site.<br><br>The proposed offset strategy for the proposal is discussed in **Section 6.0**. | | | |

### 5.4.2 Impacts on Threatened Species that Require Further Consideration

The following threatened species were specifically identified in the SEARs as requiring further consideration in the BAR:

- *Austrostipa wakoolica* – endangered under the TSC and EPBC Acts.
- spiny peppercress (*Lepidium aschersonii*) - vulnerable under the TSC and EPBC Acts.
- small purple-pea (*Swainsona recta*) - endangered under the TSC and EPBC Acts.
- silky Swainson-pea (*Swainsona sericea*) – vulnerable under the TSC Act.

**Table 5.5** below provides further information for the threatened species identified in the SEARs as requiring further consideration as per Section 9.2.5 of the FBA (OEH 2014a).

**Table 5.5 Impacts on Threatened Species that Require Further Consideration as per the SEARs**

| ***Austrostipa wakoolica*** | **Spiny peppercress** ***Lepidium aschersonii*** | **Small purple-pea** ***Swainsona recta*** | **Silky Swainson-pea** ***Swainsona sericea*** |
|---|---|---|---|
| **(a) the size of the local population directly and indirectly impacted by the development** | | | |
| *Austrostipa wakoolica* was not recorded within the Development Site despite thorough vegetation surveys undertaken in accordance with the seasonal requirements for this species. The habitats within the Development Site are highly disturbed and generally in low condition due to surrounding agricultural practices and disturbance from the rail corridor.<br><br>The closest record of the species occurs approximately 5 km to the east of the Development Site between Parkes and Bogan Gate (OEH 2016d).<br><br>No known populations of *Austrostipa wakoolica* occur within the Development Site and it is considered that the species will not be impacted as a result of the proposal. | Spiny peppercress was not recorded within the Development Site despite thorough vegetation surveys undertaken in accordance with the seasonal requirements for this species. The habitats within the Development Site are highly disturbed and generally in low condition due to surrounding agricultural practices and disturbance from the rail corridor.<br><br>The closest record of the species occurs approximately 50 km to the north of the Development Site near Eumungerie (OEH 2016d).<br><br>No known populations of spiny peppercress occur within the Development Site and it is considered that the species will not be impacted as a result of the proposal. | Small purple-pea was not recorded within the Development Site despite thorough vegetation surveys undertaken in accordance with the seasonal requirements for this species. The habitats within the Development Site are highly disturbed and generally in low condition due to surrounding agricultural practices and disturbance from the rail corridor.<br><br>The closest most recent record of the species occurs approximately 30 km to the north-west of the Development Site near Trangie (OEH 2016d).<br><br>No known populations of small purple-pea occur within the Development Site and it is considered that the species will not be impacted as a result of the proposal. | Silky Swainson-pea was not recorded within the Development Site despite thorough vegetation surveys undertaken in accordance with the seasonal requirements for this species. The habitats within the Development Site are highly disturbed and generally in low condition due to surrounding agricultural practices and disturbance from the rail corridor.<br><br>The two closest records of the species occur approximately 4 km to the south-east of the Development Site at Parkes, and approximately 25 km to the east of the Development Site; these records are from 1970 and 1947, respectively (OEH 2016d).<br><br>No known populations of small purple-pea occur within the Development Site and it is considered that the species will not be impacted as a result of the proposal. |

| ***Austrostipa wakoolica*** | **Spiny peppercress**<br>***Lepidium aschersonii*** | **Small purple-pea**<br>***Swainsona recta*** | **Silky Swainson-pea**<br>***Swainsona sericea*** |
|---|---|---|---|
| **(b) the likely impact (including direct and indirect impacts) that the development will have on the habitat of the local population, including but not limited to:**<br>***(i) an estimate of the change in habitat available to the local population as a result of the proposed development*** | | | |
| *Austrostipa wakoolica* grows 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. The Development Site contains areas near watercourses and open woodlands.<br><br>No known populations of *Austrostipa wakoolica* occur within the Development Site and no change in known habitat will occur as a result of the proposal. | Spiny peppercress grows on ridges of gilgai clays dominated by brigalow (*Acacia harpophylla*), belah (*Casuarina cristata*), buloke (*Allocasuarina luehmanii*) and grey box (*Eucalyptus microcarpa*). The Development Site contains areas dominated by belah and grey box.<br><br>No known populations of spiny peppercress occur within the Development Site and no change in known habitat will occur as a result of the proposal. | Small purple-pea occurs in woodlands and open forests dominated by Blakely's red gum (*Eucalyptus blakelyi*), yellow box (*Eucalyptus melliodora*), candlebark gum (*Eucalyptus rubida*) and long-leaf box (*Eucalyptus goniocalyx*). The Development Site contains areas consisting of yellow box and fragmented woodlands.<br><br>No known populations of small purple-pea occur within the Development Site and no change in known habitat will occur as a result of the proposal. | Silky Swainson-pea occurs in box-gum woodlands in the south western slopes. The Development Site contains areas including box-gum woodlands.<br><br>No known populations of silky Swainson-pea occur within the Development Site and no change in known habitat will occur as a result of the proposal. |

| *Austrostipa wakoolica* | **Spiny peppercress**<br>***Lepidium aschersonii*** | **Small purple-pea**<br>***Swainsona recta*** | **Silky Swainson-pea**<br>***Swainsona sericea*** |
|---|---|---|---|
| ***(ii) the proposed loss, modification, destruction or isolation of the available habitat used by the local population, and*** | | | |
| The proposal will remove a range of native vegetation communities within the Development Site including fragmented woodlands and derived native grassland. The majority of impacts will occur in cleared and non-native vegetation associated with the rail corridor.<br><br>No known habitat for *Austrostipa wakoolica* occurs within the Development Site and the proposal will not result in the loss, modification, destruction for isolation of habitat for the species. | The proposal will remove a range of native vegetation communities within the Development Site including fragmented woodlands and derived native grassland. The majority of impacts will occur in cleared and non-native vegetation associated with the rail corridor.<br><br>No known habitat for spiny peppercress occurs within the Development Site and the proposal will not result in the loss, modification, destruction for isolation of habitat for the species. | The proposal will remove a range of native vegetation communities within the Development Site including fragmented woodlands and derived native grassland. The majority of impacts will occur in cleared and non-native vegetation associated with the rail corridor.<br><br>No known habitat for small purple-pea occurs within the Development Site and the proposal will not result in the loss, modification, destruction for isolation of habitat for the species. | The proposal will remove a range of native vegetation communities within the Development Site including fragmented woodlands and derived native grassland. The majority of impacts will occur in cleared and non-native vegetation associated with the rail corridor.<br><br>No known habitat for silky Swainson-pea occurs within the Development Site and the proposal will not result in the loss, modification, destruction for isolation of habitat for the species. |
| ***(iii) modification of habitat required for the maintenance of processes important to the species' life cycle (such as in the case of a plant – pollination, seed set, seed dispersal, germination), genetic diversity and long-term evolutionary development.*** | | | |
| *Austrostipa wakoolica* flowers mainly in response to rain. Seed dispersal occurs mainly from wind, rain and flood events. Seeds are buried in the soil and believed to be viable for three to five years.<br><br>No known habitat for *Austrostipa wakoolica* occurs within the Development Site and the proposal will not result in the modification of habitat important to the species life cycle. | Spiny peppercress flowers from spring to autumn. The species occurs at some sites that are occasionally flooded, and shows some adaptation to the seasonal filling and drying of wetlands.<br><br>No known habitat for spiny peppercress occurs within the Development Site and the proposal will not result in the modification of habitat important to the species life cycle. | Small purple-pea plants die back in summer, with surviving rootstocks producing new shoots in autumn. The species is generally tolerant of fire, which also enhances germination by breaking the seed coat and reduces competition from other species.<br><br>No known habitat for small purple-pea occurs within the Development Site and the proposal will not result in the modification of habitat important to the species life cycle. | Silky Swainson-pea regenerates from seed after fire.<br><br>No known habitat for silky Swainson-pea occurs within the Development Site and the proposal will not result in the modification of habitat important to the species life cycle. |

| *Austrostipa wakoolica* | **Spiny peppercress**<br>***Lepidium aschersonii*** | **Small purple-pea**<br>***Swainsona recta*** | **Silky Swainson-pea**<br>***Swainsona sericea*** |
|---|---|---|---|
| **(c) the likely impact on the ecology of the local population:**<br>***(ii) for flora, address how the proposal is likely to affect the ecology and biology of any residual plant population that will remain post development including where information is available:***<br>***– pollination cycle***<br>***– seedbanks***<br>***– recruitment, and***<br>***– interactions with other species (e.g. pollinators, host species, mycorrhizal associations)*** | | | |
| No known habitat for *Austrostipa wakoolica* occurs within the Development Site. The proposal is unlikely to affect the ecology and biology of any residual population in the locality following the development of the proposal. | No known habitat for spiny peppercress occurs within the Development Site. The proposal is unlikely to affect the ecology and biology of any residual population in the locality following the development of the proposal. | No known habitat for small purple-pea occurs within the Development Site. The proposal is unlikely to affect the ecology and biology of any residual population in the locality following the development of the proposal. | No known habitat for silky Swainson-pea occurs within the Development Site. The proposal is unlikely to affect the ecology and biology of any residual population in the locality following the development of the proposal. |
| **(d) a description of the extent to which the local population will become fragmented or isolated as a result of the proposed development** | | | |
| *Austrostipa wakoolica* is not known to occur within the Development Site and is not expected to be impacted by the proposal. As a result the proposal will not fragment or isolate any known populations of this species. | Spiny peppercress is not known to occur within the Development Site and is not expected to be impacted by the proposal. As a result the proposal will not fragment or isolate any known populations of this species. | Small purple-pea is not known to occur within the Development Site and is not expected to be impacted by the proposal. As a result the proposal will not fragment or isolate any known populations of this species. | Silky Swainson-pea is not known to occur within the Development Site and is not expected to be impacted by the proposal. As a result the proposal will not fragment or isolate any known populations of this species. |

| *Austrostipa wakoolica* | Spiny peppercress<br>*Lepidium aschersonii* | Small purple-pea<br>*Swainsona recta* | Silky Swainson-pea<br>*Swainsona sericea* |
|---|---|---|---|
| **(e) the relationship of the local population to other population/populations of the species. This must include consideration of the interaction and importance of the local population to other population/populations for factors such as breeding, dispersal and genetic viability/diversity, and whether the local population is at the limit of the species' range** | | | |
| Local populations of *Austrostipa wakoolica* are known to the south and west of Parkes (OEH 2016d). The Development Site would be at the northern extent of the species known range, however *Austrostipa wakoolica* has not been recorded in the Development Site. Seed dispersal occurs mainly from wind, rain and flood events.<br><br>It is unlikely that the proposal will impede the ability of other populations to interact for dispersal and genetic viability or diversity. | Populations of spiny peppercress occur approximately 100 kilometres to the southwest of Parkes and 40 kilometres north of Narromine (OEH 2016d). The Development Site would not be at the limit of the species known range. The species has not been recorded in the Development Site.<br><br>It is unlikely that the proposal will impede the ability of other populations to interact for dispersal and genetic viability or diversity. | Local populations of small purple-pea occur approximately 80 kilometres to the northeast of Parkes and 30 kilometres northwest of Narromine (OEH 2016d). The Development Site would not be at the limit of the species known range. The species has not been recorded in the Development Site.<br><br>It is unlikely that the proposal will impede the ability of other populations to interact for dispersal and genetic viability or diversity. | Historic local populations of silky Swainson-pea are known to occur in Parkes and in a range of locations around the Development Site (OEH 2016d). The Development Site would not be at the limit of the species known range. The species has not been recorded in the Development Site.<br><br>It is unlikely that the proposal will impede the ability of other populations to interact for dispersal and genetic viability or diversity. |

| *Austrostipa wakoolica* | **Spiny peppercress**<br>***Lepidium aschersonii*** | **Small purple-pea**<br>***Swainsona recta*** | **Silky Swainson-pea**<br>***Swainsona sericea*** |
|---|---|---|---|
| **(f) the extent to which the proposed development will lead to an increase in threats and indirect impacts, including impacts from invasive flora and fauna, that may in turn lead to a decrease in the viability of the local population** | | | |
| Key threats for *Austrostipa wakoolica* include the invasion of weeds, grazing pressure and habitat reduction through clearing for agriculture and developments.<br><br>The proposal will result in the removal of a range of native vegetation communities and would be likely to exacerbate these threats if it occurred, however, no known habitat for *Austrostipa wakoolica* occurs within the Development Site. | Key threats for spiny peppercress include the invasion of weeds, grazing and loss of habitat through clearing for land development.<br><br>The proposal will result in the removal of a range of native vegetation communities and would be likely to exacerbate these threats if it occurred, however, no known habitat for spiny peppercress occurs within the Development Site. | Key threats for small purple-pea as described in the recovery plan include the invasion of weeds, grazing and loss of habitat through clearing for land development and inappropriate rail reserve maintenance.<br><br>The proposal will result in the removal of a range of native vegetation communities and would be likely to exacerbate these threats if it occurred, however, no known habitat for small purple-pea occurs within the Development Site. | Key threats for silky Swainson-pea include the invasion of weeds and loss of habitat through clearing for agriculture and infrastructure development.<br><br>The proposal will result in the removal of a range of native vegetation communities and would be likely to exacerbate these threats if it occurred, however, no known habitat for silky Swainson-pea occurs within the Development Site. |
| **(g) the measure/s proposed to contribute to the recovery of the species in the IBRA subregion.** | | | |
| As part of the proposal, ARTC is preparing a Biodiversity Offset Strategy in accordance with the NSW *Biodiversity Offsets Policy for Major Projects* (OEH 2014a). This will require the identification of suitable land-based or non-land based offsets as outlined in this Policy.<br><br>In the case of land-based offsets, these may be located in the same or any adjoining IBRA subregion in which the development occurs. The establishment of a BioBank site, as per BBAM (2014b), will include specific management actions that must be carried out to maintain and improve these communities at the BioBank Site.<br><br>The proposed offset strategy for the proposal is discussed in **Section 6.0**. | | | |

## 5.5 Seven Part Tests of Significance

Threatened species impact assessment is an integral part of environmental impact assessment. The objective of s. 5A of the EP&A Act, the *assessment of significance*, is to improve the standard of consideration afforded to threatened species, populations and ecological communities, and their habitats through the planning and assessment process, and to ensure that the consideration is transparent.

Although it is understood that the preparation of a BioBanking Assessment under the FBA supersedes the requirement to prepare Seven Part Tests, the Department of Planning and Environment (DPE) has advised that the requirements of Section 5A of the EP&A Act be considered in the BAR. The preparation of a BAR under the FBA addresses the components of the Seven Part Tests by use of the BBCC. A summary of the requirements of the Seven Part Tests of Significance and where they are addressed in the FBA Assessment is outlined in **Table 5.6** below.

**Table 5.6 Seven Part Tests of Significance and the FBA**

| Seven Part Test of Significance | Where Addressed in the FBA Process |
|---|---|
| a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction; | Threatened species (ecosystem-credit and species-credit) are predicted in the BBCC by the landscape features of the Development Footprint (native vegetation cover, IBRA regions, patch sizes, condition and plant community types) and assessed by the impact on these features.<br><br>Impacts requiring further consideration (Section 9.2 of the FBA (OEH 2014a) identify impacts on critically endangered threatened species, impacts that may cause the extinction of a species in a IBRA subregion and impacts that significantly reduce the viability of a species. |
| b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction | Endangered populations are predicted in the BBCC by the landscape features of the Development Footprint (native vegetation cover, IBRA regions, patch sizes, condition and plant community types) and assessed by the impact on these features.<br><br>Impacts requiring further consideration (Section 9.2 of the FBA (OEH 2014a) identify impacts that may cause the extinction of an endangered population in a IBRA subregion and impacts that significantly reduce the viability of a population. |
| c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed;<br><br>i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction; and<br><br>ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction; | Endangered ecological communities are predicted in the BBCC by the plant community types and biometric community types identified from the field surveys and entered into the BBCC.<br><br>Impacts requiring further consideration (Section 9.2 of the FBA (OEH 2014a) are identified as impacts on any critically endangered or endangered ecological community that may cause the extinction of the EEC/CEEC in a IBRA subregion or significantly reduce the viability of an EEC/CEEC. |

| Seven Part Test of Significance | Where Addressed in the FBA Process |
|---|---|
| d) in relation to the habitat of a threatened species, population or ecological community;<br>i. the extent to which habitat is likely to be removed or modified as a result of the action proposed;<br>ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and<br>iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality; | Habitat loss is assessed in the BBCC via the 'Site Values' tab and the loss in site value score entered for each vegetation zone.<br>Fragmentation of habitat is addressed as part of the 'Landscape Value' score including consideration of features before and after the development including per cent native vegetation cover, connectivity value and vegetation condition. The per cent cleared scores for the dominant Mitchell Landscape is also calculated in the 'Landscape Value' score.<br>Important habitat features are identified through determining geographic and habitat features relevant for particular species-credit species and the assessment of landscape features (such as riparian buffers, important wetlands and state or regionally significant biodiversity links).<br>The extent of habitat loss is ultimately determined by the measure of ecosystem credits and species credits calculated in the BBCC. |
| e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly); | Critical habitat is addressed under impacts that require further consideration by the consent authority (refer to Section 9.2 of the FBA (OEH 2014a)). |
| f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan; and | Recovery plans are not directly addressed in the FBA. Recovery plans have been prepared for superb parrot (*Polytelis swainsonii*) (Baker-Gabb 2011), koala (*Phascolarctos cinereus*) (DECC 2008) and White Box White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC (DECCW 2010). It is likely that the proposal would be inconsistent with any recovery plans prepared for the threatened species and/or communities impacted by the proposal as it relates to impacts on the CEEC and habitat for the species. However the proposal will not impede the implementation of these recovery plans.<br>If supplementary offsetting measures are used (as per Appendix B of the NSW Biodiversity Offset Policy for Major Projects) to offset species or communities impacted by projects, reference can be made to the key objectives and actions in the relevant recovery plans. |

| Seven Part Test of Significance | Where Addressed in the FBA Process |
|---|---|
| g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process. | Key threatening processes are not directly assessed under the FBA.<br><br>In this case, the proposal is likely to contribute to the following key threatening processes through the clearing of vegetation:<br><br>• Clearing of native vegetation (TSC Act and EPBC Acts)<br>• Loss of hollow-bearing trees (TSC Act)<br>• Removal of dead wood and dead trees (TSC Act)<br><br>The proposal may to contribute to the following key threatening processes through clearing of vegetation, edge effects and the operation of the proposal:<br><br>• Aggressive exclusion of birds by noisy miners (*Manorina melanocephala*) (TSC and EPBC Acts)<br>• Competition and grazing by the feral European rabbit (*Oryctolagus cuniculus*) (TSC and EPBC Acts)<br>• Predation by the European red fox (*Vulpes vulpes*) (TSC and EPBC Acts)<br>• Invasion of native plant communities by exotic perennial grasses (TSC Act).<br><br>While the proposal is considered likely to contribute to the function of the above key threatening processes, the proposal as a whole, or any component of the proposal would not be classified as a key threatening process. |

## 5.6 Impacts on Matters of National Environmental Significance

Under the Commonwealth EPBC Act, the approval of the Commonwealth Minister for the Environment is required for any action that may have a significant impact on matters of national environmental significance (MNES). These matters are:

- listed threatened species and communities
- migratory species protected under international agreements
- Ramsar wetlands of international importance
- the Commonwealth marine environment
- the Great Barrier Reef Marine Park
- World Heritage properties
- National Heritage places
- nuclear actions, and
- a water resource, in relation to coal seam gas development and large coal mining development.

A Referral to the Commonwealth Environment Minister was prepared and included assessments of significance for applicable MNES in accordance with the *Significant Impact Guidelines 1.1* (DoE 2013). Assessments of significance were undertaken for the following MNES:

- White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC
- Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC
- Weeping Myall Woodlands EEC
- painted honeyeater (*Grantiella picta*)
- superb parrot (*Polytelis swainsonii*)
- koala (*Phascolarctos cinereus*) (combined population of QLD, NSW and the ACT)
- south-eastern long-eared bat (*Nyctophilus corbeni*).

The Action (that is, the proposal as described in **Section 1.1**) was deemed to comprise a 'Controlled Action' by DoEE on 11 October 2016, due to the potential for significant impacts on the following matters protected under the EPBC Act:

- listed threatened species and communities (18 and 18A).

DoEE considers the proposed action is likely to have a significant impact on MNES, including but not limited to:

- the removal of up to 33.82 ha of critically endangered White Box-Yellow box Blakely's Red Gum Grassy Woodland and Derived Native Grassland ecological community
- the removal of up to 41.67 ha of endangered Grey Box (*Eucalyptus microcarpa*) Grassy woodlands and Derived Native Grasslands of South-eastern Australia
- the removal of over 60 ha of known foraging habitat for the Superb Parrot (*Polytelis swainsonil*), and
- the removal of approximately 15 ha of known foraging habitat for the Regent Honeyeater (*Anthochaera phrygia*), and Swift Parrot (*Lathamus discolor*).

The Department considers that *Tylophora linearis* may be present within the proposed action area and a significant impact on this species from the proposed action is possible.

The DoEE also determined that the action be assessed in accordance with the Bilateral agreement made under section 45 of the EPBC Act. Supplementary SEARs were issued on 8 November 2016 and a detailed response to each of the matters raised is provided in the *ARTC Inland Rail – Parkes to Narromine Commonwealth Matters Assessment* (Umwelt 2017a).

### 5.6.1 Summary of Commonwealth Matters Assessment

Based on the direct and permanent impacts associated with the proposal that are summarised in **Table 4.3** and the range of avoidance, mitigation and management measures described in **Section 4.0**, the proposal is not considered likely to result in a residual significant impact on threatened species and communities listed under the EPBC Act and detailed offsetting of the proposal in accordance with the DoEE Environmental Offsets Policy is not required. Despite this, TECs and threatened species habitats impacted by the proposal will be offset in accordance with the NSW FBA, as detailed in **Table 5.7**.

**Table 5.7 Summary of the Impacts of the Proposal on Relevant MNES**

| Matter of National Environmental Significance | Proposal Impact | Like-for-like Offset In accordance with NSW FBA |
|---|---|---|
| White Box Yellow Box – Blakely's Red Gum Woodland and Derived Native Grassland CEEC | The proposal will result in the permanent loss of 17.3 hectares of the CEEC, of which 6.52 hectares comprises woodland and 10.78 hectares of grassland. | Subject to the revision of credits as part of the detailed design process, 768 ecosystem credits will be retired to offset impacts to this CEEC, in accordance with the Programme Biodiversity Offset Strategy and the NSW FBA. |
| Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC | The proposal will result in the permanent loss of 31.53hectares of the EEC, of which 7.89 hectares comprises woodland and 23.64 hectares of derived native grasslands. | Subject to the revision of credits as part of the detailed design process, 1029 ecosystem credits will be retired to offset impacts to this EEC, in accordance with the Programme Biodiversity Offset Strategy and the NSW FBA. |
| *Tylophora linearis* | The habitats within the proposal area are generally highly disturbed and in low condition due to surrounding agricultural practices and disturbance from the rail corridor. *Tylophora linearis* was not recorded within the proposal area despite thorough vegetation surveys undertaken in accordance with the seasonal requirements for this species. The closest record of the species occurs approximately 10 km to the east of the proposal site within Goobang National Park (OEH 2016d). This species distribution is known to overlap with occurrences of White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC, which occurs in the proposal site and | Subject to the revision of credits as part of the detailed design process, 442 ecosystem credits will be retired to offset impacts to *White Box Yellow Box – Blakely's Red Gum Woodland* CEEC, which provides potential habitat for this species, in accordance with the Programme Biodiversity Offset Strategy and the NSW FBA. |

| Matter of National Environmental Significance | Proposal Impact | Like-for-like Offset In accordance with NSW FBA |
|---|---|---|
| | therefore there is potential for this species to occur (albeit low) in the proposal site. A *population* of the species (as described by the significant impact guidelines) is not expected to occur within the proposal area. | |
| Superb Parrot | Six superb parrots were recorded flying over the proposal site at two locations during targeted surveys. Four individuals were recorded within the proposal area 1-4 km to the south of Peak Hill in May 2016 and two individuals were recorded approximately 25 km north of Peak Hill in October 2014. The species has also been widely recorded between Parkes and Narromine (OEH 2016d). All of the vegetation communities identified in the proposal site are expected to provide potential foraging habitat, however potential breeding habitat is not expected to occur. The proposal will result in the permanent loss of approximately 66.72 hectares of native woodland and grassland communities that provide foraging habitat for the species. Blakely's red gum was not recorded in the proposal site and therefore breeding habitat is not likely to be impacted by the proposal. | Subject to the revision of credits as part of the detailed design process, 2,561 ecosystem credits will be retired to offset impacts to the habitat of this threatened species, in accordance with the Programme Biodiversity Offset Strategy and the NSW FBA. |
| Regent Honeyeater | The regent honeyeater was not recorded within the proposal area despite thorough general fauna surveys, as well as targeted surveys for the species in winter 2015, undertaken in accordance with the seasonal requirements for this species. The proposal area contains two known foraging tree species (according to the approved National Recovery Plan (DoE 2016c)). The closest record of the species occurs approximately 30 km to the east of the Proposal area near Dubbo (OEH 2016d). The habitat within the proposal site is substantially degraded. This species is considered to have a low likelihood of occurrence within the proposal site, however approximately 15.1 hectares of potential foraging habitat for the species will be directly impacted. | Subject to the revision of credits as part of the detailed design process, 877 ecosystem credits will be retired to offset impacts to habitat for this species, in accordance with the Programme Biodiversity Offset Strategy and the NSW FBA. |

| Matter of National Environmental Significance | Proposal Impact | Like-for-like Offset In accordance with NSW FBA |
|---|---|---|
| Swift Parrot | The swift parrot was not recorded within the proposal area despite thorough general fauna surveys, as well as targeted surveys for the species in winter 2015, undertaken in accordance with the seasonal requirements for this species undertaken throughout the proposal site. There are no known records of swift parrot within 10km of the proposal site. | Subject to the revision of credits as part of the detailed design process, 877 ecosystem credits will be retired to offset impacts to habitat for this species, in accordance with the Programme Biodiversity Offset Strategy and the NSW FBA. |

## 5.7 Environmental Values not Assessed under the FBA

As per Section 2.3 of the FBA (OEH 2014a), biodiversity values not considered under the FBA include marine mammals, wandering sea birds and biodiversity that are endemic to Lord Howe Island. None of these biodiversity values occur or have the potential to occur within the Development Site and as such have not been specifically assessed as part of this assessment.

In addition, the FBA does not assess the direct impacts of a proposal that are not associated with clearing of vegetation. Examples of these impacts include, but are not limited to:

- bird and bat strike associated with wind farm developments
- vehicle strike
- subsidence and cliff falls associated with mining developments
- downstream impacts on hydrology and environmental flows on surface vegetation and groundwater dependent ecosystems
- impacts on karst ecosystems.

The proposal will not involve impacts related to wind farms, mining developments or on karst ecosystems. It is likely that vehicle (train) strike will occur along the operational rail corridor. The impacts associated with increased train movements are outlined in **Section 4.4.1.3**. The potential impacts on groundwater dependent ecosystems and downstream impacts on hydrology and environmental flows on vegetation are outlined in the *ARTC Inland Rail – Parkes to Narromine Aquatic Ecology Assessment* (Umwelt, 2017b). As the proposal does not involve substantial excavations that are that likely to interfere significantly with groundwater, the risk of significant impacts to groundwater and groundwater dependent ecosystems is low.

## 5.8 Impacts on Aquatic Biodiversity

An assessment of the impacts of the proposal on aquatic species and communities has been prepared in the Aquatic Impact Assessment in Volume 3 of the EIS. A summary of the outcomes is provided below.

Twenty-five third order or higher streams occur within the proposal area. Analysis of key fish habitat values and sensitivity typing of the watercourses in combination with a literature review of fish community analysis by NSW DPI identifies that a number of these named watercourses have moderate or higher fish community value. The Mehi River and Gwydir River have both been identified as Class 1 Key Fish Habitat in accordance with DPI (Fisheries) guidelines.

A number of state and Commonwealth listed threatened fish species, endangered populations and TECs have been recorded or are predicted to occur in major watercourses within the Parkes and Narromine LGAs, however none are likely to occur in the watercourses within the proposal area due to a lack of preferred habitat. The proposed corridor intersects watercourses associated with the Bogan River that may be part of the *Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Darling River* downstream of Peak Hill and tributaries of Ridgey Creek that may be part of the *Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Lachlan River* both listed under the FM Act.

An assessment of significance of impact of the proposal on aquatic communities, threatened species and endangered populations identified that the proposal is unlikely to have an adverse impact, with the adoption of appropriately designed fish friendly crossing structures and other mitigation measures to further reduce impacts.

Potential groundwater dependent ecosystems (GDEs) in the Development Site are associated with the River Red Gum Forest along Burrill Creek and the Belah woodland at Tomingley Creek. Given that the works to culverts and bridges are not expected to significantly change local surface water flow regimes and the proposal will not require extraction of groundwater, the proposal is not expected to adversely impact these potential GDEs.

Further detail on this assessment is outlined in the Aquatic Impact Assessment in Volume 3 of the EIS.

# 6.0 Biodiversity Offset Strategy

ARTC is committed to delivering a Biodiversity Offset Strategy that appropriately compensates for the unavoidable loss of ecological values as a result of the proposal under the NSW *Biodiversity Offsets Policy for Major Projects* (OEH 2014a). Firstly, ARTC has, where possible, altered the proposal to avoid and minimise ecological impacts in the proposal planning stage, and a range of impact mitigation strategies have been included in the proposal to mitigate the impact on ecological values (refer to **Section 4.0**) prior to the consideration of offsetting requirements.

## 6.1 Biodiversity Credit Report

Full Credit Calculator reports for the proposal are included in **Appendix F**.

**Table 6.1** below provides a summary of the ecosystem and species credits that require offsetting as a result of the proposal based on the Development Footprint used for this assessment.

**Table 6.1 Ecosystem and Species Credits Generated at the Development Site**

| Name | Credits Required |
|---|---|
| **Ecosystem Credits** | |
| PCT26 (CW205, LA212) Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion | 146 |
| PCT36 (CW183, LA193) River Red Gum tall to very tall open forest / woodland wetland on rivers on floodplains mainly in the Darling Riverine Plains Bioregion | 54 |
| PCT55 (CW104, LA105) Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions | 342 |
| PCT70 (CW220, LA223) White Cypress Pine woodland on sandy loams in central NSW wheatbelt | 38 |
| PCT76 (CW145, LA154) Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions | 1,029 |
| PCT244 (CW172, LA178) Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt) | 114 |
| PCT201 (CW138, LA145) Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion | 70 |
| PCT267 (CW213, LA218) White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion | 185 |
| PCT276 (CW226, LA226) Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion | 583 |
| **Total** | **2,561** |
| **Species Credits** | |
| koala (*Phascolarctos cinereus*) | 491 |
| **Total** | **491** |

As detailed in **Table 6.1**, a total of 2,561 ecosystem credits and 491 species credits are required to offset the direct impacts of the proposal. The final credit generation for the proposal will be confirmed as an outcome of the detailed design process and the biodiversity offsetting for the proposal will be based on the final credit calculations. ARTC commits to the retirement of credits in accordance with the FBA and is developing a strategy to address the above offset requirement.

# 7.0 References


Anstis, M, (2002) Tadpoles of South-eastern Australia. Reed New Holland, Sydney.

Baker-Gabb, D. (2011). *National Recovery Plan for the Superb Parrot Polytelis swainsonii*. [Online]. Melbourne, Victoria: Department of Sustainability and Environment (DSE).

Barker, J, Grigg, G, C, & Tyler, M, J, (1995) *A Field Guide to Australian Frogs*. Surrey Beatty & Sons, Sydney.

BioBanking Credit Calculator (BBCC) (2016) (Major Project Assessment Type), online calculator tool, accessed July 2016.

Birdlife International (2015) Birdlife Taxonomic Checklist, Version 8.0, October 2015

Botanic Gardens Trust, (2016) *PlantNET* – The Plant Information Network System of Botanic Gardens Trust, Sydney, Australia (version 2.0). <http://plantnet.rbgsyd.nsw.gov.au> accessed February 2015.

Bureau of Meteorology (BoM) (2016) Weather data for Parkes and Narromine stations, < http://www.bom.gov.au/climate/data/index.shtml?bookmark=136> accessed May 2016.

Cogger, H, G. (2000) *Reptiles and Amphibians of Australia.* Reed Books, Chatswood.

Cronquist, A, (1981) An Integrated System of Classification of Flowering Plants. Columbia University Press, New York. Department of the Environment (2013) Significant Impact Guidelines 1.1 – Matters of National Environmental Significance.

Department of Environment and Climate Change (DECC) (2008) Approved Recovery Plan for the Koala (*Phascolarctos cinereus*), November 2008.

Department of Environment and Communities (DEC) (2006) Department of Environment and Conservation (DEC) (2004) *Threatened Species Survey and Assessment: Guidelines for development and activities (working draft)*, November 2004.

Department of Environment, Climate Change and Water (DECCW) (2010) National Recovery Plan for White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland. Department of Environment, Climate Change and Water NSW, Sydney.

Department of Primary Industries (DPI) (2004) Policy and Guidelines for Fish Friendly Waterway Crossings

Department of the Environment (DoE) (2013) Significant Impact Guidelines 1.1 – Matters of National Environmental Significance.

Department of the Environment (DoE) (2016a) Protected Matters Search Tool http://www.environment.gov.au/webgis-framework/apps/pmst/pmst.jsf accessed April 2016.

Department of the Environment (DoE) (2016b) National Flying-fox Monitoring Viewer < http://www.environment.gov.au/webgis-framework/apps/ffc-wide/ffc-wide.jsf>, accessed in May 2016.

Department of the Environment (2016c) National Recovery Plan for the Regent Honeyeater (*Anthochaera phrygia*). Commonwealth of Australia, 2016.

Department of the Environment and Heritage (DEH) (2006) White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland Ecological Community Species List, Appendix A of the EPBC

Act Policy Statement 3.5 for White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland Ecological Community

Department of the Environment, Heritage and the Arts (DEWHA) (2009) Weeping Myall Woodlands – A nationally threatened ecological community *Environment Protection and Biodiversity Conservation Act 1999* - Policy Statement 3.17.

GHD (2017) *ARTC Inland Rail – Parkes to Narromine Hydrology and Flooding Assessment*.

GHD (2014) Parkes to Narromine and Narrabri to North Star – MBIR Preliminary Contamination Assessment and Preliminary Soil and Water Management Plan.

Harden, G, J, editor, (1992) *Flora of New South Wales. Volume 3*. Royal Botanic Gardens Sydney & New South Wales University Press, Sydney.

Harden, G, J, editor, (1993) *Flora of New South Wales. Volume 4*. Royal Botanic Gardens Sydney & New South Wales University Press, Sydney.

Harden, G, J, editor, (2000) *Flora of New South Wales. Volume 1*. 2nd edition. New South Wales University Press and Royal Botanic Gardens, Sydney.

Harden, G, J, editor, (2002) *Flora of New South Wales. Volume 2*. Revised edition. Royal Botanic Gardens Sydney & New South Wales University Press, Sydney.

Landcom (2004) Managing Urban Stormwater – Soils and Construction, Volume 1, 4th Edition.

Menkhorst, P, and Knight, F, (2004) *A Field Guide to the Mammals of Australia*, Oxford University Press, South Melbourne.

NSW Scientific Committee (NSWSC) (2002) Final Determination to list *White Box Yellow Box Blakely's Red Gum Woodland* as an endangered ecological community, 15 March 2002.

NSW Scientific Committee (NSWSC) (2004) Final Determination to list *Fuzzy Box Woodland on alluvial soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions* as an endangered ecological community, 24 September 2004.

NSW Scientific Committee (NSWSC) (2005) Final Determination to list *Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South western Slopes bioregions* as an endangered ecological community, 15 July 2005.

NSW Scientific Committee (NSWSC) (2007) Final Determination to list *Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions* as an endangered ecological community, 27 April 2007.

Office of Environment and Heritage (OEH) (2014b) BioBanking Assessment Methodology, September 2014.

Office of Environment and Heritage (OEH) (2014a) Framework for Biodiversity Assessment – NSW Biodiversity Offsets Policy for Major Projects, September 2014

Office of Environment and Heritage (OEH) (2016a) Credit Calculator for Major Projects and BioBanking Operational Manual, February 2016.

Office of Environment and Heritage (OEH) (2016b) Threatened Species Profile Database (TSPD), accessed between April and July 2016

Office of Environment and Heritage (OEH) (2016c) Vegetation Information System (VIS) accessed between April and July 2016.

Office of Environment and Heritage (OEH) (2016d) BioNet Atlas of NSW Wildlife, accessed April 2016.

Office of Environment and Heritage (OEH) (2016e) NSW Guide to Surveying Threatened Plants, February 2016

Parsons Brinckerhoff, Aurecon and Halcrow (2010) Melbourne to Brisbane Inland Rail Alignment Study – Appendix H Preliminary Environmental Assessment, final report July 2010.

Phillips, S., and Callaghan, J. (2011) The Spot Assessment Technique: a tool for determining localised levels of habitat use by koalas *Phascolarctos cinereus*. *Australian Zoologist* 35: 774–780.

Pizzey, G. and Knight, F. (2012) The Field Guide to the Birds of Australia, Ninth Edition.

Reconstructed and Extant Distribution of Native Vegetation in the Central West and Lachlan Catchment

Robinson, M, (1998) *A Field Guide to Frogs of Australia*. Australian Museum/Reed New Holland, Sydney

Strahler, A. N., (1952) Hypsometric (area-altitude) analysis of erosional topography, *Geological Society of America Bulletin* 63 (11): 1117-1142.

Threatened Species Scientific Committee (TSSC) (2006a) White Box - Yellow Box - Blakely's Red Gum Grassy Woodlands and Derived Native Grasslands Listing Advice, registered 17 May 2006.

Threatened Species Scientific Committee (TSSC) (2008) Listing Advice for Weeping Myall Woodlands.

Threatened Species Scientific Committee (TSSC) (2010) Listing Advice for Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia.

Tonkinson, D. and Robertson, G. (2010) National Recovery Plan for the Red Swainson-pea *Swainsona plagiotropis*. Department of Sustainability and Environment, Victoria.

Travelling Stock Reserve Conservation Values spatial layer (Rural Lands Protection Board 2010)

Umwelt (2013). *Environmental Assessment Northparkes Step Change Project*. Prepared by Umwelt on behalf of Northparkes Mines.

Umwelt (Australia) Pty Limited (2014) Melbourne Brisbane Inland Rail Parkes to Narromine and Narrabri to North Star Ecological Investigations. Report prepared on behalf of Australian Rail Track Corporation.

Umwelt (2017a) Inland Rail Parkes to Narromine Commonwealth Matters Assessment. Report prepared on behalf of Australian Rail Track Corporation.

Umwelt (2017b) Inland Rail Parkes to Narromine Aquatic Ecology Assessment. Report prepared on behalf of Australian Rail Track Corporation.

Van Dyck, D. and Strahan, R. (2008) The Mammals of Australia, Third Edition, Reed New Holland Publishers, 2008.

Webster, R. (1988). *The Superb Parrot: a survey of the breeding distribution and habitat requirements*. Australian National Parks & Wildlife Service, Canberra.

Wheeler D, J, B, Jacobs S, W, L, and Whalley R, D, B, (2002) *Grasses of New South Wales*, 3rd Edition. The University of New England, Armidale.

Wilson, S, and Swan, G, (2008) *A Complete Guide to Reptiles of Australia*. Reed New Holland, Sydney.

# APPENDIX A

**Landscape, Survey and Results Figures**


Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

## Legend

- Development Site
- 550m Buffer Area
- Rail Line Kilometerage

FIGURE A1

**Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment**


Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

**Legend**

- Development Site
- 550m Buffer Area
- Mitchell Landscape Area
- Rail Line Kilometerage

FIGURE A2

**Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment**


Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

**Legend**

- Development Site
- 550m Buffer Area
- Mitchell Landscape Area
- Rail Line Kilometerage

FIGURE A3

**Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment**

File Name (A4): R06/3606_007.dgn
20160530 14.16


Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

**Legend**

- Development Site
- 550m Buffer Area
- Mitchell Landscape Area
- Rail Line Kilometerage

FIGURE A4

**Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment**

File Name (A4): R06/3606_008.dgn
20160719 15.30


Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

**Legend**

- Development Site
- 550m Buffer Area
- Mitchell Landscape Area
- Rail Line Kilometerage

FIGURE A5

**Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment**

File Name (A4): R06/3606_009.dgn
20160719 15.31


Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

**Legend**

- Development Site
- 550m Buffer Area
- Mitchell Landscape Area
- Rail Line Kilometerage

FIGURE A6

**Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment**

File Name (A4): R06/3606_010.dgn
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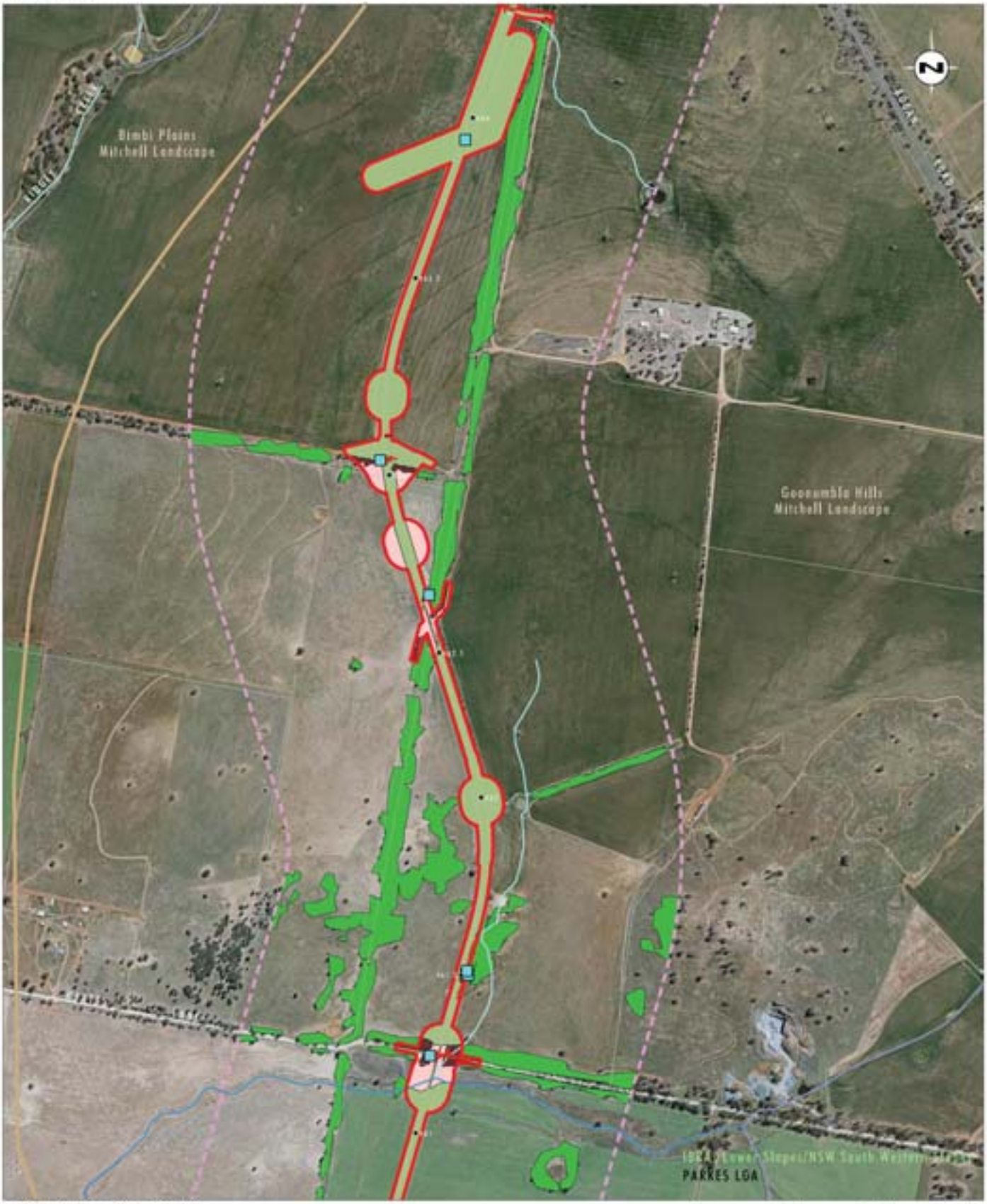



Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

## Legend

- Development Site
- 550m Buffer Area
- Mitchell Landscape Area
- Rail Line Kilometerage

FIGURE A7

**Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment**

File Name (A4): R06/3606_011.dgn
20160922 13.57

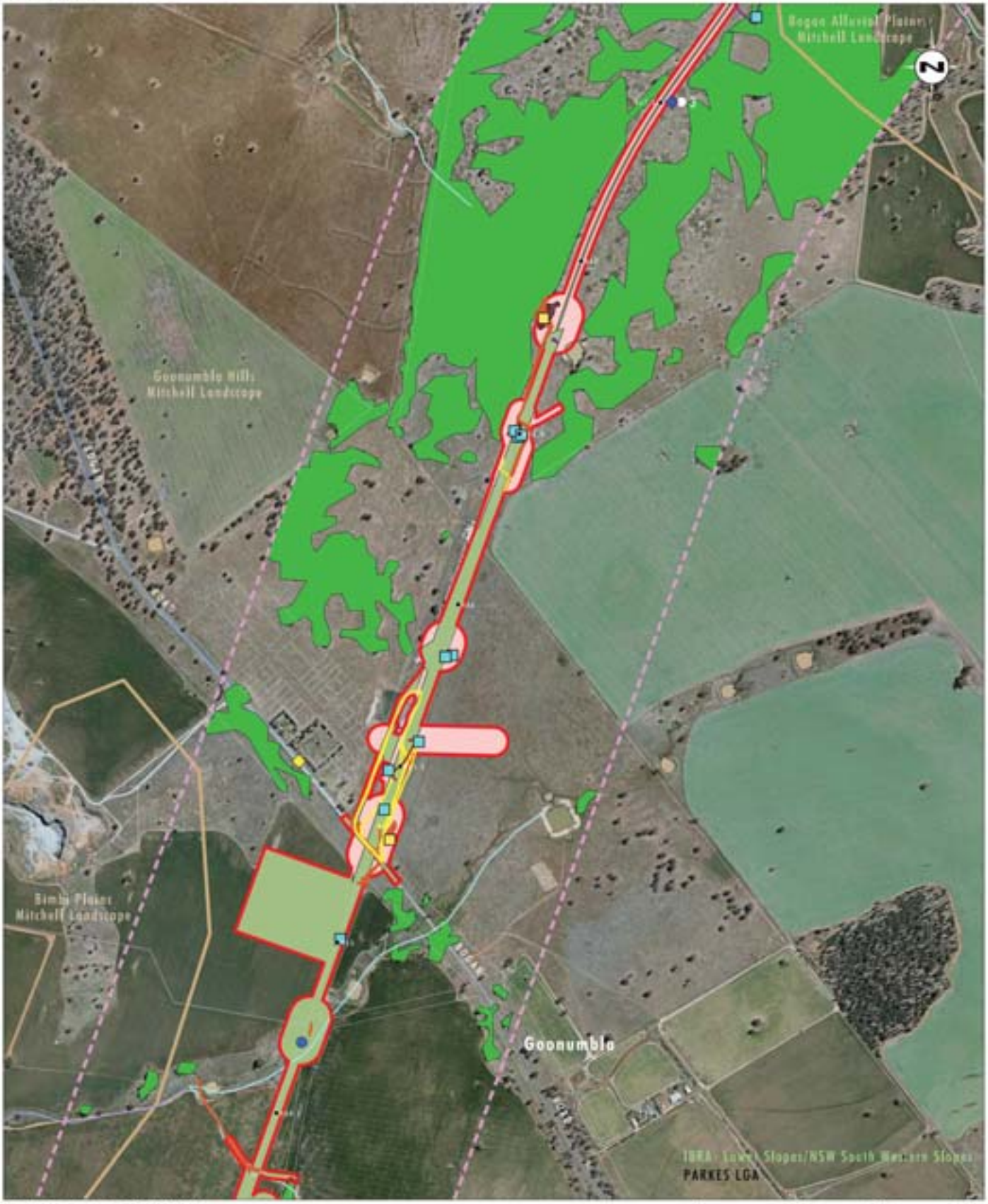



Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

**Legend**

- Development Site
- 550m Buffer Area
- Mitchell Landscape Area
- Rail Line Kilometerage

FIGURE A8

**Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment**

File Name (A4): R06/3606_012.dgn
20160922 14.27


Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

**Legend**

- Development Site
- 550m Buffer Area
- Mitchell Landscape Area
- Rail Line Kilometerage

FIGURE A9

**Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment**


Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

**Legend**

- Development Site
- 550m Buffer Area
- Mitchell Landscape Area
- Rail Line Kilometerage

FIGURE A10

**Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment**


Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

## Legend

- Development Site
- 550m Buffer Area
- Mitchell Landscape Area
- Rail Line Kilometerage

FIGURE A11

**Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment**

File Name (A4): R06/3606_015.dgn
20160922 14:29


Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

**Legend**

- Development Site
- 550m Buffer Area
- Mitchell Landscape Area
- Rail Line Kilometerage

FIGURE A12

**Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment**

File Name (A4): R06/3606_016.dgn
20160922 14.30


Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

**Legend**

- Development Site
- 550m Buffer Area
- Mitchell Landscape Area
- Rail Line Kilometerage

FIGURE A13

**Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment**

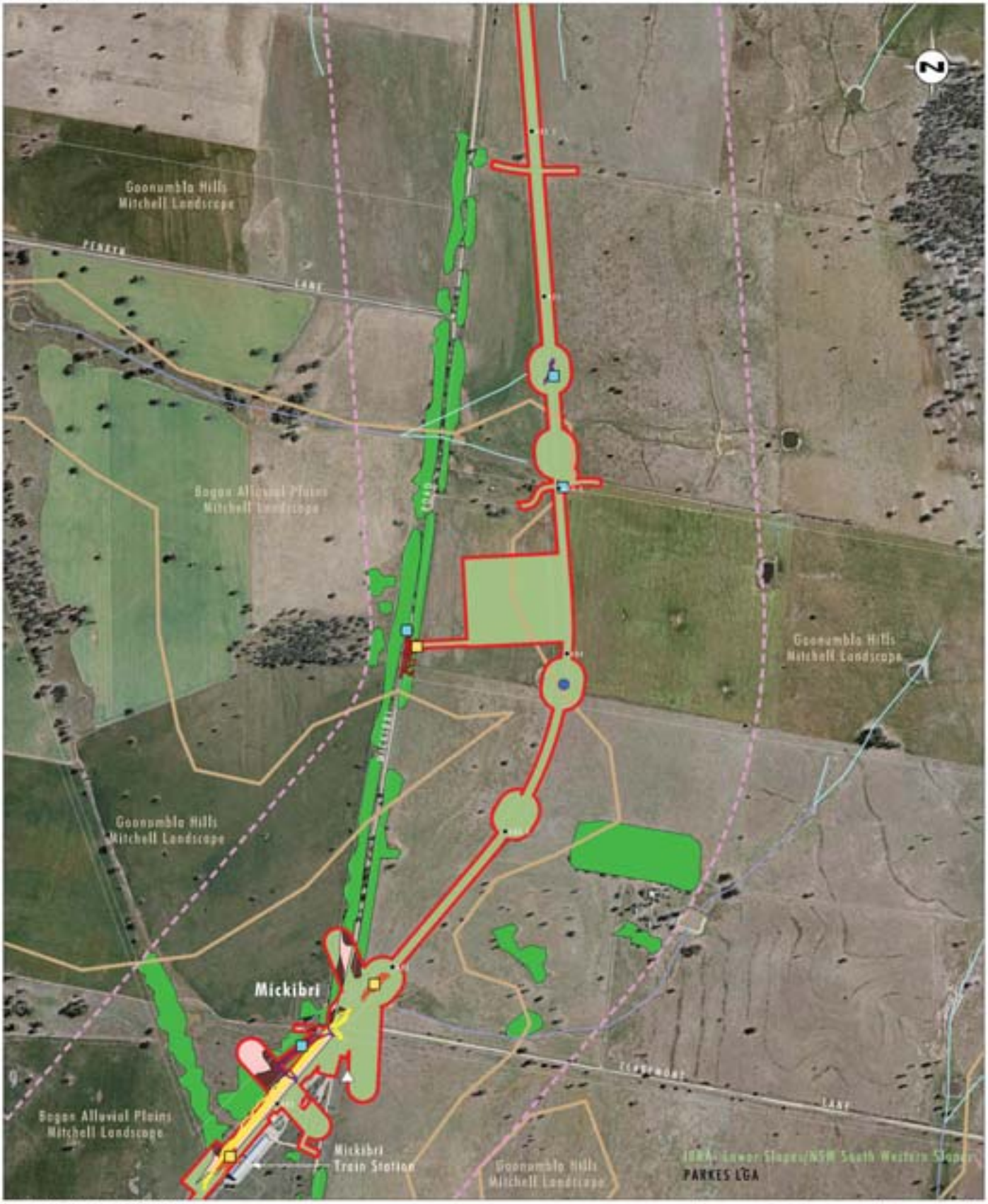



Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

**Legend**

- Development Site
- 550m Buffer Area
- Mitchell Landscape Area
- Rail Line Kilometerage

FIGURE A14

**Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment**

File Name (A4): R06/3606_018.dgn
20160922 14:28


Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

## Legend

- Development Site
- 550m Buffer Area
- Mitchell Landscape Area
- Rail Line Kilometerage

FIGURE A15

**Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment**

File Name (A4): R06/3606_019.dgn
20160922 14:27

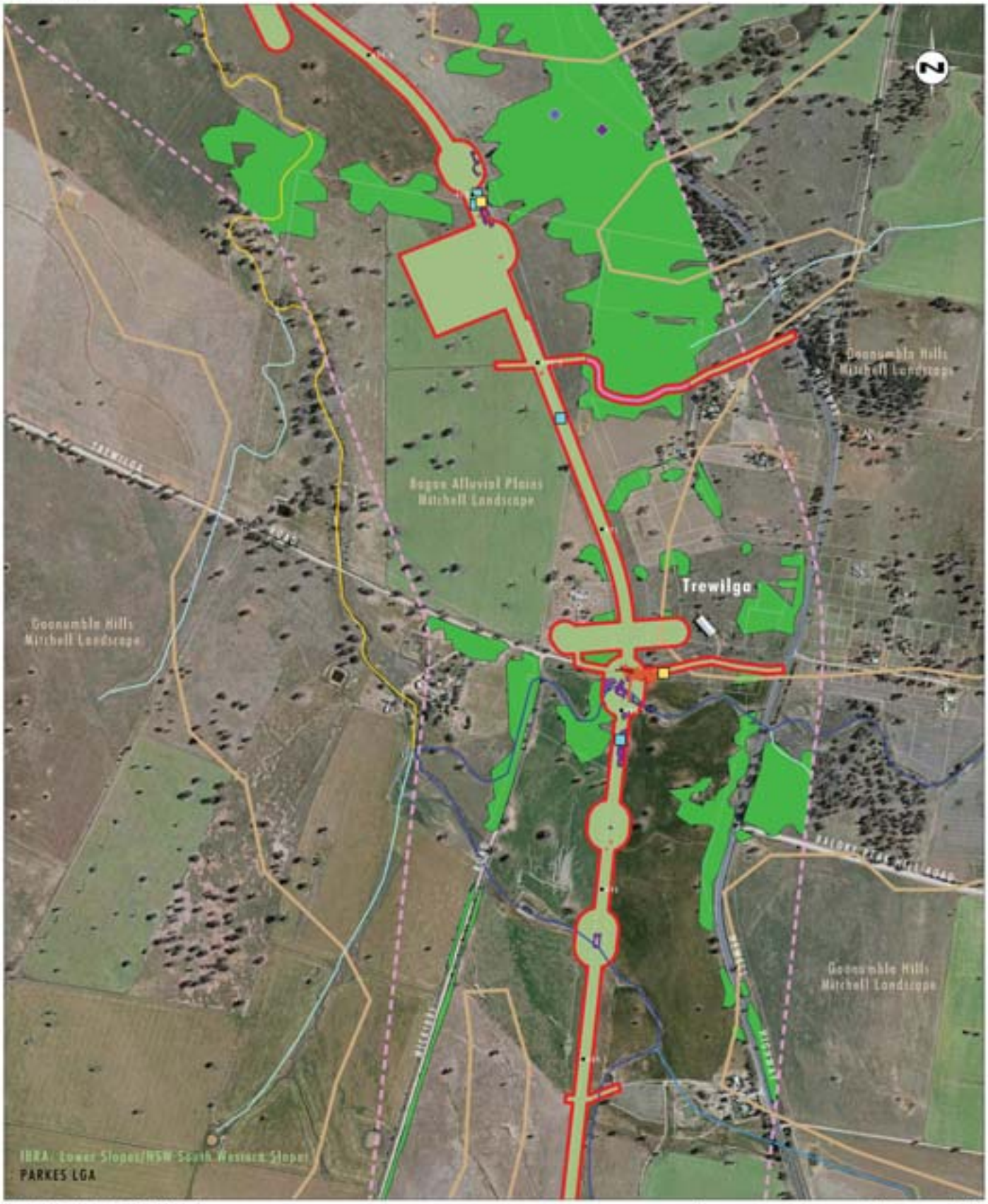



Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

**Legend**

- Development Site
- 550m Buffer Area
- Mitchell Landscape Area
- Rail Line Kilometerage

FIGURE A16

**Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment**


Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

## Legend

- Development Site
- 550m Buffer Area
- Mitchell Landscape Area
- Rail Line Kilometerage

FIGURE A17

**Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment**


Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

**Legend**

- Development Site
- 550m Buffer Area
- Mitchell Landscape Area
- Rail Line Kilometerage

FIGURE A18

**Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment**

File Name (A4): R06/3606_022.dgn
20160922 14.25


Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

## Legend

- Development Site
- 550m Buffer Area
- Mitchell Landscape Area
- Rail Line Kilometerage

FIGURE A19

**Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment**

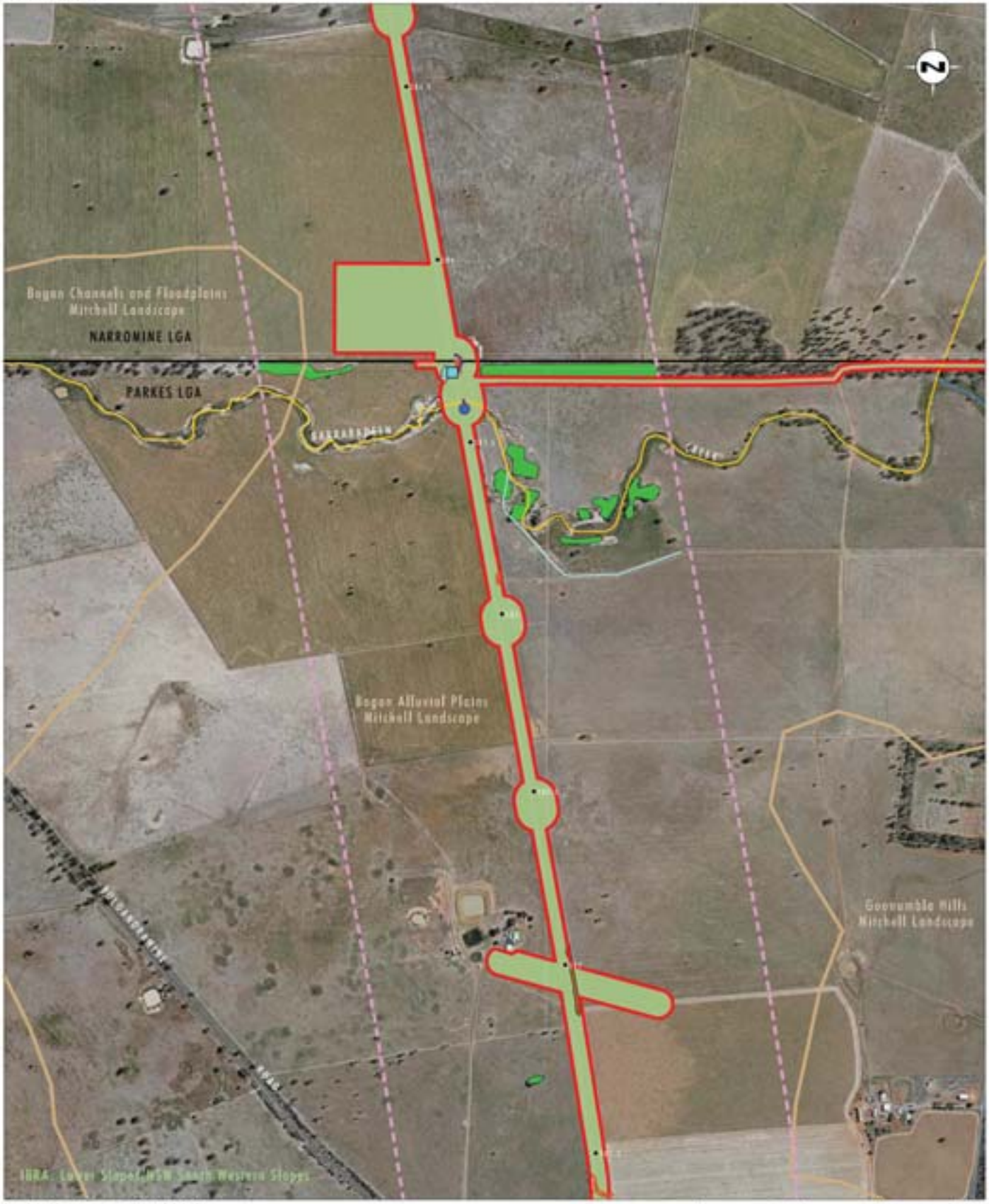



Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

**Legend**

- Development Site
- 550m Buffer Area
- Mitchell Landscape Area
- Local Government Area
- Rail Line Kilometerage

FIGURE A20

**Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment**

File Name (A4): R06/3606_024.dgn
20160922 14.17


Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

**Legend**

- Development Site
- 550m Buffer Area
- Mitchell Landscape Area
- Rail Line Kilometerage

FIGURE A21

**Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment**

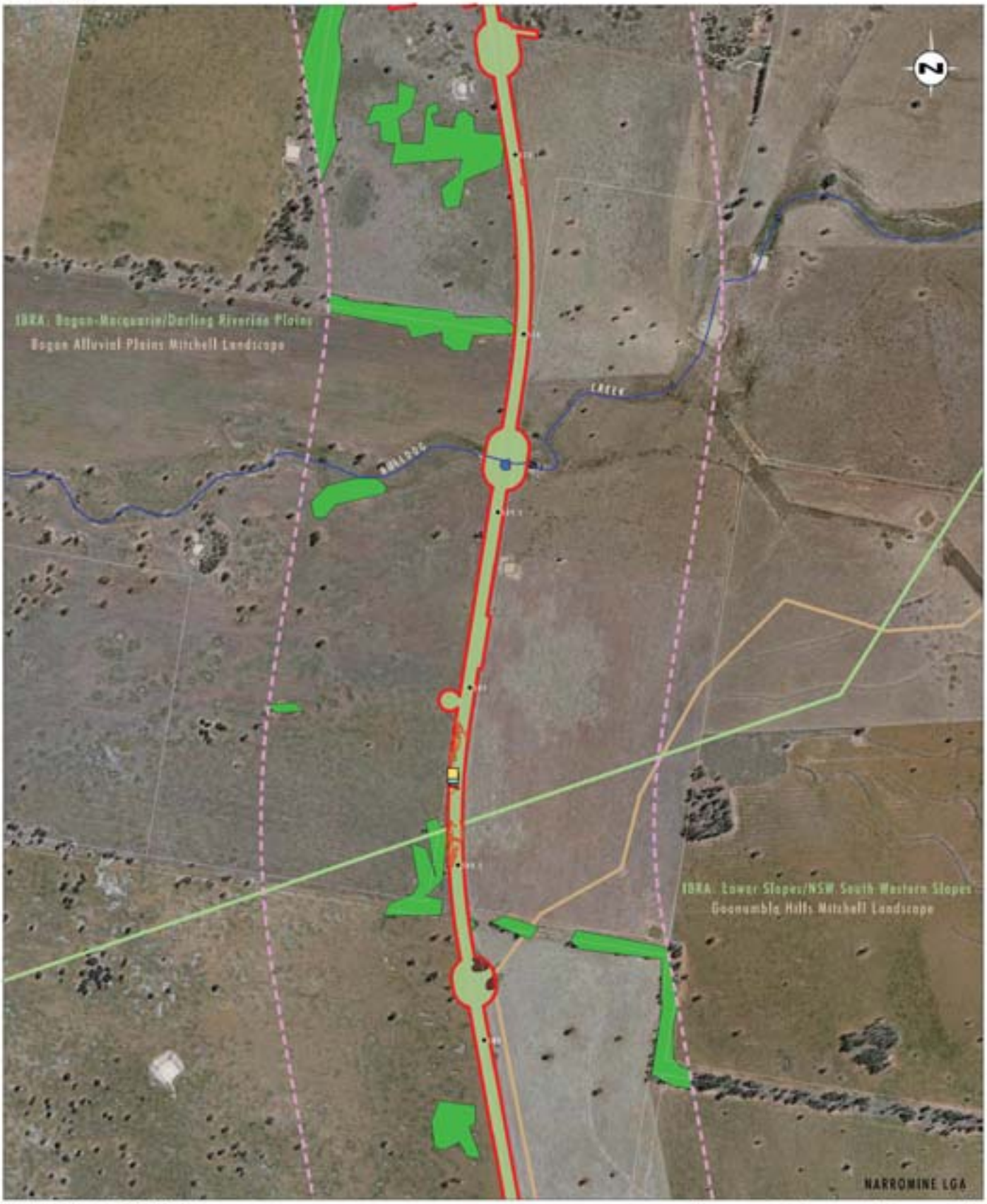



Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

**Legend**

- Development Site
- 550m Buffer Area
- Mitchell Landscape Area
- IBRA Regions and Subregion Area
- Rail Line Kilometerage

FIGURE A22

**Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment**

File Name (A4): R06/3606_026.dgn
20160922 14.16

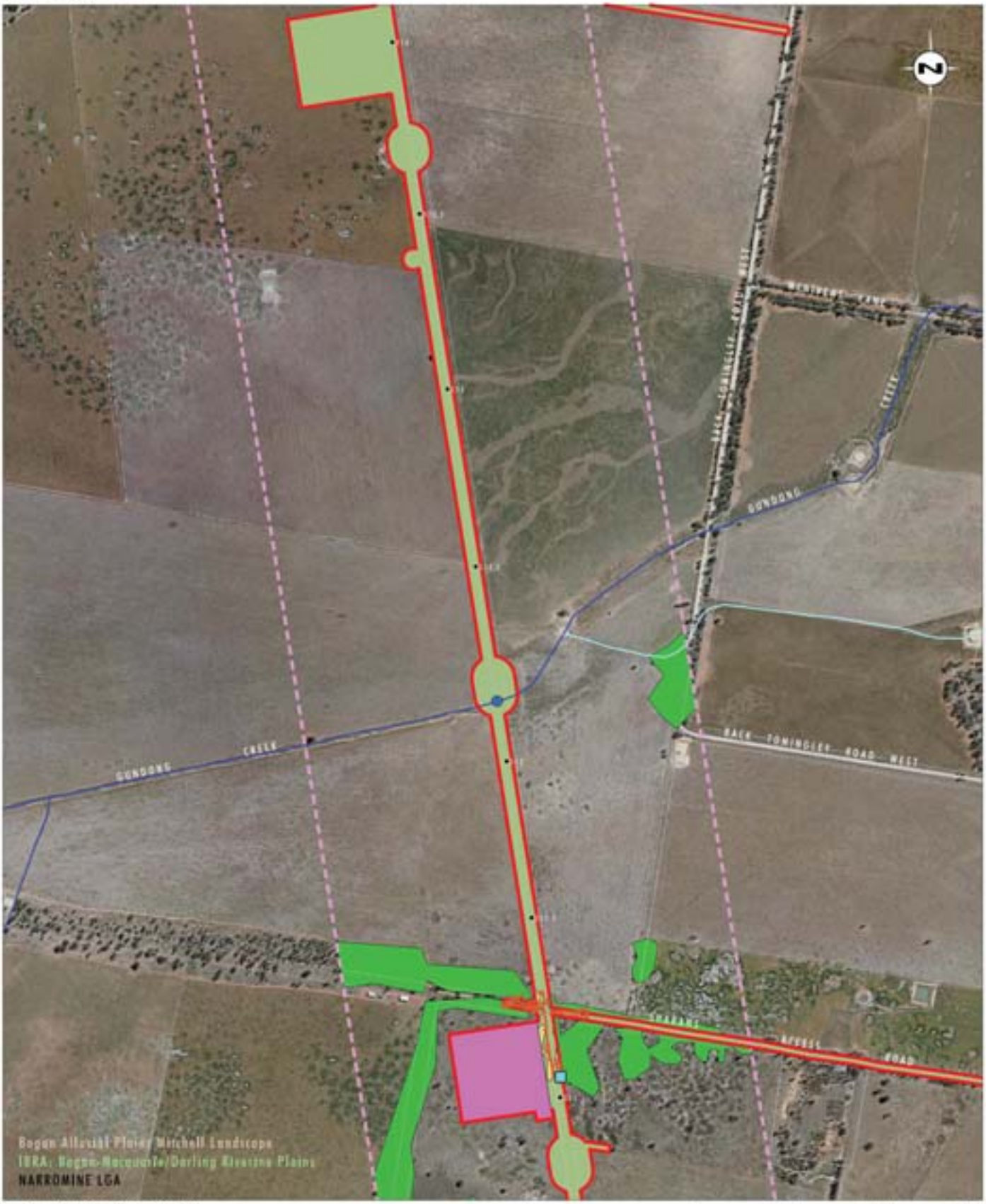



Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

## Legend

- Development Site
- 550m Buffer Area
- Rail Line Kilometerage

FIGURE A23

**Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment**

File Name (A4): R06/3606_027.dgn
20160922 14:12


Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

**Legend**

- Development Site
- 550m Buffer Area
- Rail Line Kilometerage

FIGURE A24

**Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment**

File Name (A4): R06/3606_028.dgn
20160922 14.11

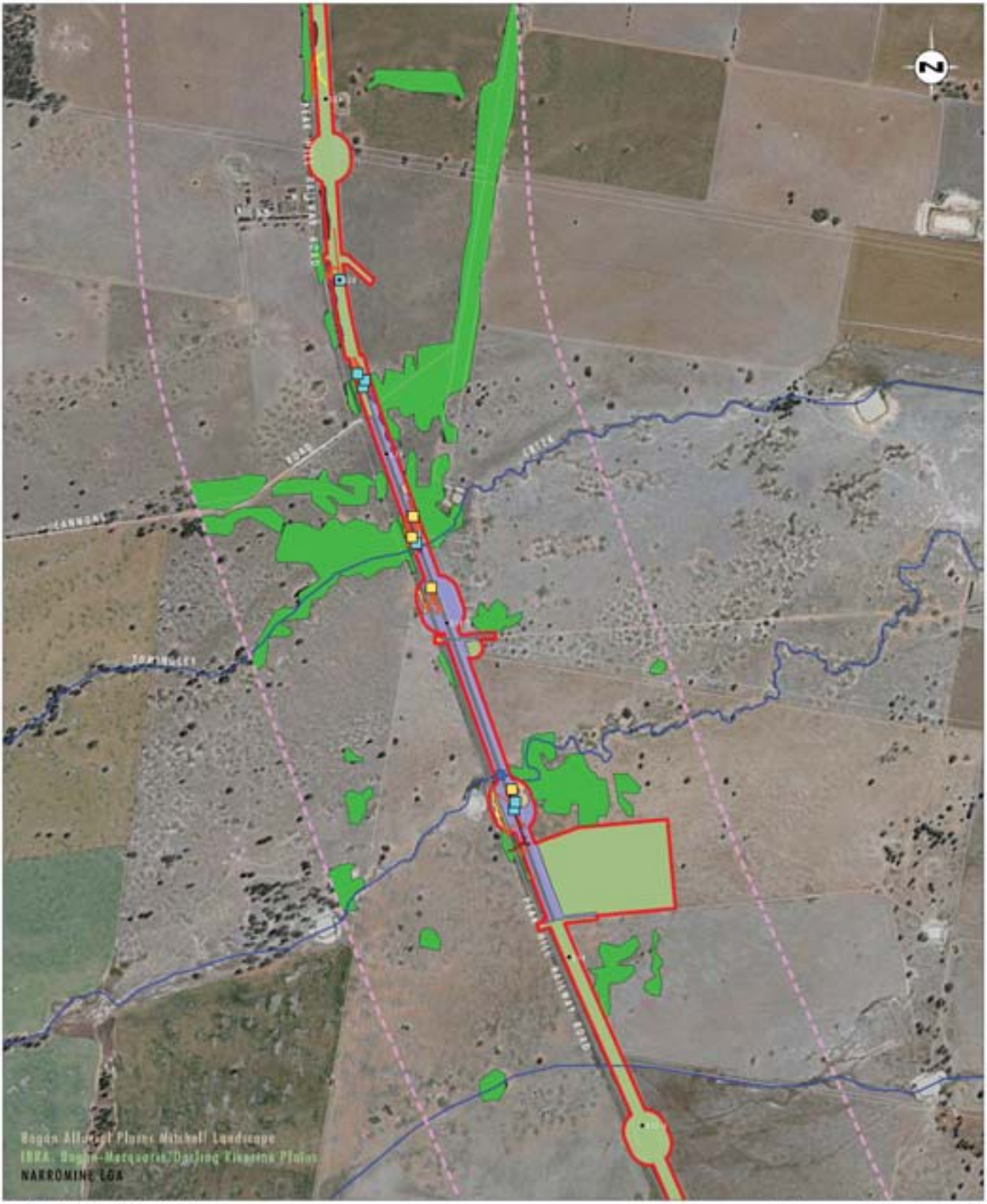



Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

## Legend

- Development Site
- 550m Buffer Area
- Rail Line Kilometerage

FIGURE A25

**Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment**


Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

**Legend**

- Development Site
- 550m Buffer Area
- Rail Line Kilometerage

FIGURE A26

**Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment**

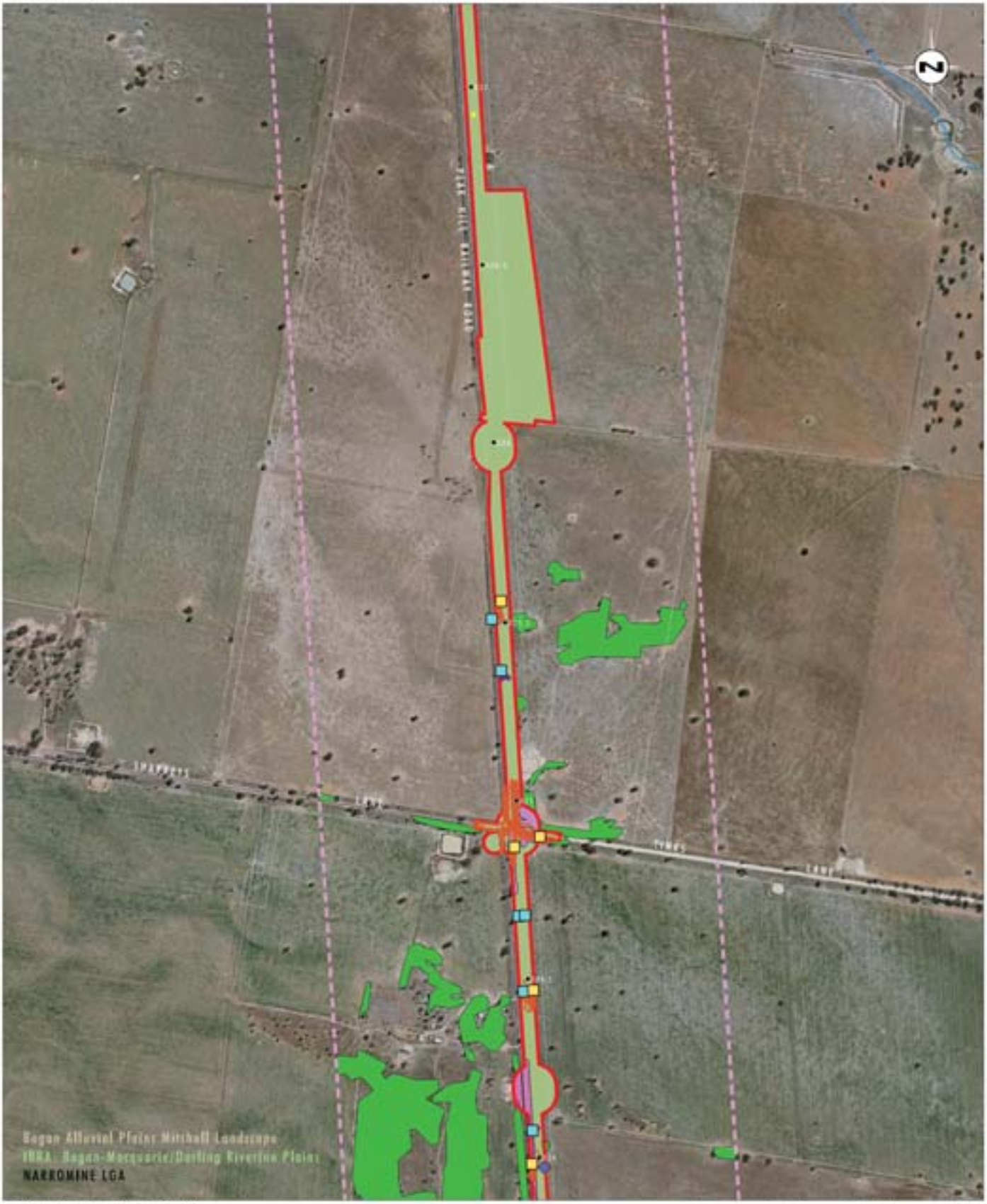



Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

**Legend**

- Development Site
- 550m Buffer Area
- Rail Line Kilometerage

FIGURE A27

**Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment**

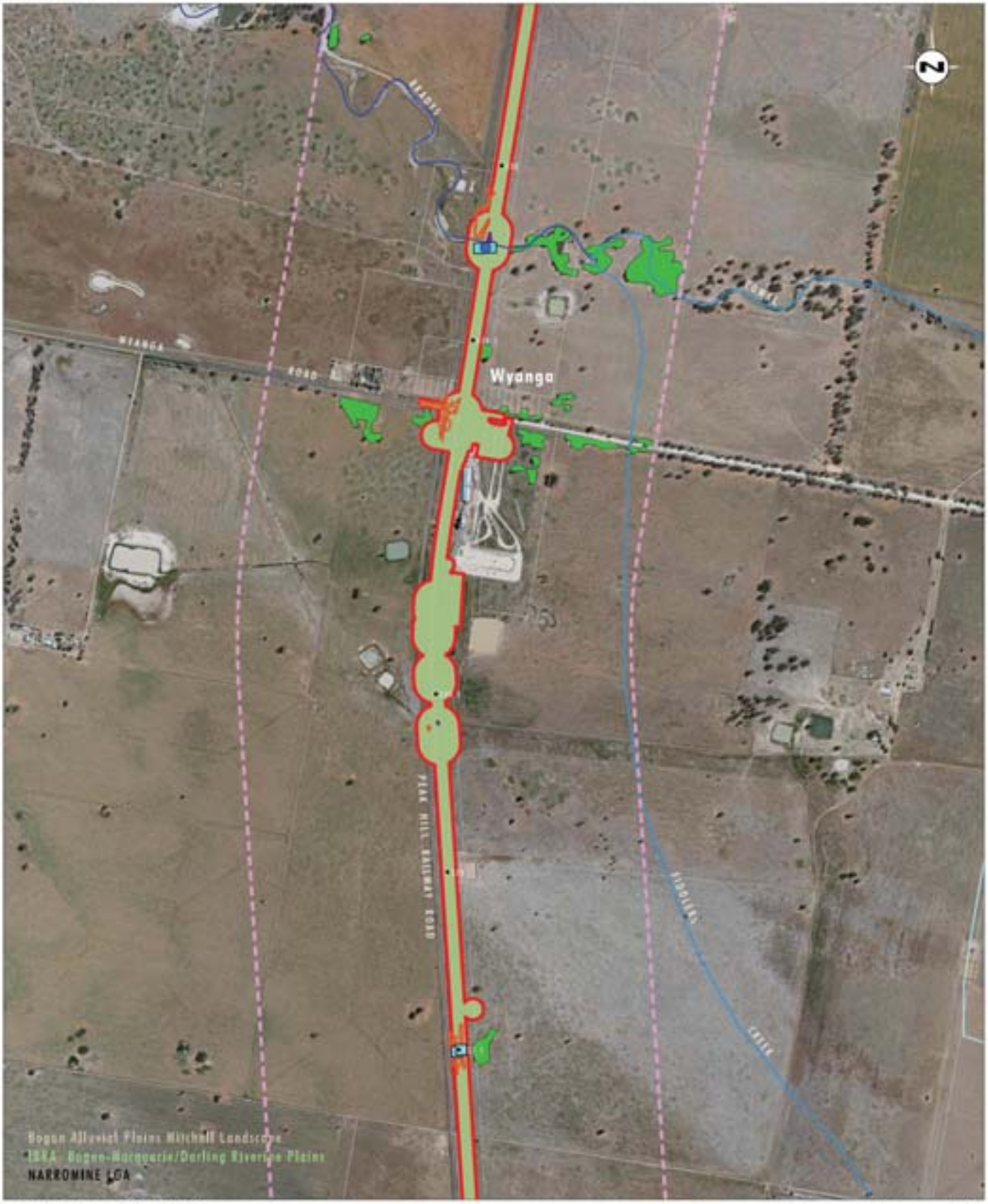



Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

**Legend**

- Development Site
- 550m Buffer Area
- Rail Line Kilometerage

FIGURE A28

**Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment**

File Name (A4): R06/3606_032.dgn
20160922 14.01

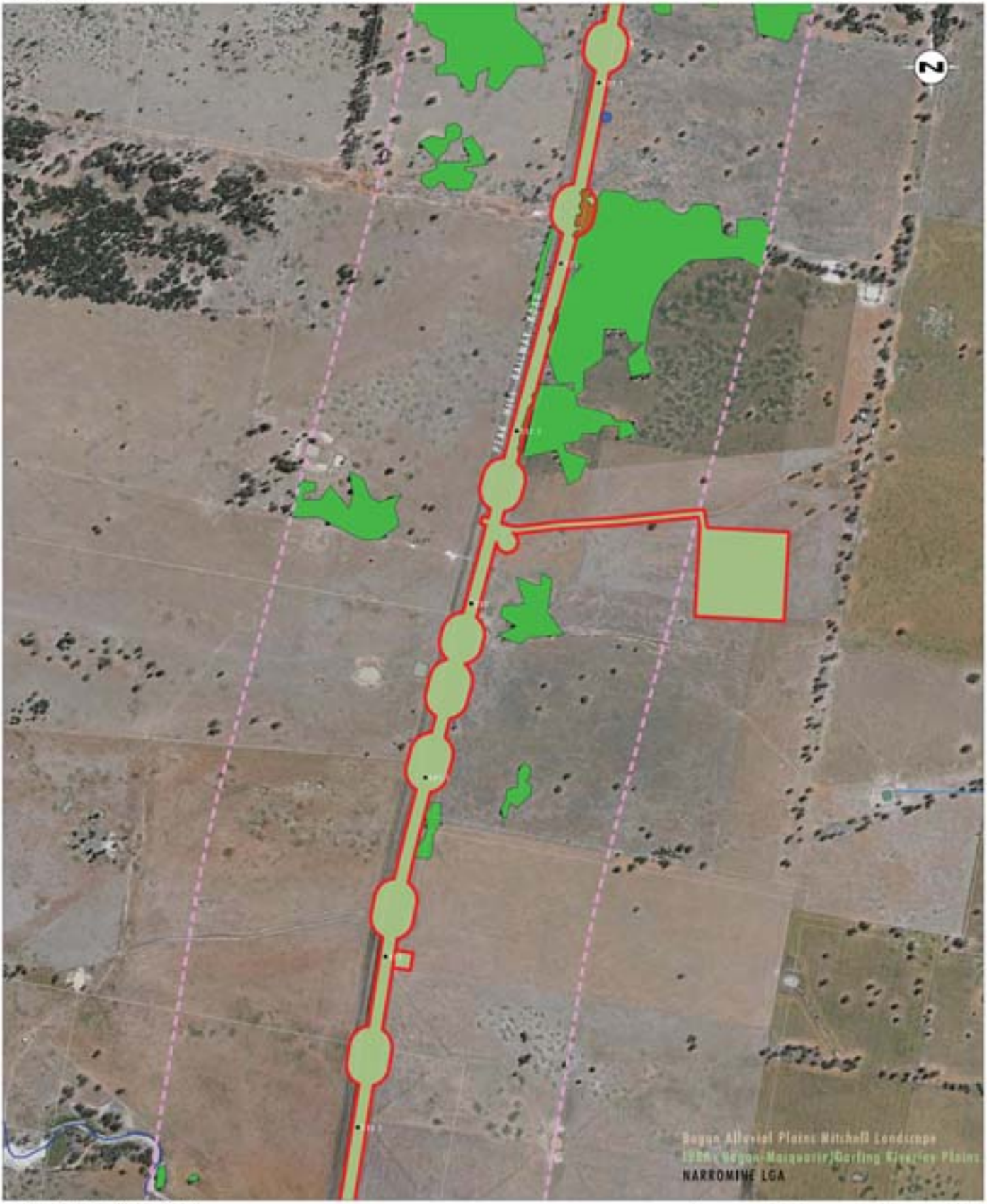



Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

**Legend**

- Development Site
- 550m Buffer Area
- Rail Line Kilometerage

FIGURE A29

**Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment**

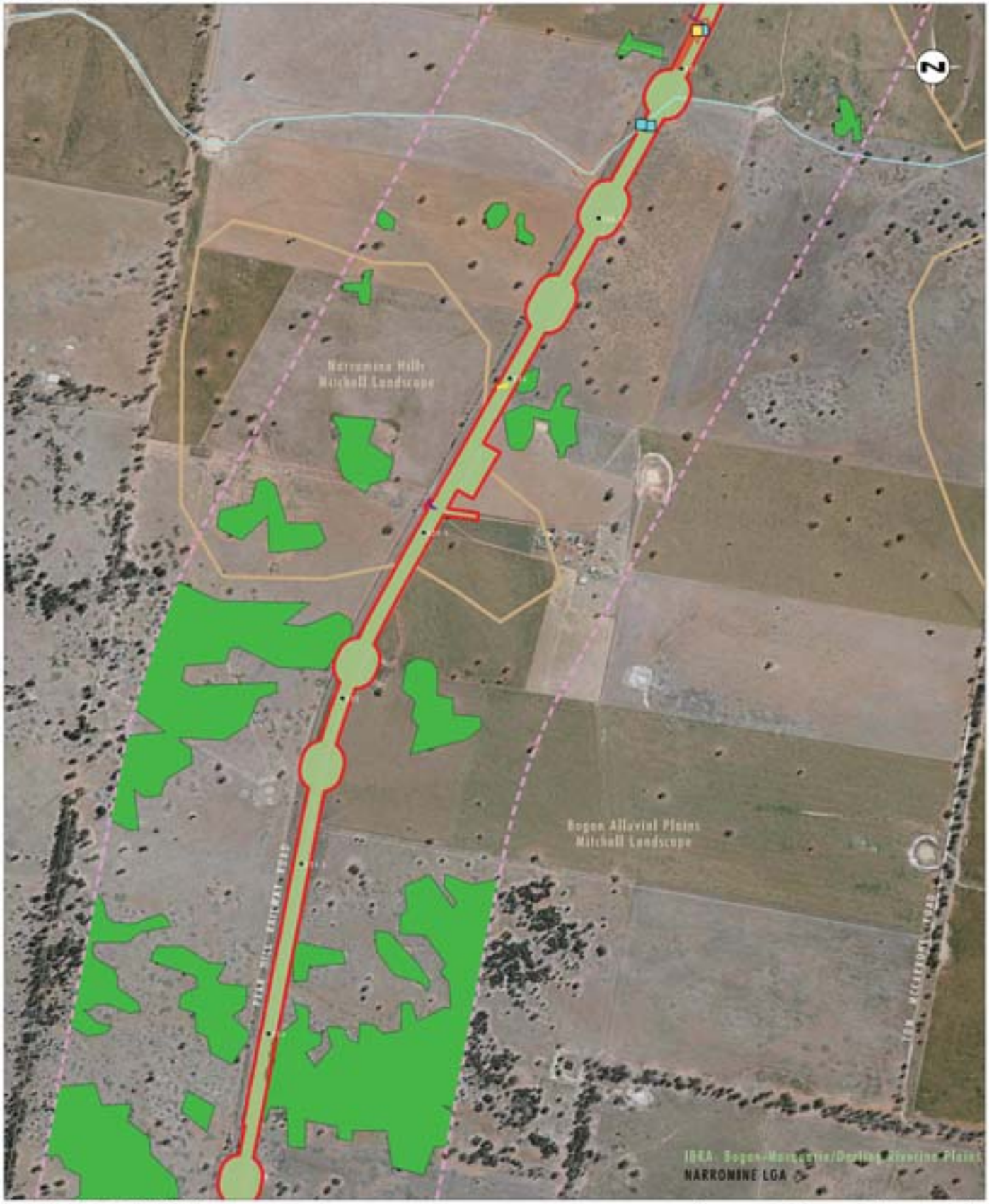



Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

**Legend**

- Development Site
- 550m Buffer Area
- Mitchell Landscape Area
- Rail Line Kilometerage

FIGURE A30

**Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment**


Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

## Legend

- Development Site
- 550m Buffer Area
- Mitchell Landscape Area
- Rail Line Kilometerage

FIGURE A31

**Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment**

File Name (A4): R06/3606_035.dgn
20160922 13.57

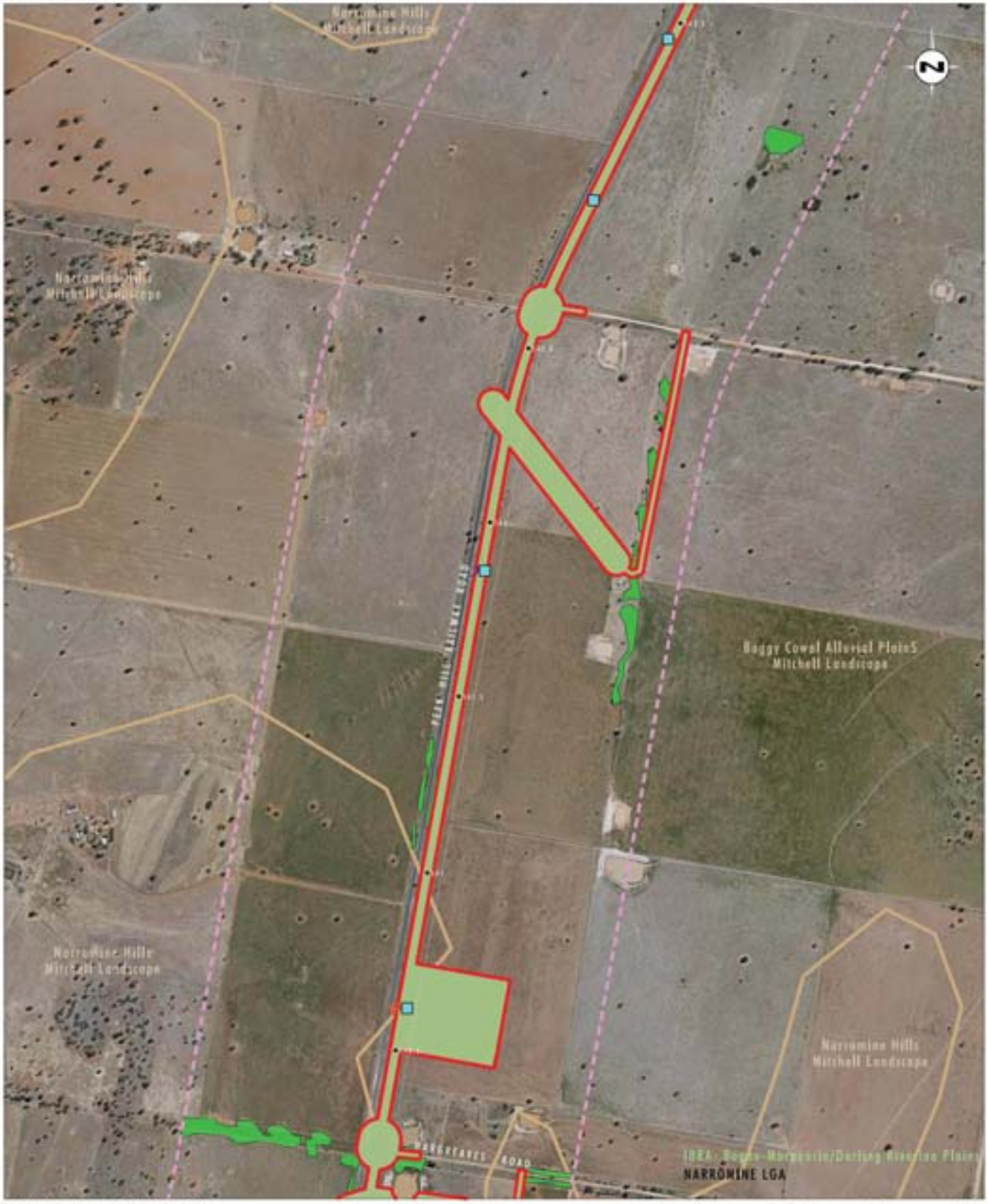



Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

**Legend**

- Development Site
- 550m Buffer Area
- Mitchell Landscape Area
- Rail Line Kilometerage

FIGURE A32

**Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment**

File Name (A4): R06/3606_036.dgn
20160922 13.56


Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

**Legend**

- Development Site
- 550m Buffer Area
- Mitchell Landscape Area
- Rail Line Kilometerage

FIGURE A33

**Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment**

File Name (A4): R06/3606_037.dgn
20160922 13:55


Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

**Legend**

- Development Site
- 550m Buffer Area
- Rail Line Kilometerage

FIGURE A34

**Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment**


Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

**Legend**

- Development Site
- 550m Buffer Area
- Mitchell Landscape Area
- Rail Line Kilometerage

FIGURE A35

**Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment**

File Name (A4): 806/3606_039.dgn
20160922 13:54

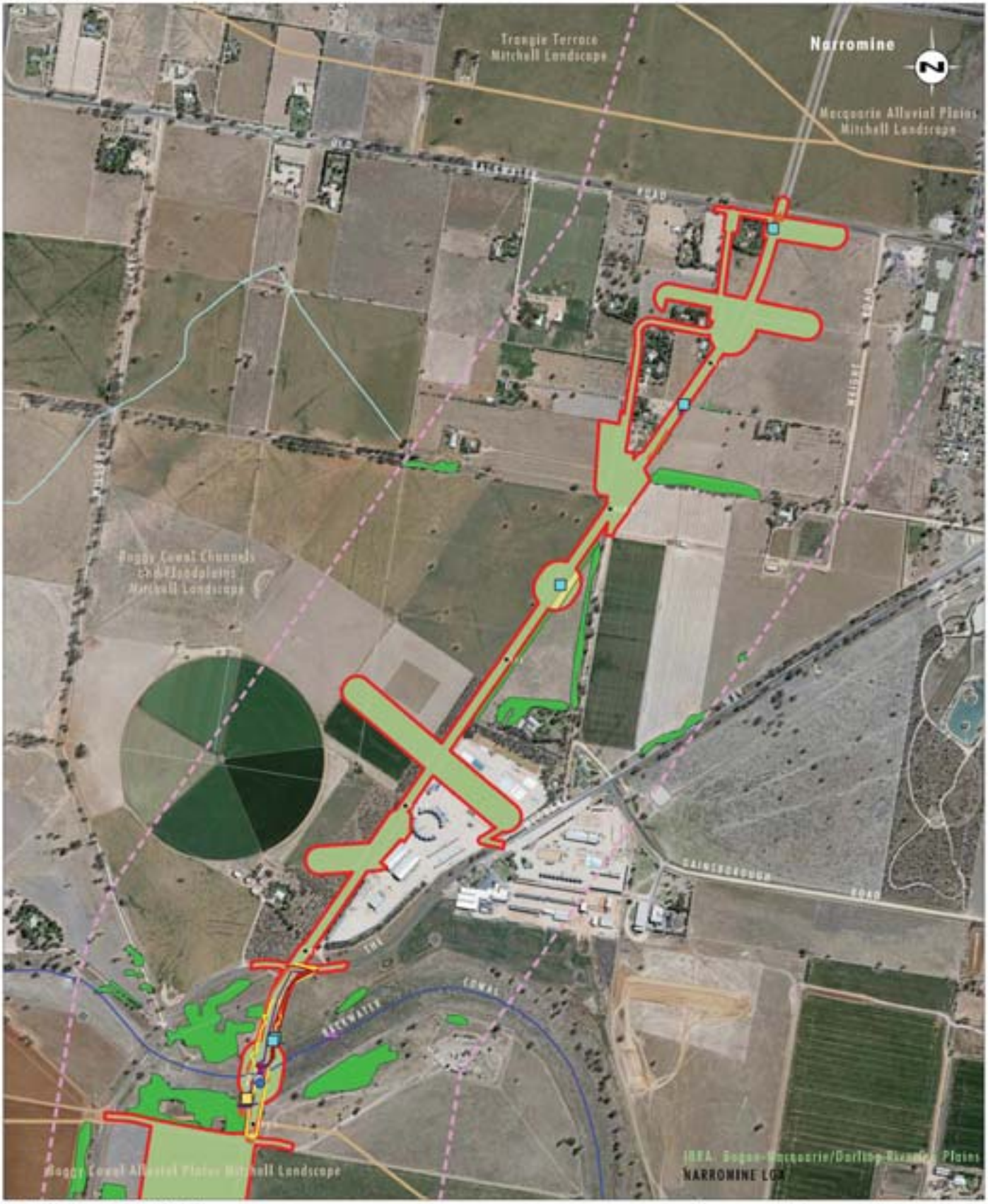



Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

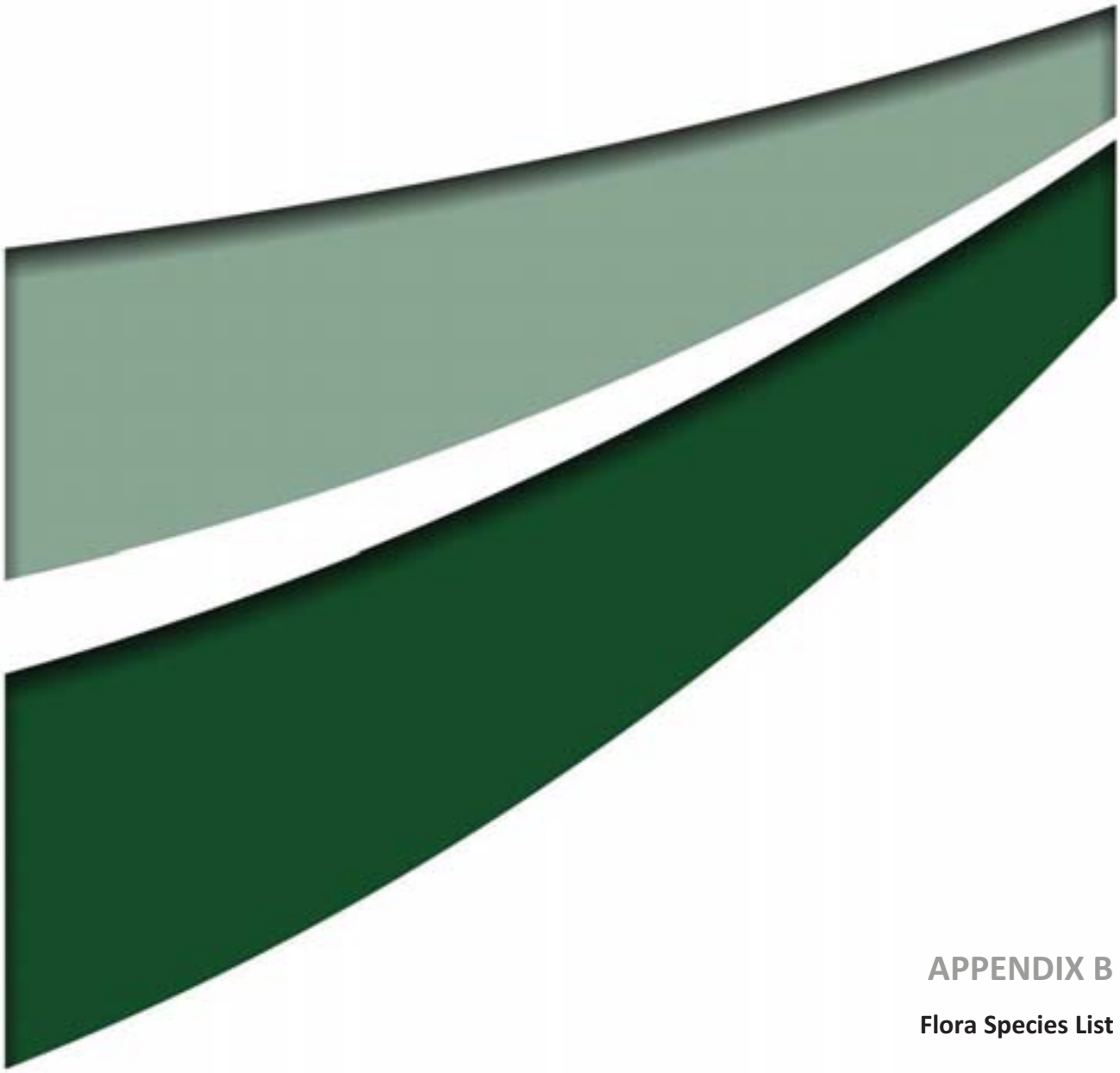
**Legend**

- Development Site
- 550m Buffer Area
- Mitchell Landscape Area
- Rail Line Kilometerage

FIGURE A36

**Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment**

File Name (A4): R06/3606_040.dgn
20160719 15.58



# APPENDIX B

**Flora Species List**

## Appendix B - Flora Species List

The following list was developed from surveys of the Development Site by Umwelt in January and May 2016. It includes all species of vascular plants observed during these surveys. It is acknowledged that the list is not comprehensive, as not all species are readily detected at any one time of the year. Many species flower only during restricted periods of the year, and some flower only once in several years. In the absence of flowering material, many of these species cannot be identified, or even detected.

Names of classes and families follow a modified Cronquist (1981) System.

Any species that could not be identified to the lowest taxonomic level are denoted in the following manner:

| | |
|---|---|
| sp. | specimens that are identified to genus level only. |

The following abbreviations or symbols are used in the list:

| | |
|---|---|
| asterisk (*) | denotes species non-native species |
| double asterisk (**) | denotes a Weed of National Significance (WoNS) |
| subsp. | subspecies and |
| var. | variety. |

All vascular plants recorded or collected were identified using keys and nomenclature in Harden (1992, 1993, 2000 and 2002) and Wheeler *et al.* (2002). Where known, changes to nomenclature and classification have been incorporated into the results, as derived from PlantNET (Botanic Gardens Trust 2016), the on-line plant name database maintained by the National Herbarium of New South Wales.

Common names used follow Harden (1992, 1993, 2000 and 2002) where available, and draw on other sources such as local names where these references do not provide a common name.

| Family | Scientific Name | Common Name | P01 | P02 | P03 | P04 | P05 | P06 | P07 | P08 | P09 | P10 | P11 | P12 | P13 | P14 | P15 | P16 | P17 | P18 | P19 | P20 | P21 | P22 | P23 | P24 | P25 | P26 | P27 | P28 | P29 | P30 | P31 | P32 | P33 | P34 | P35 | P36 | P37 | P38 | P39 | P40 | P41 | P42 | P43 | P44 | P45 | P46 | P47 | P48 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Coniferopsida (Conifers)** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Cupressaceae** | *Callitris glaucophylla* | white cypress pine | ✓ | | | | ✓ | ✓ | | | | | | | | | ✓ | | ✓ | ✓ | | | | | | | | | ✓ | | | ✓ | ✓ | | | | | | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | | | | | |
| **Filicopsida (Ferns)** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ✓ | | | | | | | | | |
| **Adiantaceae** | *Cheilanthes distans* | bristly cloak fern | | | | | | ✓ | | | ✓ | | | | | | | | ✓ | | | | ✓ | | | | | | | | | | | | | | | | | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | |
| **Adiantaceae** | *Cheilanthes sieberi* | rock fern | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Marsileaceae** | *Marsilea drummondii* | common nardoo | | | | | | | | | | | | | ✓ | ✓ | ✓ | | | | | | | | ✓ | ✓ | | ✓ | | | | | | ✓ | | | | ✓ | | | | | | | | | | |
| **Marsileaceae** | *Marsilea hirsuta* | short-fruited nardoo | | | | | | | | | | | | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | |
| **Marsileaceae** | *Marsilea* sp. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ✓ |
| **Magnoliopsida (Flowering Plants) - Liliidae (Monocots)** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Anthericaceae** | *Arthropodium milleflorum* | pale vanilla-lily | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Asphodelaceae** | **Asphodelus fistulosus* | onion weed | | | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Cyperaceae** | *Carex inversa* | knob sedge | | | | | ✓ | ✓ | ✓ | | | | | | | ✓ | | | | | | | | | ✓ | ✓ | | ✓ | | | | | | | | | | | | | | | | | | | | |
| **Cyperaceae** | *Cyperus gracilis* | slender flat-sedge | | | | | | | | | | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | |
| **Cyperaceae** | *Cyperus* sp. | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ✓ |
| **Juncaceae** | *Juncus* sp. | a rush | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | ✓ |
| **Juncaceae** | **Juncus cognatus* | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Lomandraceae** | *Lomandra filiformis* | wattle matt-rush | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | ✓ | | | | | | ✓ | | | ✓ | | | | | | ✓ | | | | ✓ | |
| **Lomandraceae** | *Lomandra longifolia* | spiny-headed mat-rush | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | |
| **Lomandraceae** | *Lomandra* sp. | mat-rush | | | | | ✓ | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Phormiaceae** | *Dianella longifolia* | blueberry lily | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ✓ | | ✓ | ✓ | | | | | | | | | | ✓ | |
| **Phormiaceae** | *Dianella revoluta* | blueberry lily | | | | | | ✓ | | | | | ✓ | | | | | | | | | ✓ | | | | ✓ | | ✓ | | | | | | | | | | | | | | | | | | | |
| **Poaceae** | *Aristida behriana* | bunch wiregrass | ✓ | | | | | ✓ | | | ✓ | | | | | | | ✓ | | ✓ | | ✓ | | | | | | | | ✓ | | | | | ✓ | | | | | | | | | ✓ | | | | |
| **Poaceae** | *Aristida benthamii* | three-awned spear grass | | | | | | | | | | | | | | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | |
| **Poaceae** | *Aristida calycina* var. *calycina* | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Poaceae** | *Aristida jerichoensis* var. *subspinulifera* | Jericho wiregrass | | | | | | | | | | | | | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | ✓ | |
| **Poaceae** | *Aristida ramosa* | purple wiregrass | | | ✓ | | | ✓ | | | | | | | | ✓ | | | ✓ | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | |
| **Poaceae** | *Aristida* sp. | a wiregrass | | ✓ | | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | ✓ | | | | ✓ | | | ✓ | ✓ | ✓ | | | ✓ | |
| **Poaceae** | *Aristida vagans* | threeawn speargrass | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Poaceae** | *Austrostipa aristiglumis* | plains grass | | | | | | | | | | | | | | ✓ | | | | | | ✓ | | ✓ | ✓ | | | | | | | | | | | | | ✓ | | | ✓ | | | | | | | | |
| **Poaceae** | *Austrostipa bigeniculata* | Yanganbil | ✓ | ✓ | ✓ | | | | | | | | | | | ✓ | | | | | | | | | | | | ✓ | | | | | | | ✓ | ✓ | | ✓ | | | | ✓ | | | | | | |

| Family | Scientific Name | Common Name | P01 | P02 | P03 | P04 | P05 | P06 | P07 | P08 | P09 | P10 | P11 | P12 | P13 | P14 | P15 | P16 | P17 | P18 | P19 | P20 | P21 | P22 | P23 | P24 | P25 | P26 | P27 | P28 | P29 | P30 | P31 | P32 | P33 | P34 | P35 | P36 | P37 | P38 | P39 | P40 | P41 | P42 | P43 | P44 | P45 | P46 | P47 | P48 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Poaceae** | *Austrostipa scabra* | speargrass | ✓ | ✓ | | | | ✓ | ✓ | | ✓ | ✓ | ✓ | | | | | ✓ | ✓ | ✓ | | | | | | ✓ | | ✓ | | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | | ✓ | | | | | | ✓ | ✓ | |
| **Poaceae** | *Austrostipa* sp. | speargrass | | | | | | | | | | | | | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | ✓ | ✓ | | |
| **Poaceae** | *Austrostipa stuposa* | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | |
| **Poaceae** | *Austrostipa verticillata* | slender bamboo grass | | | | ✓ | | | | | ✓ | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | |
| **Poaceae** | **Avena barbata* | bearded oats | | | | | | | | | | | | ✓ | | | | | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | ✓ | | | ✓ | | ✓ | ✓ | | | | |
| **Poaceae** | **Avena sativa* | oats | | | | | | ✓ | ✓ | ✓ | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Poaceae** | **Avena* sp. | oats | ✓ | | ✓ | | ✓ | | | | ✓ | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Poaceae** | *Bothriochloa macra* | red grass | | | | ✓ | | | | | | | | | | | | | ✓ | | | | | | | ✓ | ✓ | | | ✓ | | | | | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | | | ✓ | ✓ |
| **Poaceae** | **Bromus catharticus* | prairie grass | | | | | | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Poaceae** | **Bromus hordeaceus* | soft brome | | | | ✓ | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Poaceae** | **Bromus* sp. | a brome | | | | | | ✓ | | | | | | | | ✓ | ✓ | | | | | | | ✓ | ✓ | ✓ | | | | | | | | | | ✓ | | | | | | | | | | | | |
| **Poaceae** | **Chloris gayana* | Rhodes grass | | | | | | | | | | | | | | | ✓ | ✓ | | ✓ | | ✓ | ✓ | ✓ | | ✓ | | ✓ | ✓ | | ✓ | | | | ✓ | | | | | | | | ✓ | ✓ | | | | |
| **Poaceae** | *Chloris truncata* | windmill grass | | ✓ | | ✓ | ✓ | | ✓ | ✓ | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | ✓ | | | ✓ | | | | | | |
| **Poaceae** | *Chloris ventricosa* | tall chloris | | | | ✓ | | | | | | ✓ | | ✓ | | | | ✓ | | | | ✓ | | | | | ✓ | ✓ | | | | | | | | | | | | | | | | | | | | |
| **Poaceae** | *Chloris* sp. | | | ✓ | | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Poaceae** | *Cynodon dactylon* | common couch | | | | | ✓ | | ✓ | ✓ | | | | ✓ | | ✓ | | | | | ✓ | | ✓ | | | | | | | | | | | | | | ✓ | ✓ | ✓ | | | ✓ | ✓ | | | | | | |
| **Poaceae** | *Dactyloctenium radulans* | button grass | | | | | | | | | | | | | | ✓ | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Poaceae** | *Dichanthium sericeum subsp.* | Queensland bluegrass | ✓ | | ✓ | ✓ | ✓ | | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | ✓ | | ✓ | | ✓ | | ✓ | | ✓ | ✓ | | ✓ | ✓ | ✓ | | | | | | | | | | | | |
| **Poaceae** | *Digitaria brownii* | cotton panic grass | ✓ | | | | | | | ✓ | | | | | | | | | ✓ | | | | | | | | | | ✓ | | | | | | | | | | | | | | | ✓ | ✓ | | | | |
| **Poaceae** | *Digitaria* sp. | a finger grass | | | | | | | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Poaceae** | *Echinochloa colona* | awnless barnyard grass | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Poaceae** | *Elymus scaber* | common wheatgrass | | | ✓ | | | ✓ | | | ✓ | ✓ | ✓ | | | | | | ✓ | ✓ | | ✓ | | | ✓ | | ✓ | | | ✓ | ✓ | ✓ | | | ✓ | | | | | ✓ | ✓ | ✓ | | | | | ✓ | |
| **Poaceae** | *Elymus* sp. | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ✓ | | | | | | | | |
| **Poaceae** | *Enneapogon gracilis* | slender nineawn | ✓ | | | | | | | | | | ✓ | | | | | | | ✓ | | | | | | | | | ✓ | | | | | | | | | | | | | | | ✓ | ✓ | | | ✓ | ✓ |
| **Poaceae** | *Enneapogon nigricans* | niggerheads | | | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | ✓ | ✓ | | | | |
| **Poaceae** | *Enteropogon acicularis* | curly windmill grass | ✓ | | ✓ | | | | ✓ | | | | ✓ | | | | | | | ✓ | | | | | ✓ | | | ✓ | ✓ | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | | | ✓ | ✓ |
| **Poaceae** | *Eragrostis brownii* | brown's lovegrass | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | |
| **Poaceae** | **Eragrostis cilianensis* | stinkgrass | | | | | | | | ✓ | | | | ✓ | | | ✓ | | ✓ | | ✓ | | ✓ | | | | | | | | | | | | | | | ✓ | | | | | ✓ | | ✓ | ✓ | | | | |
| **Poaceae** | *Eragrostis leptostachya* | paddock lovegrass | | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | ✓ | ✓ | ✓ | | | | ✓ | ✓ | | | | |

| Family | Scientific Name | Common Name | P01 | P02 | P03 | P04 | P05 | P06 | P07 | P08 | P09 | P10 | P11 | P12 | P13 | P14 | P15 | P16 | P17 | P18 | P19 | P20 | P21 | P22 | P23 | P24 | P25 | P26 | P27 | P28 | P29 | P30 | P31 | P32 | P33 | P34 | P35 | P36 | P37 | P38 | P39 | P40 | P41 | P42 | P43 | P44 | P45 | P46 | P47 | P48 |
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| **Poaceae** | *Eragrostis parviflora* | weeping lovegrass | | | | ✓ | ✓ | | | | | | | ✓ | | | | | | | | | | | | | | | ✓ | ✓ | ✓ | | | | | | | | | | | | | | | | | | | |
| **Poaceae** | *Eragrostis* sp. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ✓ | ✓ | ✓ | |
| **Poaceae** | *Eriochloa crebra* | cup grass; tall cupgrass | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ✓ | ✓ | | | | | | |
| **Poaceae** | *Eriochloa pseudoacrotricha* | early spring grass | | | | ✓ | ✓ | | ✓ | ✓ | | ✓ | | ✓ | | | ✓ | | | ✓ | | ✓ | | ✓ | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | |
| **Poaceae** | **Lolium* sp. | a ryegrass | | | | | | | | | | | | ✓ | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Poaceae** | *Panicum buncei* | native panic | | | | | | | | | | ✓ | | ✓ | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Poaceae** | *Panicum decompositum* | native millet | ✓ | | | | | | ✓ | | | | | | | | ✓ | | | | ✓ | | | | ✓ | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | |
| **Poaceae** | *Panicum effusum* | hairy panic | | | | | | | | | | | | | | | ✓ | ✓ | ✓ | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | ✓ | |
| **Poaceae** | *Panicum queenslandicum* | Yadbila grass | | | | ✓ | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Poaceae** | *Panicum* sp. | panicum | | ✓ | | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ | | | | | | ✓ | ✓ | | ✓ | ✓ | | | ✓ | ✓ | | ✓ | | ✓ | | | | | | | | | | | ✓ | ✓ | ✓ | | | | | |
| **Poaceae** | *Paspalidium aversum* | bent summer grass | | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Poaceae** | *Paspalidium caespitosum* | Brigalow grass | | | | | | | | | | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | |
| **Poaceae** | *Paspalidium constrictum* | knottybutt grass | | ✓ | | | | | | | | | | | ✓ | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | |
| **Poaceae** | *Paspalidium distans* | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Poaceae** | *Paspalidium gracile* | slender panic | | | | | ✓ | | ✓ | | ✓ | ✓ | | | | | | | | ✓ | | | | | | | ✓ | | | ✓ | | | | | | | | | | | | | | | | | | | | |
| **Poaceae** | *Paspalidium* sp. | | | | | | | | | | | | | | | | | | | ✓ | | ✓ | | | | | | | | | | | | | | ✓ | | | | | | ✓ | | ✓ | ✓ | | | | | |
| **Poaceae** | **Paspalum dilatatum* | paspalum | | | | | ✓ | | ✓ | | | | | | | | | | ✓ | | | | | | ✓ | ✓ | | | ✓ | | | | | | | ✓ | ✓ | | | ✓ | | | | | | | | | ✓ |
| **Poaceae** | **Paspalum* sp. | | | | ✓ | | | ✓ | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | ✓ | | | | | | | | |
| **Poaceae** | *Poa* sp. | | | | | | | | ✓ | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Poaceae** | *Rytidosperma bipartita* | wallaby grass | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Poaceae** | *Rytidosperma caespitosa* | ringed wallaby grass | | | | | | | | | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Poaceae** | *Rytidosperma fulva* | wallaby grass | | | ✓ | ✓ | | | ✓ | | ✓ | | | | ✓ | ✓ | ✓ | ✓ | | | | ✓ | | | | ✓ | ✓ | ✓ | | | | ✓ | ✓ | ✓ | | ✓ | | | | | | | | | | | | | | |
| **Poaceae** | *Rytidosperma setacea* | small-flowered wallaby-grass | | ✓ | | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Poaceae** | *Rytidosperma* sp. | | | | ✓ | | | | | | ✓ | | ✓ | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | |
| **Poaceae** | **Setaria parviflora* | | | | | | | | | | | | | ✓ | | | | | ✓ | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | ✓ | |
| **Poaceae** | *Sporobolus caroli* | fairy grass | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | ✓ | ✓ | | ✓ | | | | ✓ | | | | ✓ | ✓ | | | | |
| **Poaceae** | *Sporobolus creber* | slender rat's tail grass | | | | ✓ | | | | | ✓ | | | ✓ | | | | | ✓ | | | | | | | | | ✓ | | | | | | | | | | | | | | | ✓ | | | ✓ | ✓ | | | | |
| **Poaceae** | *Themeda triandra* | Kangaroo grass | | | | | ✓ | ✓ | | | | | | | | | | | | | | | | | | | ✓ | | | ✓ | | | | | | | | | | | | | | | | ✓ | ✓ | | | | |
| **Poaceae** | *Tragus australianus* | small burrgrass | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| Family | Scientific Name | Common Name | P01 | P02 | P03 | P04 | P05 | P06 | P07 | P08 | P09 | P10 | P11 | P12 | P13 | P14 | P15 | P16 | P17 | P18 | P19 | P20 | P21 | P22 | P23 | P24 | P25 | P26 | P27 | P28 | P29 | P30 | P31 | P32 | P33 | P34 | P35 | P36 | P37 | P38 | P39 | P40 | P41 | P42 | P43 | P44 | P45 | P46 | P47 | P48 |
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| **Poaceae** | **Triticum aestivum* | wheat | | | | ✓ | ✓ | | | | | | | | ✓ | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Poaceae** | **Urochloa panicoides* | urochloa grass | | | | | | | | | | | | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ | | ✓ | ✓ | | | | ✓ | | | | | | ✓ | ✓ | | | | ✓ | | | | | ✓ | ✓ | | | | |
| **Poaceae** | **Vulpia* sp. | rat's-tail fescue | | | | | ✓ | | | | ✓ | | | | | | | | | | | | ✓ | ✓ | | | | ✓ | | | | ✓ | | ✓ | | | | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | |
| **Poaceae** | *Walwhalleya proluta* | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Magnoliopsida (Flowering Plants) - Magnoliidae (Dicots)** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Acanthaceae** | *Rostellularia adscendens* | pink tongues | | | | | | ✓ | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ✓ | |
| **Amaranthaceae** | *Alternanthera angustifolia* | | | | | | | | | | | | | | | | | | | | | ✓ | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Amaranthaceae** | *Alternanthera denticulata* | lesser joyweed | | | | ✓ | ✓ | | | | | | | | | ✓ | ✓ | | | | ✓ | | | | | ✓ | | ✓ | | ✓ | | | | | | | | | | | | ✓ | | | | | | | | |
| **Amaranthaceae** | **Alternanthera pungens* | khaki weed | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Amaranthaceae** | *Alternanthera* sp. | joyweed | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Amaranthaceae** | *Amaranthus* sp. | amaranth | | | | | | | | | ✓ | | | ✓ | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | |
| **Amaranthaceae** | *Ptilotus indivisus* | | | | | | | | | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Amaranthaceae** | *Ptilotus* sp. | | | | | | ✓ | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Apiaceae** | **Cyclospermum leptophyllum* | slender celery | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Apiaceae** | *Eryngium paludosum* | long eryngium | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | |
| **Asteraceae** | **Bidens pilosa* | cobblers pegs | | | | | | | | | | | | | | | ✓ | | | | | ✓ | | | | | | ✓ | | | ✓ | | | | ✓ | | | ✓ | | | ✓ | | | | | | | | |
| **Asteraceae** | **Bidens subalternans* | greater beggars ticks | | | | | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Asteraceae** | *Brachyscome* sp. | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Asteraceae** | *Calotis cuneifolia* | purple burr-daisy | | | | | | | | | | | | ✓ | | | | ✓ | | | | | | | | | | | | | | ✓ | ✓ | | | | | | | | | | | | | | ✓ | |
| **Asteraceae** | *Calotis lappulacea* | yellow burr-daisy | | ✓ | | | | ✓ | | | ✓ | | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | | ✓ | ✓ | | | | ✓ | ✓ | | | ✓ | | | | | ✓ | | | | | ✓ | ✓ | ✓ | ✓ | | | | ✓ | |
| **Asteraceae** | *Calotis* sp. | a burr-daisy | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | |
| **Asteraceae** | *Cassinia* sp. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ✓ | |
| **Asteraceae** | **Carthamus lanatus* | saffron thistle | ✓ | | | | | | | | | ✓ | | | | | | | | | | ✓ | | ✓ | ✓ | ✓ | ✓ | | | ✓ | | | | | | | ✓ | ✓ | ✓ | ✓ | | | | | ✓ | ✓ | | |
| **Asteraceae** | **Centaurea calcitrapa* | star thistle | | | ✓ | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Asteraceae** | **Chondrilla juncea* | skeleton weed | ✓ | | ✓ | | | | | | ✓ | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Asteraceae** | *Chrysocephalum apiculatum* | common everlasting | | | | | | | | | | | | | | | | | ✓ | ✓ | | | ✓ | | | | | | ✓ | ✓ | | | | | | | | | | | | | | ✓ | ✓ | | | | |
| **Asteraceae** | *Chrysocephalum semipapposum* | clustered everlasting | | | | | | | | | | | | | | ✓ | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Asteraceae** | **Cirsium vulgare* | spear thistle | | | ✓ | ✓ | ✓ | | | | | | | | ✓ | ✓ | ✓ | | | | | | | | | | | | | | | | | | | | ✓ | ✓ | | | | | | | | | ✓ |
| **Asteraceae** | **Conyza bonariensis* | flaxleaf fleabane | ✓ | | | | ✓ | | ✓ | ✓ | | | | | ✓ | ✓ | ✓ | | | ✓ | | ✓ | | ✓ | ✓ | ✓ | ✓ | | ✓ | | ✓ | | | | | ✓ | | | | | ✓ | | | ✓ | ✓ | | | | |

| Family | Scientific Name | Common Name | P01 | P02 | P03 | P04 | P05 | P06 | P07 | P08 | P09 | P10 | P11 | P12 | P13 | P14 | P15 | P16 | P17 | P18 | P19 | P20 | P21 | P22 | P23 | P24 | P25 | P26 | P27 | P28 | P29 | P30 | P31 | P32 | P33 | P34 | P35 | P36 | P37 | P38 | P39 | P40 | P41 | P42 | P43 | P44 | P45 | P46 | P47 | P48 |
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| **Asteraceae** | *Eclipta platyglossa* | yellow twin-heads | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | |
| **Asteraceae** | *Euchiton involucratus* | star cudweed | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Asteraceae** | **Hedypnois rhagadioloides* | cretan weed | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Asteraceae** | **Hypochaeris glabra* | smooth catsear | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ✓ | | |
| **Asteraceae** | **Hypochaeris radicata* | catsear | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ✓ | | ✓ |
| **Asteraceae** | **Lactuca serriola* | prickly lettuce | | | | | ✓ | | | | | | | | | | | | | | | | | | ✓ | ✓ | | | | ✓ | | | | | | | | | | | | | | | | | | | |
| **Asteraceae** | *Pycnosorus globosus* | drumsticks | | | | | | | | | | | | | ✓ | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Asteraceae** | **Schkuhria pinnata* var. *abrotanoides* | dwarf marigold | | | | | | | | | | | | | | ✓ | ✓ | | | | | | | ✓ | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Asteraceae** | **Soliva sessilis* | bindyi | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | |
| **Asteraceae** | **Sonchus oleraceus* | common sowthistle | | | ✓ | | ✓ | | | | | ✓ | | | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | ✓ |
| **Asteraceae** | *Vittadinia cervicularis* | | | | | | | ✓ | ✓ | | | ✓ | | | ✓ | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | |
| **Asteraceae** | *Vittadinia cervicularis var. cervicularis* | a fuzzweed | | | | | | | | | | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | |
| **Asteraceae** | *Vittadinia cuneata* | a fuzzweed | | ✓ | ✓ | | | | | | | | | | | | | | | ✓ | ✓ | | | | | | | | | | | | | | | ✓ | | | ✓ | | | | | | | | | |
| **Asteraceae** | *Vittadinia dissecta* | | | | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Asteraceae** | *Vittadinia muelleri* | a fuzzweed | | | | | | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Asteraceae** | *Vittadinia pterochaeta* | rough fuzzweed | | | | ✓ | | | | | | | | ✓ | | ✓ | ✓ | ✓ | | | | ✓ | ✓ | | | | ✓ | | ✓ | | | | | | | | ✓ | | | | | | | | | | | |
| **Asteraceae** | *Vittadinia* sp. | fuzzweed | | | | | | ✓ | | | ✓ | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ✓ | ✓ | ✓ | |
| **Asteraceae** | *Vittadinia sulcata* | | | | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | |
| **Asteraceae** | *Xerochrysum viscosum* | sticky everlasting | | | | | | ✓ | | | ✓ | | | | | | | ✓ | ✓ | ✓ | | | ✓ | | | | | | ✓ | | | | | | | | | | | | | | | ✓ | | | | |
| **Boraginaceae** | **Echium plantagineum* | Pattersons curse | | | ✓ | | | | | | | ✓ | | | ✓ | ✓ | ✓ | | | | ✓ | ✓ | ✓ | | | | | ✓ | | | | | | | | | | | | | | | | | | | | |
| **Boraginaceae** | **Heliotropium amplexicaule* | blue heliotrope | | | | | | | | | | | | | | | ✓ | | ✓ | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | ✓ | ✓ | | | |
| **Boraginaceae** | **Heliotropium europaeum* | potato weed | ✓ | | ✓ | | | | | ✓ | | | ✓ | | | ✓ | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Brassicaceae** | **Hirschfeldia incana* | buchan weed | | | | | | | | ✓ | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | |
| **Brassicaceae** | **Lepidium africanum* | common peppercress | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | | ✓ | ✓ | | | | | | | | | ✓ | ✓ | | | ✓ | ✓ | ✓ | | | | ✓ | | | | | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | | ✓ | | | | | |
| **Brassicaceae** | *Lepidium pseudohyssopifolium* | peppercress | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Brassicaceae** | **Lepidium* sp. | a peppercress | | | ✓ | ✓ | ✓ | | | | ✓ | ✓ | | | | ✓ | | | | | | | | | ✓ | ✓ | | | | | | | | | | | | | | | | | | | | | | |
| **Brassicaceae** | **Rapistrum rugosum* | turnip weed | | | | | | | | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | ✓ | | | | | | | | | | | |

| Family | Scientific Name | Common Name | P01 | P02 | P03 | P04 | P05 | P06 | P07 | P08 | P09 | P10 | P11 | P12 | P13 | P14 | P15 | P16 | P17 | P18 | P19 | P20 | P21 | P22 | P23 | P24 | P25 | P26 | P27 | P28 | P29 | P30 | P31 | P32 | P33 | P34 | P35 | P36 | P37 | P38 | P39 | P40 | P41 | P42 | P43 | P44 | P45 | P46 | P47 | P48 |
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| **Cactaceae** | **Cereus uruguayanus* | apple cactus | | | | | | | | | | | ✓ | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | |
| **Cactaceae** | ***Opuntia aurantiaca* | tiger pear | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | |
| **Campanulaceae** | *Wahlenbergia communis* | tufted bluebell | | ✓ | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | ✓ | | | | ✓ | ✓ | | | | | | |
| **Campanulaceae** | *Wahlenbergia gracilis* | sprawling bluebell | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | |
| **Campanulaceae** | *Wahlenbergia littoricola* | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | |
| **Campanulaceae** | *Wahlenbergia* sp. | bluebell | ✓ | | | ✓ | | | | | | | | | | | | ✓ | | ✓ | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Capparaceae** | *Apophyllum anomalum* | warrior bush | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | |
| **Caryophyllaceae** | *Spergularia marina* | lesser sea-spurrey | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Casuarinaceae** | *Casuarina cristata* | belah | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | ✓ | | | | | | | ✓ | | | | | | | | | | | | | | | | |
| **Chenopodiaceae** | *Atriplex semibaccata* | creeping saltbush | ✓ | | | | | | | | | ✓ | | | | | ✓ | | | ✓ | | ✓ | | | ✓ | | ✓ | | | | ✓ | ✓ | ✓ | ✓ | | | | | | | | | | | | | | | | |
| **Chenopodiaceae** | *Atriplex* sp. | a saltbush | | | | | | | | | ✓ | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Chenopodiaceae** | *Chenopodium desertorum* | desert goosefoot | | | | | | | | | | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Chenopodiaceae** | *Dysphania pumilio* | small crumbweed | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | |
| **Chenopodiaceae** | *Einadia hastata* | berry saltbush | | | | | | | | | ✓ | | | | | | | | | | | ✓ | | | | ✓ | ✓ | | | | | ✓ | | | ✓ | | | ✓ | | | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | |
| **Chenopodiaceae** | *Einadia nutans* | climbing saltbush | | | | | | ✓ | | | ✓ | | | | | | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | | | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | | | ✓ | ✓ |
| **Chenopodiaceae** | *Einadia polygonoides* | knotweed goosefoot | ✓ | ✓ | | | | ✓ | | | | ✓ | | | ✓ | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Chenopodiaceae** | *Einadia* sp. | | | | | | | | ✓ | | ✓ | | ✓ | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Chenopodiaceae** | *Einadia trigonos* | fishweed | | | | | | | | | | | | | | | | | | | | | | | | | | | ✓ | | | | ✓ | | | | | | | | | | | | | | | | |
| **Chenopodiaceae** | *Enchylaena tomentosa* | ruby saltbush | | | | | | | | | | | | | | | | | ✓ | | | | | | | | | | ✓ | | | | ✓ | ✓ | | | ✓ | | | | ✓ | | | | | | | | |
| **Chenopodiaceae** | *Maireana decalvans* | black cotton bush | | | | | | | | | | | | | | | | | | | | | | ✓ | ✓ | | | | | | | | | ✓ | | | | | | | | | | | | | | | ✓ | |
| **Chenopodiaceae** | *Maireana enchylaenoides* | wingless fissure-weed | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ✓ | | | | | ✓ | | | | ✓ | | | | ✓ | | | | |
| **Chenopodiaceae** | *Maireana microphylla* | small-leaf bluebush | | ✓ | ✓ | | | | | | | | | | | ✓ | | ✓ | | ✓ | | ✓ | | | ✓ | ✓ | | | ✓ | | ✓ | ✓ | | ✓ | | ✓ | ✓ | | | | ✓ | ✓ | ✓ | | ✓ | ✓ | | | |
| **Chenopodiaceae** | *Maireana* sp. | cotton bush; bluebush; fissure-weed | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Chenopodiaceae** | *Rhagodia spinescens* | thorny saltbush | | | | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Chenopodiaceae** | *Salsola australis* | buckbush;soft rolpoly; saltwort | | | | | | | ✓ | | | ✓ | | ✓ | | | | | | | | | ✓ | | | ✓ | | ✓ | | | | | ✓ | ✓ | | | | | | ✓ | | ✓ | ✓ | ✓ | | | | | | |
| **Chenopodiaceae** | *Sclerolaena birchii* | galvinized burr | | | | | | | | | | | | | | | ✓ | | | | | ✓ | | | ✓ | ✓ | | ✓ | | | ✓ | | ✓ | | | | | | | | | | | | | | | | |

| Family | Scientific Name | Common Name | P01 | P02 | P03 | P04 | P05 | P06 | P07 | P08 | P09 | P10 | P11 | P12 | P13 | P14 | P15 | P16 | P17 | P18 | P19 | P20 | P21 | P22 | P23 | P24 | P25 | P26 | P27 | P28 | P29 | P30 | P31 | P32 | P33 | P34 | P35 | P36 | P37 | P38 | P39 | P40 | P41 | P42 | P43 | P44 | P45 | P46 | P47 | P48 |
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| **Chenopodiaceae** | *Sclerolaena diacantha* | grey copperburr | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | ✓ | ✓ | | | | | | | | | | ✓ | | | | | | | |
| **Chenopodiaceae** | *Sclerolaena muricata* | black rolypoly | | ✓ | | | | | ✓ | | | ✓ | | | | | | | | | | | | | ✓ | | ✓ | | | | | | | ✓ | | ✓ | ✓ | | | | ✓ | | | ✓ | | | | | | |
| **Chenopodiaceae** | *Sclerolaena* sp. | copperburr; poverty-bush | | | | | | ✓ | | | | ✓ | | | | | | | ✓ | ✓ | | | | | | | | | | | ✓ | | ✓ | | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | |
| **Clusiaceae** | **Hypericum* sp. | | | | | | | | | | | | | | | ✓ | | ✓ | | | | | ✓ | | | | | ✓ | | ✓ | | | | | | | | | | | | | | | | | | | | | |
| **Convolvulaceae** | *Convolvulus angustissimus* | | ✓ | | | ✓ | | | | | | | | | | | | | | ✓ | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Convolvulaceae** | *Convolvulus erubescens* | pink bindweed | ✓ | | ✓ | | | ✓ | ✓ | | | ✓ | | | | ✓ | ✓ | ✓ | | | | | ✓ | ✓ | ✓ | | | | | | ✓ | ✓ | ✓ | | ✓ | | ✓ | | | ✓ | | | ✓ | ✓ | ✓ | ✓ | | | | |
| **Convolvulaceae** | *Convolvulus* sp. | a bindweed | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | |
| **Convolvulaceae** | *Dichondra repens* | kidney weed | | ✓ | | ✓ | ✓ | | | | | ✓ | | | | | | | | | | | ✓ | | | | ✓ | ✓ | ✓ | | | | | | | ✓ | | | | | | ✓ | ✓ | | | | | ✓ | ✓ |
| **Cucurbitaceae** | **Cucumis myriocarpus* subsp. *leptodermis* | paddy melon | | | | | | | | | | | | | | | ✓ | | | | ✓ | | ✓ | | | | | | | | | | | | | | | | | | | | | ✓ | ✓ | | | | |
| **Cucurbitaceae** | **Cucumis* sp. | | | | | | | | | | | | | | | | | | ✓ | | | | | | | ✓ | | | | | | | | ✓ | | | | | | | | | | | | | | | |
| **Euphorbiaceae** | *Chamaesyce dallachyana* | | ✓ | | | | | | | ✓ | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | ✓ | | | | | | | |
| **Euphorbiaceae** | *Chamaesyce drummondii* | caustic weed | | | | | | | ✓ | | | | | | ✓ | ✓ | ✓ | | ✓ | | | | ✓ | | ✓ | | | ✓ | | ✓ | ✓ | | | ✓ | | | | | | | | | | | | | | | |
| **Euphorbiaceae** | *Chamaesyce* sp. | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | |
| **Euphorbiaceae** | *Euphorbia* sp. | | | | | | | | | ✓ | | | | | ✓ | | | | | | | | | | | | | | | | ✓ | | | | | | | ✓ | | | | | | | | | | | | |
| **Fabaceae (Caesalpinioideae)** | *Senna artemisioides group* | | | | | | | | | | | | | | | | | | | ✓ | | ✓ | | | | | | ✓ | | | ✓ | | | | | | | | | ✓ | | | | | | ✓ | | |
| **Fabaceae (Caesalpinioideae)** | *Senna clavigera* | | | | | | | ✓ | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Fabaceae (Caesalpinioideae)** | **Senna occidentalis* | coffee senna | | | | | ✓ | | | | | | | | | ✓ | | | ✓ | | ✓ | | ✓ | ✓ | | ✓ | | | | | ✓ | | ✓ | | | | | | | ✓ | | | | | | | | | |
| **Fabaceae (Caesalpinioideae)** | *Senna* sp. | | ✓ | | | | | | | | ✓ | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Fabaceae (Faboideae)** | *Cullen tenax* | emu-foot | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Fabaceae (Faboideae)** | *Desmodium varians* | slender tick-trefoil | | | | | | | | | ✓ | | | | | | | | | | | | | | | | ✓ | | | | | | | | | ✓ | | | | | | ✓ | | | | | | | |
| **Fabaceae (Faboideae)** | *Glycine canescens* | silky glycine | | | | | | | | | ✓ | | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | |
| **Fabaceae (Faboideae)** | *Glycine clandestina* | twining glycine | | | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | ✓ | | | | | | ✓ | |
| **Fabaceae (Faboideae)** | *Glycine* sp. | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ✓ | | | | | | | |
| **Fabaceae (Faboideae)** | *Glycine tabacina* | variable glycine | ✓ | ✓ | | | ✓ | ✓ | | | ✓ | | ✓ | | | | | ✓ | | ✓ | | ✓ | | | | | | | ✓ | | ✓ | | ✓ | | | | | | | | | | ✓ | ✓ | | | | | | ✓ |
| **Fabaceae (Faboideae)** | **Medicago* sp. | a medic | | | | ✓ | | ✓ | | | | | | | | | | | ✓ | ✓ | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | ✓ | ✓ | | |

| Family | Scientific Name | Common Name | P01 | P02 | P03 | P04 | P05 | P06 | P07 | P08 | P09 | P10 | P11 | P12 | P13 | P14 | P15 | P16 | P17 | P18 | P19 | P20 | P21 | P22 | P23 | P24 | P25 | P26 | P27 | P28 | P29 | P30 | P31 | P32 | P33 | P34 | P35 | P36 | P37 | P38 | P39 | P40 | P41 | P42 | P43 | P44 | P45 | P46 | P47 | P48 |
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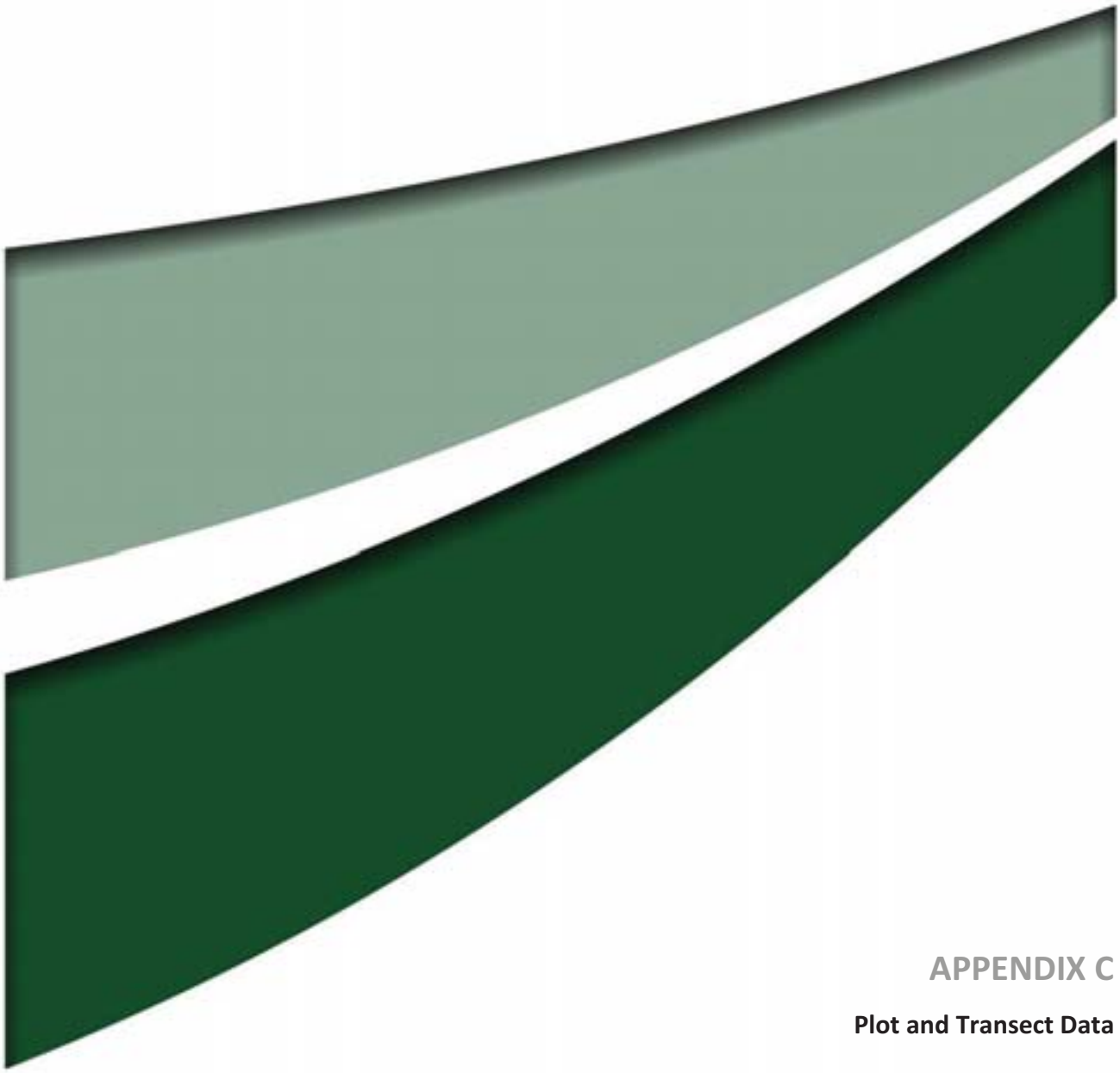
| **Fabaceae (Faboideae)** | **Medicago truncatula* | barrel medic | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Fabaceae (Faboideae)** | **Trifolium arvense* | haresfoot clover | ✓ | | ✓ | ✓ | ✓ | | ✓ | | ✓ | ✓ | | | | | | | ✓ | | | | | | | | | | | ✓ | | | | | | | ✓ | | | | | | | | | | | | | |
| **Fabaceae (Mimosoideae)** | *Acacia deanei* | green wattle | | | | | | | | | | | | | | | | ✓ | ✓ | ✓ | | | | | | | | | ✓ | ✓ | | | | | | | | | | | | | | | | | | | | ✓ |
| **Fabaceae (Mimosoideae)** | *Acacia decora* | western silver wattle | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ✓ | ✓ | ✓ | ✓ | | | ✓ | |
| **Fabaceae (Mimosoideae)** | *Acacia difformis* | drooping wattle | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | |
| **Fabaceae (Mimosoideae)** | *Acacia oswaldii* | Miljee | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Fabaceae (Mimosoideae)** | *Acacia pendula* | Boree | | | | | | | | | | | | | ✓ | | | | | | | | | | ✓ | | | | | | | | | ✓ | | | | | | | | | | | | | | | |
| **Fabaceae (Mimosoideae)** | *Acacia salicina* | cooba | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Gentianaceae** | **Centaurium* sp. | | | | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Geraniaceae** | *Geranium solanderi* | native geranium | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Geraniaceae** | *Geranium* sp. | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ✓ | ✓ | ✓ | |
| **Goodeniaceae** | *Goodenia hederacea* | ivy goodenia | | | | | | | | | | | | | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | |
| **Goodeniaceae** | *Goodenia heterophylla* subsp. *heterophylla* | | | | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Goodeniaceae** | *Goodenia pinnatifida* | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ✓ | |
| **Goodeniaceae** | *Goodenia* sp. | | | | | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Haloragaceae** | *Haloragis heterophylla* | variable raspwort | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Lamiaceae** | **Marrubium vulgare* | white horehound | | | | | | ✓ | | | ✓ | | ✓ | ✓ | | | | | | | | ✓ | | | | ✓ | ✓ | ✓ | | | | | | | | | | | | | | | | | | | | | |
| **Lamiaceae** | *Mentha satureioides* | native pennyroyal | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Lamiaceae** | **Salvia reflexa* | mintweed | | | | | | | | | | | | | | | | | | | | | | | | | | | | ✓ | | | | | | ✓ | | | | | | | | | | | | |
| **Lamiaceae** | **Salvia verbenaca* | vervain | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ✓ | ✓ | ✓ | ✓ |
| **Lamiaceae** | **Stachys arvensis* | stagger weed | ✓ | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | ✓ | | ✓ | | | ✓ | ✓ | ✓ | | | ✓ | | ✓ | | ✓ | ✓ | | | | |
| **Lobeliaceae** | *Pratia concolor* | poison pratia | | | | ✓ | | | | | | | | | | ✓ | ✓ | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | |
| **Lobeliaceae** | *Pratia purpurascens* | whiteroot | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | |
| **Lobeliaceae** | *Pratia* sp. | | | | ✓ | | | ✓ | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Loranthaceae** | *Amyema quandang* | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | |
| **Malvaceae** | **Malvastrum americanum* | spiked malvastrum | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ✓ | | | | | | | | | ✓ | ✓ | | | | |

| Family | Scientific Name | Common Name | P01 | P02 | P03 | P04 | P05 | P06 | P07 | P08 | P09 | P10 | P11 | P12 | P13 | P14 | P15 | P16 | P17 | P18 | P19 | P20 | P21 | P22 | P23 | P24 | P25 | P26 | P27 | P28 | P29 | P30 | P31 | P32 | P33 | P34 | P35 | P36 | P37 | P38 | P39 | P40 | P41 | P42 | P43 | P44 | P45 | P46 | P47 | P48 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Malvaceae** | **Modiola caroliniana* | red-flowered mallow | | | ✓ | | ✓ | | | ✓ | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Malvaceae** | *Sida corrugata* | corrugated sida | ✓ | | ✓ | ✓ | ✓ | | ✓ | | ✓ | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ | ✓ | | ✓ | | ✓ | ✓ | ✓ | ✓ | | | ✓ | |
| **Malvaceae** | *Sida cunninghamii* | ridge sida | | | | | | ✓ | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Malvaceae** | *Sida filiformis* | | | ✓ | | | | | | | | | | | | ✓ | | | | ✓ | | | | | | | ✓ | | | | | | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | | ✓ | ✓ | | | | | | | |
| **Malvaceae** | **Sida rhombifolia* | Paddy's lucerne | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | |
| **Malvaceae** | *Sida* sp. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ✓ | |
| **Myoporaceae** | *Eremophila debilis* | amulla | ✓ | | ✓ | | | ✓ | | | | ✓ | ✓ | | | | | ✓ | | | | | | | | | ✓ | | ✓ | | | | ✓ | | | ✓ | | | | | | | ✓ | ✓ | | | | ✓ | ✓ |
| **Myoporaceae** | *Eremophila mitchellii* | budda | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | |
| **Myoporaceae** | *Myoporum montanum* | western boobialla | | | | | | | | | | | | | | | | ✓ | | ✓ | | | | | | | ✓ | | ✓ | | | | ✓ | | | | | | | | | | | | | | | | | |
| **Myrtaceae** | *Eucalyptus albens* | white box | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ✓ | | | | | | | |
| **Myrtaceae** | *Eucalyptus camaldulensis* | river red gum | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ✓ |
| **Myrtaceae** | *Eucalyptus conica* | fuzzy box | | | | | | | | | ✓ | ✓ | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Myrtaceae** | *Eucalyptus melliodora* | yellow box | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ✓ | | | ✓ | | ✓ | | | | | | | | |
| **Myrtaceae** | *Eucalyptus microcarpa* | western grey box | ✓ | ✓ | | | | | | | | | | ✓ | | | | ✓ | | | | | | | | | ✓ | | | | | ✓ | ✓ | | | | | | | | | | | | | | | | |
| **Myrtaceae** | *Eucalyptus populnea* subsp. *bimbil* | bimble box | | | | | | ✓ | | | | | | | | | ✓ | | | ✓ | | ✓ | | | | ✓ | | ✓ | | ✓ | | | | | | | | | | | | | | | | | | | | |
| **Nyctaginaceae** | *Boerhavia dominii* | tarvine | | ✓ | | | | | | | ✓ | ✓ | | ✓ | | | ✓ | | | ✓ | | | ✓ | | | ✓ | | ✓ | | ✓ | | | | | | | | | ✓ | | | | | | | | | | ✓ |
| **Oleaceae** | *Notelaea microcarpa* | native olive | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ✓ | ✓ | | | | | | | | | | | | | | | |
| **Oleaceae** | **Olea europaea* subsp. *cuspidata* | African olive | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Onagraceae** | **Oenothera* sp. | | | | | | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Onagraceae** | **Oenothera stricta* subsp. *stricta* | | | | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Oxalidaceae** | *Oxalis perennans* | | | | | | | | | | | | | | ✓ | | | ✓ | | | ✓ | | | | | | | | ✓ | | | | | | | | | | | | | | ✓ | | | | | ✓ | |
| **Oxalidaceae** | *Oxalis* sp. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | |
| **Phyllanthaceae** | *Phyllanthus virgatus* | wiry spurge | | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | |
| **Plantaginaceae** | *Plantago debilis* | shade plantain | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Plantaginaceae** | **Plantago lanceolata* | lamb's tongues | ✓ | | | | ✓ | | ✓ | ✓ | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Plantaginaceae** | *Plantago turrifera* | small sago-weed | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | |
| **Polygonaceae** | *Persicaria prostrata* | creeping knotweed | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Polygonaceae** | **Polygonum aviculare* | wireweed | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Polygonaceae** | *Rumex brownii* | swamp dock | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| Family | Scientific Name | Common Name | P01 | P02 | P03 | P04 | P05 | P06 | P07 | P08 | P09 | P10 | P11 | P12 | P13 | P14 | P15 | P16 | P17 | P18 | P19 | P20 | P21 | P22 | P23 | P24 | P25 | P26 | P27 | P28 | P29 | P30 | P31 | P32 | P33 | P34 | P35 | P36 | P37 | P38 | P39 | P40 | P41 | P42 | P43 | P44 | P45 | P46 | P47 | P48 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Polygonaceae** | **Rumex crispus* | curled dock | | | | | | | | | | | | ✓ | | ✓ | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Polygonaceae** | *Rumex* sp. | dock | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Portulacaceae** | *Portulaca oleracea* | pigweed | | | | | | | | | | | | ✓ | | | ✓ | | | | | | | | ✓ | ✓ | | | | | | | | | | | | | | | | | | | | | | | | |
| **Rubiaceae** | *Asperula conferta* | common woodruff | | ✓ | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | |
| **Rubiaceae** | **Galium* sp. | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Rubiaceae** | *Psydrax odorata* | shiny-leaved canthium | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ✓ | | | | | | | | |
| **Rubiaceae** | **Sherardia arvensis* | field madder | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Rutaceae** | *Geijera parviflora* | wilga | | | | | | ✓ | | | ✓ | ✓ | ✓ | | | | ✓ | ✓ | ✓ | ✓ | | ✓ | | | | | ✓ | ✓ | ✓ | | ✓ | | | ✓ | | | | | | | | | ✓ | | | ✓ | ✓ | | | ✓ | |
| **Sapindaceae** | *Alectryon oleifolius* | western rosewood | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Sapindaceae** | *Dodonaea viscosa* | sticky hop-bush | | | | | | | | | | | | | | | | | | | | | ✓ | | | | | | | | ✓ | ✓ | | | | | | | | | | | | | | | | | | |
| **Scrophulariaceae** | **Kickxia elatine* | pointed toadflax | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Scrophulariaceae** | **Misopates orontium* | lesser snapdragon | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Scrophulariaceae** | **Verbascum virgatum* | twiggy mullein | | | | | | | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | ✓ | ✓ | | | | |
| **Solanaceae** | ***Lycium ferocissimum* | African boxthorn | | | | | | | | | | | | | | | ✓ | | | ✓ | | | | | | ✓ | | ✓ | | | | | | ✓ | | | | | | | ✓ | | | | | | | | |
| **Solanaceae** | ***Solanum elaeagnifolium* | silver-leaved nightshade | | | | | | | ✓ | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Solanaceae** | *Solanum esuriale* | quena | ✓ | | ✓ | | ✓ | | | | | ✓ | | ✓ | | ✓ | ✓ | | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | | | | | ✓ | | | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | |
| **Solanaceae** | **Solanum nigrum* | black-berry nightshade | | | | | | | | | | | | | | | | | | | ✓ | ✓ | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Solanaceae** | *Solanum* sp. | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | |
| **Stackhousiaceae** | *Stackhousia muricata* | stackhousia | | | | | | ✓ | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Sterculiaceae** | *Brachychiton populneus* | kurrajong | ✓ | | | | | | | | | | | | | | | | ✓ | ✓ | | ✓ | | | | | | ✓ | | ✓ | | ✓ | | | | | | | | | | | | | | | | | |
| **Ulmaceae** | *Trema tomentosa var. aspera* | native peach | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Verbenaceae** | **Verbena bonariensis* | purpletop | | | | | ✓ | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Verbenaceae** | **Verbena incompta* | | | | | | | | | | | | | | | | | | ✓ | | ✓ | | | | | | | | ✓ | | | | ✓ | | | | | | | | | | | ✓ | | | | |
| **Verbenaceae** | **Verbena officinalis* | common verbena | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | ✓ | ✓ | | | | |
| **Verbenaceae** | **Verbena* sp. | | | | | | | | | | | | | ✓ | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Zygophyllaceae** | *Tribulus micrococcus* | spineless caltrop | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ✓ | | | | | | |
| **Zygophyllaceae** | *Tribulus* sp. | cat-head; caltrop | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Zygophyllaceae** | **Tribulus terrestris* | cat-head | | | | | | | | | | | | | | | ✓ | | | | | | ✓ | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | |



# APPENDIX C

**Plot and Transect Data**

## Appendix C - Plot and Transect Data

The following plot and transect data was collected from surveys of the Development Site. It includes the ten site attributes that are recorded in each Biometric plot and transect as per Table 2 of the FBA (OEH 2014a). This data is assessed against benchmark data for PCTs and then entered into the BioBanking Calculator to assess the site value of each PCT in the Development Site.

The following abbreviations or symbols are used in the list:

| | |
|---|---|
| NPS | native plant species |
| NOC | native overstorey cover |
| NMC | native midstorey cover |
| NGCG | native ground cover (grasses) |
| NGCS | native ground cover (shrubs) |
| NGCO | native ground cover (other) |
| EPC | exotic plant cover |
| NTH | number of trees with hollows |
| OR | overstorey regeneration, and |
| FL | total length of fallen logs. |

| Plot Name | NPS | NOS | NMS | NGCG | NGCS | NGCO | EPC | NTH | OR | FL | Easting | Northing | Zone |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Zone 1: CW205, LA212_Weeping Myall Open Woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion_Moderate/Good** | | | | | | | | | | | | | |
| **P13** | 17 | 17.5 | 0 | 34 | 0 | 6 | 0 | 0 | 1 | 0 | 610211.44 | 6380228.2 | 55 |
| **P21** | 26 | 1 | 0 | 114 | 0 | 32 | 28 | 0 | 1 | 0 | 613120.71 | 6426762.16 | 55 |
| **P32** | 22 | 2.5 | 0 | 48 | 34 | 36 | 0 | 1 | 1 | 60.5 | 609202.85 | 6388281.52 | 55 |
| **Zone 2: CW183, LA193_River Red Gum Tall to very Tall Open Forest/woodland wetland on rivers on floodplains mainly in the Darling Riverine Plains Bioregion_Moderate/Good** | | | | | | | | | | | | | |
| **P48** | 13 | 27.5 | 0 | 38 | 0 | 32 | 12 | 2 | 1 | 50 | 610084 | 6361069 | 55 |
| **Zone 3: CW183, LA193_River Red Gum Tall to very Tall Open Forest/woodland wetland on rivers on floodplains mainly in the Darling Riverine Plains Bioregion_Low - Regeneration** | | | | | | | | | | | | | |
| **P05** | 26 | 0 | 0 | 54 | 2 | 18 | 46 | 0 | 1 | 4 | 610099.71 | 6361049.68 | 55 |
| **Zone 4: CW104, LA105_Belah Woodland on alluvial plain and low rises on the Central NSW wheatbelt to Pilliga and Liverpool Plains regions_Moderate/Good** | | | | | | | | | | | | | |
| **P26** | 32 | 16 | 0 | 39 | 2 | 2 | 2 | 0 | 0.5 | 0 | 607031.94 | 6398448.80 | 55 |
| **Zone 5: CW104, LA105_Belah Woodland on Alluvial Plain and Low Rises on the Central NSW Wheatbelt to Pilliga and Liverpool Plains Regions_Moderate/Good – Derived Native Grassland** | | | | | | | | | | | | | |
| **P33** | 12 | 0 | 0 | 86 | 0 | 0 | 0 | 0 | 1.0 | 0 | 607308.39 | 6397685.35 | 55 |
| **P14** | 29 | 0 | 0 | 48 | 0 | 20 | 6 | 0 | 1.0 | 0 | 607082.21 | 6398249.80 | 55 |
| **P15** | 30 | 14 | 1 | 36 | 2 | 14 | 18 | 1 | 1.0 | 0 | 607028.60 | 6398390.96 | 55 |
| **Zone 6: CW220, LA223_White Cypress Pine Woodland on Sandy Loams in Central NSW Wheatbelt_Moderate/Good** | | | | | | | | | | | | | |
| **P38** | 19 | 2.6 | 0 | 52 | 2 | 8 | 16 | 0 | 0.66 | 0 | 604579.72 | 6335569.98 | 55 |
| **Zone 7: CW145, LA154_Western Grey Box Tall Grassy Woodland on Alluvial Loam and Clay Soils in the NSW South West Slopes and Riverina Bioregions_Moderate/Good** | | | | | | | | | | | | | |
| **P01** | 25 | 4.5 | 0 | 32 | 0 | 4 | 0 | 1 | 0.75 | 10.1 | 604330.19 | 6342492.62 | 55 |
| **P02** | 29 | 6.7 | 0 | 32 | 0 | 0 | 0 | 3 | 0.75 | 17.8 | 605896.72 | 6349724.42 | 55 |
| **P12** | 25 | 9.5 | 0 | 26 | 0 | 10 | 4 | 1 | 0.75 | 2.5 | 610485.13 | 6379138.91 | 55 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **P16** | 30 | 33 | 4.5 | 36 | 4 | 8 | 2 | 0 | 0.75 | 0 | 606686.60 | 6401007.91 | 55 |
| **P25** | 28 | 26.5 | 0 | 28 | 0 | 14 | 4 | 5 | 0.75 | 2.75 | 611299.72 | 6376679.50 | 55 |
| **P30** | 20 | 8.5 | 0 | 26 | 2 | 8 | 8 | 2 | 0.75 | 6 | 605755.07 | 6333435.03 | 55 |
| **P31** | 30 | 32.5 | 0 | 50 | 0 | 34 | 0 | 2 | 0.75 | 8 | 612111.00 | 6374322.15 | 55 |
| **Zone 8: CW145, LA154_Western Grey Box Tall Grassy Woodland on Alluvial Loam and Clay Soils in the NSW South West Slopes and Riverina Bioregions_Moderate/Good – Derived Native Grassland** | | | | | | | | | | | | | |
| **P03** | 19 | 0 | 0 | 50 | 0 | 8 | 4 | 0 | 0.5 | 0 | 605468.01 | 6348264.17 | 55 |
| **P04** | 21 | 0 | 0 | 60 | 0 | 2 | 0 | 0 | 0.5 | 0 | 606489.40 | 6350709.85 | 55 |
| **P07** | 20 | 0 | 0 | 44 | 0 | 10 | 20 | 0 | 0.5 | 0 | 611784.53 | 6363463.94 | 55 |
| **P36** | 13 | 0 | 0 | 72 | 0 | 24 | 2 | 0 | 0.5 | 11 | 609507.96 | 6355576.05 | 55 |
| **Zone 9: CW172, LA178_Poplar Box Grassy Woodland on Alluvial Clay-loam Soils mainly in the Temperate (hot summer) Climate Zone of Central NSW (wheatbelt) _Moderate/Good** | | | | | | | | | | | | | |
| **P06** | 31 | 11 | 0 | 42 | 0 | 2 | 0 | 0 | 0.8 | 0 | 612225.34 | 6373804.04 | 55 |
| **P17** | 32 | 0 | 0 | 6 | 0 | 28 | 88 | 0 | 0.8 | 10.5 | 606595.94 | 6402470.85 | 55 |
| **P18** | 37 | 4.5 | 12.5 | 22 | 4 | 18 | 0 | 0 | 0.8 | 16 | 606545.32 | 6403072.77 | 55 |
| **P20** | 29 | 31 | 0 | 20 | 0 | 18 | 24 | 0 | 0.8 | 0 | 606568.11 | 6403988.22 | 55 |
| **P24** | 23 | 16.5 | 0 | 22 | 0 | 10 | 30 | 5 | 0.8 | 7 | 614371.93 | 6430004.82 | 55 |
| **P27** | 24 | 14 | 10 | 28 | 6 | 6 | 0 | 0 | 0.8 | 12 | 606568.84 | 6402281.88 | 55 |
| **P29** | 18 | 11.5 | 0.5 | 38 | 2 | 28 | 42 | 0 | 0.8 | 0 | 606496.21 | 6403959.05 | 55 |
| **Zone 10: CW172, LA178_Poplar Box Grassy Woodland on Alluvial Clay-loam Soils mainly in the Temperate (hot summer) Climate Zone of Central NSW (wheatbelt) _Moderate/Good – Derived Native Grassland** | | | | | | | | | | | | | |
| **P28** | 22 | 0 | 0 | 86 | 2 | 22 | 18 | 0 | 0.8 | 0 | 606610.02 | 6402337.32 | 55 |
| **P43** | 21 | 0 | 6 | 70 | 24 | 24 | 2 | 0 | 0.8 | 14 | 606633.24 | 6401906.55 | 55 |
| **P44** | 22 | 0 | 0 | 70 | 6 | 16 | 8 | 0 | 0.8 | 13 | 606610.27 | 6402250.28 | 55 |
| **Zone 11: CW138, LA145_Fuzzy Box Woodland on Alluvial Brown Loam Soils mainly in the NSW South Western Slopes Bioregion_Moderate/Good** | | | | | | | | | | | | | |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **P09** | 33 | 15.5 | 0 | 66 | 0 | 10 | 0 | 0 | 0.33 | 0 | 613885.35 | 6371162.88 | 55 |
| **P10** | 28 | 15 | 0 | 42 | 0 | 4 | 0 | 1 | 0.33 | 0 | 613375.60 | 6372482.45 | 55 |
| **Zone 12: CW213, LA218_White Box – White Cypress Pine – Western Grey Box shrub/grass/forb Woodland in the NSW South Western Slopes Bioregion_Moderate/Good** | | | | | | | | | | | | | |
| **P11** | 22 | 11 | 0 | 52 | 0 | 12 | 0 | 1 | 0.75 | 2.5 | 612428.98 | 6373455.90 | 55 |
| **P40** | 25 | 1.9 | 0.6 | 56 | 12 | 20 | 0 | 1 | 0.75 | 22 | 612307.31 | 6364890.94 | 55 |
| **Zone 13: CW213, LA218_White Box – White Cypress Pine – Western Grey Box shrub/grass/forb Woodland in the NSW South Western Slopes Bioregion_Moderate/Good – Derived Native Grassland** | | | | | | | | | | | | | |
| **P41** | 24 | 0 | 0 | 80 | 0 | 34 | 8 | 0 | 0.75 | 2 | 612363.05 | 6373506.55 | 55 |
| **Zone 14: CW226, LA226_Yellow Box Grassy Tall Woodland on Alluvium or Parna Loams and Clays on Flats in NSW South Western Slopes Bioregion_Moderate/Good** | | | | | | | | | | | | | |
| **P34** | 24 | 9.7 | 0 | 62 | 4 | 24 | 0 | 1 | 0.75 | 8 | 609943.10 | 6359480.46 | 55 |
| **P39** | 29 | 4.2 | 0 | 66 | 6 | 24 | 4 | 2 | 0.75 | 24 | 609797.82 | 6359184.92 | 55 |
| **P47** | 32 | 18.5 | 12.5 | 56 | 6 | 16 | 1 | 2 | 1 | 5 | 612200 | 6373944 | 55 |
| **Zone 15: CW226, LA226_Yellow Box Grassy Tall Woodland on Alluvium or Parna Loams and Clays on Flats in NSW South Western Slopes Bioregion_Moderate/Good – Derived Native Grassland** | | | | | | | | | | | | | |
| **P35** | 18 | 8 | 0 | 82 | 0 | 20 | 2 | 0 | 0.75 | 0 | 609954.97 | 6359403.71 | 55 |
| **P37** | 11 | 0 | 0 | 92 | 2 | 2 | 16 | 0 | 0.75 | 0 | 609814.04 | 6359079.40 | 55 |
| **P42** | 24 | 1 | 0 | 76 | 4 | 20 | 0 | 0 | 0.75 | 3 | 612261.35 | 6373947.90 | 55 |

# APPENDIX D

## Threatened Ecological Community Analysis

# Threatened Ecological Communities

Eight of the vegetation zones described above and mapped within the Development Site conform to State and Commonwealth listed TECs, comprising:

- Weeping Myall Woodlands:
    - *Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South western Slopes bioregions EEC* under the TSC Act.
    - *Weeping Myall Woodlands EEC* under the EPBC Act
- Inland Grey Box Woodlands and Derived Native Grasslands:
    - *Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions EEC* under the TSC Act
    - *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC* under the EPBC Act
- Fuzzy Box Woodlands:
    - *Fuzzy Box Woodland on alluvial Soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions EEC* under the TSC Act
- White Box Woodlands and Derived Native Grasslands:
    - *White Box Yellow Box – Blakely's Red Gum Woodland EEC* under the TSC Act
    - *White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC* under the EPBC Act.

Analysis of consistency with the scientific determinations for each TEC was undertaken, with consideration of the advice provided by the NSW Scientific Committee and/or the Commonwealth Threatened Species Scientific Committee guidelines for interpreting listings for species, populations and ecological communities under the TSC Act and EPBC Act respectively. The vegetation zones described in Section 3.2.1 of the BAR conform to the listing advice provided for each of the TECs, except where minimum patch sizes are required or when the TEC is excluded on the basis of bioregion.

## Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South western Slopes bioregions EEC under the TSC Act

*Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South western Slopes bioregions* is listed as an EEC under the TSC Act. This ecological community is scattered across the eastern parts of the alluvial plains of the Murray-Darling river system. The structure of the community varies from low woodland and low open woodland to low sparse woodland or open shrubland, depending on site quality and disturbance history. The community is dominated by *Acacia pendula* as one of the dominant species or in some patches the only tree species present. The understorey includes an open layer of chenopod shrubs and other woody plant species and an open to continuous groundcover of grasses and herbs.

A comprehensive analysis of this vegetation community was undertaken to determine if it conformed to the Final Determination for this community (NSW Scientific Committee 2005).

**Constituent Species**

The species recorded within *Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions* EEC in the Development Site comprise species, and/or taxa below species rank, as required by the TSC Act.

This included the presence of weeping myall (*Acacia pendula*) as the dominant and frequently the sole canopy species within the Development Site.

**Assemblage of Species**

The NSW Scientific Committee (2005) lists 84 species as characterising the assemblage of species for *Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South western Slopes bioregions* EEC. As part of ecological investigations for the proposal, three systematic 20 metre x 20 metre quadrats were sampled in this community across the Development Site.

Within the Development Site, weeping myall (*Acacia pendula*) was recorded in all three quadrats sampled. A total of 19 species (23 per cent) of the species listed in the Final Determination were present within this community across the Development Site. The assemblage of species recorded in the vegetation community is considered to conform to the EEC final determination.

**Particular Area**

In relation to the particular area of the *Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South western Slopes bioregions* EEC, the NSW Scientific Committee (2005) states that the community occurs within the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South western Slopes bioregions. Additionally the community occurs within the Parkes and Narromine LGAs.

The area in which this community occurs within the Development Site is situated within the Darling Riverine Plains Bioregion and NSW South Western Slopes Bioregions; and the Parkes and Narromine LGAs (refer to Figures A19-A36 in **Appendix A**).

**Supplementary Descriptors**

In relation to supplementary descriptors, the NSW Scientific Committee (2005) includes the following key information pertaining to the *Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South western Slopes bioregions* EEC:

- ***occurs on red-brown earths and heavy textured grey and brown alluvial soils within a climatic belt receiving between 375 and 500 mm mean annual rainfall***
- ***structure of the community varies from low woodland and low open woodland to low sparse woodland or open shrubland,***
- ***the tree layer grows up to a height of about 10 metres and invariably includes Acacia pendula as one of the dominant species or the only tree species present, and***
- ***the understorey includes an open layer of chenopod shrubs and other woody plant species and an open to continuous groundcover of grasses and herbs.***

Of the above supplementary descriptors, the *Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions EEC* present in the Development Site comprises a upper stratum dominated by weeping myall (*Acacia pendula*). Beneath the canopy, the community identified within the Development Site comprises a number of chenopod shrubs along with several grass and herb species. The community identified within the Development Site is characterised by open woodland through to open shrublands, a likely result of clearing occurring within the existing rail corridor and exposure to a history of disturbance.

Climatically the Development Site has an average annual rainfall of between 526 and 643 millimetres (BOM, 2016) which is slightly higher than the measurements listed in the Final Determination, however in recent years the rainfall has been lower than these averages. Additionally, the soils on which this community occurred on within the Development Site were consistent with the Final Determination.

**Summary**

The Development Site supports a total of 3.47 hectares of *Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South western Slopes bioregions* EEC under the TSC Act within PCT26 (CW205, LA212) Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion - Moderate to Good condition.

## Weeping Myall Woodlands EEC under the EPBC Act

Weeping Myall Woodlands is listed as an EEC under the EPBC Act. The community occurs on inland alluvial plains west of the Great Dividing Range in NSW and Queensland. The Listing Advice for the community identifies the community as occurring in the Riverina, NSW South Western Slopes, Darling Riverine Plains, Brigalow Belt South, Brigalow Belt North, Murray-Darling Depression, Nandewar and Cobar Peneplain bioregions (TSSC 2008). The community is characterised by open woodlands and woodlands, generally 4-12 metres high that are dominated by weeping myall (*Acacia pendula*).

A comprehensive analysis of this vegetation community was undertaken to determine the proportion of the community that conformed to the Listing Advice for the Weeping Myall Woodlands EEC (TSSC 2008).

**Particular Area**

In relation to the particular area of the Weeping Myall Woodlands EEC, the TSSC (2008) states that the community occurs within the Brigalow Riverina, NSW South Western Slopes, Darling Riverine Plains, Brigalow Belt South, Brigalow Belt North, Murray-Darling Depression, Nandewar and Cobar Peneplain IBRA Bioregions.

The area in which this community occurs within the Development Site is situated within the Darling Riverine Plains Bioregion and NSW South Western Slopes (refer to **Appendix A**).

**Additional Criteria**

The published Listing Advice for *Weeping Myall Woodlands EEC* under the EPBC Act (TSSC 2008) and EPBC Policy Statement 3.17 (DEWHA 2009) provides a set of condition classes that patches of vegetation are required to meet in order to conform to the EEC. These are listed below and comparison was made to the Weeping Myall Woodlands identified within the Development Site.

- ***Tree canopy is dominated (at least 50% of trees present) by living, dead or defoliated Weeping Myall trees.***

The tree canopy of *Weeping Myall Woodlands EEC* within the Development Site is dominated by weeping myall (*Acacia pendula*) trees.

- ***Overstorey must have at least 5% tree canopy cover or at least 25 dead or defoliated mature Weeping Myall trees/ha.***

The 0.99 hectares of *Weeping Myall Woodlands EEC* identified in the Development Site has more than 5% tree canopy of weeping myall (*Acacia pendula*).

- ***The area is at least 0.5 hectares in size.***

A total of 3.47 hectares of PCT26 (CW205, LA212) Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion - Moderate to Good condition was identified within the Development Site. Due to the restricted nature of the rail corridor, the majority of patches strictly within corridor were smaller than the required minimum 0.5 hectare patch size. A process was undertaken to identify which patches extended outside the bounds of the Development Site and therefore met the area patch requirements of the EPBC Act community. This process identified five patches of Weeping Myall that were larger than 0.5 hectares, however, only 0.99 hectares occurred within the Development Site.

- ***Patch has either: more than two layers of regeneration of Weeping Myall Present; or the tallest layer of living, dead or defoliated Weeping Myall trees is at least 4 metres tall and of the vegetation cover present, 50% is comprised of native species.***

The 0.99 hectares of *Weeping Myall Woodland EEC* identified in the Development Site either has more than two layers of regeneration of weeping myall (*Acacia pendula*) present or the tallest layer of living, dead or defoliated weeping myall trees is at least 4 metres tall.

**Summary**

The Development Site supports a total of 0.99 hectares of *Weeping Myall Woodlands EEC* within PCT26 (CW205, LA212) Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion - Moderate to Good condition. The analysis above identified that the Development Site supports a total of 0.99 hectares of *Weeping Myall Woodlands EEC* under the EPBC Act. The remaining 2.48 hectares within the Development Site did not conform to the EEC due to the community not meeting the minimum patch size requirements in some areas of the site.

## Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions EEC under the TSC Act

Inland Grey Box Woodland is listed as an EEC under the TSC Act. This community is known to occur on the fertile soils of the western slopes and plains of NSW in which inland grey box (*Eucalyptus microcarpa*) is the most characteristic species. In NSW, the community largely occurs within the Riverina and South West Slopes Bioregions, but is also found in areas of the Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions.

A comprehensive analysis of this vegetation community was undertaken to determine if it conformed to the listing advice for the EEC (NSW Scientific Committee 2007).

**Constituent Species**

The species recorded within *Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions EEC* in the Development Site comprise species, and/or taxa below species rank, as required by the Act.

This included inland grey box (*Eucalyptus microcarpa*) being the dominant canopy species, while poplar box (*Eucalyptus populnea* subsp. *bimbil*), white cypress-pine (*Callitris glaucophylla*) and kurrajong (*Brachychiton populneus*) were also present as co-dominants or scattered canopy tree species in the woodland component. Trees were absent from the derived native grassland component.

**Assemblage of Species**

Due to the broad geographic range of this EEC, the NSW Scientific Committee (2007) lists 74 species as characterising the assemblage of species for *Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions EEC*. As part of ecological investigations for the proposal, 11 systematic 20 metre x 20 metre quadrats were sampled in this community across the Development Site.

Within the Development Site, seven quadrats were used to describe the woodland component of *Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions EEC* occurring in the Development Site for which a total of 32 (43 per cent) of the species listed in the Final Determination were recorded.

An additional four quadrats were sampled to describe the grassland component for *Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions EEC* for which a total of 17 (23 per cent) of the species listed in the Final Determination were present within this community across the Development Site.

**Particular Area**

In relation to the particular area of *Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions EEC*, the NSW Scientific Committee (2007) states that the community occurs within the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions. The southern half of the Development Site is situated within the NSW South Western Slopes Bioregion, while the northern half occurs in the Darling Riverine Plains Bioregion. As a result only areas of this community that occur within the NSW South Western Slopes Bioregion have been attributed to the EEC.

The listing advice also identifies the EEC as being present in parts of the Parkes and Narromine LGAs, which the Development Site occurs in.

**Supplementary Descriptors**

In relation to supplementary descriptors, the NSW Scientific Committee (2007) includes the following key information pertaining to *Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions EEC*:

- ***has an average rainfall of 375-800 millimetres per annum and a mean maximum annual temperate of 22-26°C;***
- ***occurs on relatively fertile soils;***

- ***shrubs are typically sparse or absent, but can also be locally common and diverse; and***

- ***the community is usually present as an open woodland 15 – 25 metres in height, but in some locations the canopy may be absent as a result of clearing or thinning.***

Of the above supplementary descriptors, the *Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions EEC* present in the Development Site occurs on relatively fertile soils. Climatically the development site has an average annual rainfall of between 526 and 643 millimetres (BOM 2016) and average maximum annual temperature of between 23 and 25°C. The overstorey is relatively intact and shrub layer is predominantly absent in the woodland form, whilst canopy trees are absent from the derived native grassland component. The understorey is variable, generally dominated by native grasses and forbs, with occurrences of introduced perennials and annual exotic grasses.

**Summary**

The Development Site supports a total of 39.39 hectares of *Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions EEC* under the TSC Act represented by PCT267 (CW145, LA145) Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions - Moderate to Good condition and Moderate to condition – Derived Native Grassland that occurs within the South Western Slopes IBRA Bioregion.

## Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC under the EPBC Act

Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia is listed as an EEC under the EPBC Act. The community is characterised by a canopy dominated by inland grey box (*Eucalyptus microcarpa*), while several other canopy species are also commonly associated with the EEC. These include, but are not limited to bulloak (*Allocasuarina luehmannii*), kurrajong (*Brachychiton populneus*) and white cypress pine (*Callitris glaucophylla*).

A comprehensive analysis of this vegetation community was undertaken to determine whether it conformed to the listing advice for the EEC (TSSC 2010).

**Particular Area**

In relation to the particular area of the *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC*, the TSSC (2010) states that the community occurs on low slopes and plains from central NSW, through northern and central Victoria into South Australia.

The area in which this community occurs within the Development Site is situated within the lower slopes of central NSW.

**Additional Criteria – Key Diagnostic Characteristics**

The *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC* occupies a transitional landscape zone between semi-arid communities, temperate woodlands and forests of the lower slopes and ranges. Key diagnostic characteristics are provided within the Listing Advice for this EEC (TSSC 2010) as many of the plant species present in the community are widespread or occur is a variety of other vegetation types that adjoin the community. The key diagnostic characteristics are provided and assessed below.

- ***The ecological community occurs on low slopes and plains from central NSW, through northern and central Victoria into South Australia. Disjunct occurrences are known from near Melbourne and in the Flinders-Lofty Block Bioregion of South Australia.***

The woodland and associated DNG within the Development Site that is considered to conform with the *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC* under the EPBC Act occurs on low slopes and plains of central NSW, particularly from Parkes to Narromine, NSW.

- ***The vegetation structure of the ecological community is typically a woodland to open forest.***

The vegetation communities within the Development Site that are considered to conform to *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC* are typically a woodland but also occur in the form of Derived Native Grasslands, with the canopy and understorey shrubs absent.

- ***The tree canopy is dominated (≥50% canopy crown cover) by Eucalyptus microcarpa (Grey Box). Other tree species may be present in the canopy and, in certain circumstances, may be co-dominant with Grey Box but are never dominant on their own.***

The woodland within the Development Site that is considered to conform to *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC* comprised a canopy dominated by inland grey box (*Eucalyptus microcarpa*). Other canopy species were recorded but were never dominant. These species included kurrajong (*Brachychiton populneus*) and white cypress pine (*Callitris glaucophylla*). Only grasslands surrounding or in the vicinity of grey box woodland were considered to be derived from grey box woodlands and therefore conforming to the EEC under the EPBC Act.

- ***The mid layer comprises shrubs of variable composition and cover, from absent to moderately dense. The mid layer usually has a crown cover of less than 30% with local patches up to 40% crown cover.***

Shrubs were commonly present in the mid stratum of the woodland within the Development Site being considered as conforming to *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC*, however, they generally comprised a total crown cover of less than 10 per cent.

- ***The ground layer is highly variable in development and composition, ranging from almost absent to mostly grassy to forb-rich. Ground layer flora commonly present include one or more of the graminoid genera: Austrodanthonia, Austrostipa, Elymus, Enteropogon, Dianella and Lomandra; and one or more of the chenopod genera: Atriplex, Chenopodium, Einadia, Enchylaena, Maireana, Salsola and Sclerolaena.***

The woodland within the Development Site that is considered to conform to *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC* varied in quality from diverse to species poor. Both woodland and DNG forms of the community recorded comprised at least one of the graminoid genera listed above. Specifically, *Austrodanthonia*, *Austrostipa*, *Atriplex*, *Einadia* and *Sclerolaena* were common.

Derived grasslands are a special state of the ecological community, whereby the canopy and mid layers have been mostly removed to <10 per cent crown cover but the native ground layer remains largely intact, with 50 per cent or more of the total vegetation cover being native.

Only grasslands surrounding or in the vicinity of grey box woodland were considered to be derived from grey box woodlands and therefore conforming to the EEC under the EPBC Act. These areas of the EEC

within the Development Site are predominantly absent of a remnant canopy, with only scattered trees and shrubs remaining. The cover of native flora species in the ground layer is at least 50 per cent.

**Additional Criteria - Condition Thresholds**

The condition thresholds identified in the Listing Advice for this EEC (TSSC 2010) have multiple criteria in order for vegetation to form with the EEC under the EPBC Act. There are general criteria as well as a number of additional criteria depending on the size of the patch, and additional criteria for DNG.

General criteria (TSSC 2010) require:

- ***the minimum patch size is 0.5 hectare;***
- ***the canopy contains inland grey box (Eucalyptus microcarpa) as a dominant or co-dominant; and***
- ***the vegetative cover of non-grass weed species is less than 30% in the ground layer at any time of year.***

Due to the nature of the proposal, the patches in the Development Site being assessed as to whether or not they conform to this EEC occur within the railway corridor. This means that many of the patches are small in size and would not, in isolation, meet the size requirements of the general criteria. However these mapped areas within the corridor are part of larger patches adjacent to the corridor and were consequently larger than 0.5 hectares. Woodland patches all comprised inland grey box (*Eucalyptus microcarpa*) as a dominant or co-dominant and the vegetative cover of non-grass weed species was less than 30 per cent throughout the mapped communities.

Additional criteria (TSSC 2010) for patches between 0.5 and 2 hectares require:

- ***at least 50% of the vegetative cover of the ground layer comprises perennial native species at any time of year; and***
- ***8 or more perennial native species are present in the mid and ground layers at any time of year.***

The biometric plots that were completed within PCT76 (CW145, LA154) Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions – Moderate to Good and Moderate to Good – Derived Native Grassland within the Development Site predominantly had at least 50 per cent of the vegetation cover comprised by perennial native species. There were some circumstances where this was not the case, however the large size of the Development Site and restrictive nature of the corridor resulted in limitations for plot locations. For this reason and based on the data collected, it is considered that the vegetation community meets this additional criterion. All floristic plots comprise at least 8 perennial native species within the mid and ground layers.

Additional criteria (TSSC 2010) for patches where the canopy is less developed or absent include:

- ***The patch is a derived grassland with clear evidence that the site formerly was a woodland with inland grey box (Eucalyptus microcarpa) as a dominant or co-dominant;***
- ***At least 50% of the vegetative cover in the ground layer comprises perennial native species at any time of year; and***
- ***The ground layer comprises at least 12 native species at any time of year.***

Only native grasslands surrounding or in the vicinity of existing grey box woodland were considered to be derived from grey box woodlands and therefore conforming to the EEC under the EPBC Act.

The biometric plots that were completed within PCT76 (CW145, LA154) Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions – Moderate to Good – Derived Native Grassland within the Development Site predominantly had at least 50 per cent of the vegetation cover comprised by perennial native species. There were some circumstances within this community where this was not the case, however the large size of the Development Site and restrictive nature of the rail corridor resulted in limitations for plot locations. Additionally, these plots all comprised at least 12 native species.

**Summary**

The Development Site supports a total of 41.51 hectares of *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC* under the EPBC Act within PCT76 (CW145, LA154) Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions – Moderate to Good and Moderate to Good – Derived Native Grassland.

## Fuzzy Box Woodland on alluvial soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions EEC under the TSC Act

Fuzzy Box Woodland on alluvial soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions is listed as an EEC under the TSC Act. This community primarily occurs in the Dubbo - Narromine - Parkes - Forbes area. It occurs on brown loam or clay, alluvial or colluvial soils on prior streams and abandoned channels or slight depressions on the undulating plains or flats of the western slopes of the Great Dividing Range and is characterised by the presence of fuzzy box (*Eucalyptus conica*), which often grows with inland grey box (*Eucalyptus microcarpa*), yellow box (*Eucalyptus melliodora*) or kurrajong (*Brachychiton populneus*).

A comprehensive analysis of this vegetation community was undertaken to determine if it conforms to the Final Determination for this community (NSW Scientific Committee 2004).

**Constituent Species**

The species recorded within *Fuzzy Box Woodland on alluvial soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions EEC* in the Development Site comprise species, and/or taxa below species rank, as required by the Act.

This included a canopy dominated by fuzzy box (*Eucalyptus conica*). In some patches yellow box (*Eucalyptus melliodora*) and/or grey box (*Eucalyptus microcarpa*) was also present as either co-dominant or associate canopy species.

**Assemblage of Species**

Due to the broad geographic range of this EEC, the NSW Scientific Committee (2004) lists 102 species as characterising the assemblage of species for *Fuzzy Box Woodland on alluvial soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions EEC*. As part of ecological investigations for the proposal, two systematic 20 metre x 20 metre quadrats were sampled in *White Box Yellow Box Blakely's Red Gum Woodland* EEC across the Development Site.

Within the Development Site, fuzzy box (*Eucalyptus conica*) was recorded in all quadrats. A total of 23 species (22.5 per cent) of the species listed in the Final Determination were present within this community across the Development Site.

**Particular Area**

In relation to the particular area of the *Fuzzy Box Woodland on alluvial soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions EEC*, the NSW Scientific Committee (2004) states that the community found principally in the South Western Slopes Bioregion and also occurs in parts of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion..

The Development Site is situated within the Darling Riverine Plains Bioregion and the South Western Slopes Bioregion (refer to **Appendix A**).

**Supplementary Descriptors**

In relation to supplementary descriptors, the NSW Scientific Committee (2004) includes the following key information pertaining to the *Fuzzy Box Woodland on alluvial soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions EEC*.

- ***occurs on brown loam or clay, alluvial or colluvial soils on prior streams and abandoned channels or slight depressions on the undulating plains or flats of the western slopes of the Great Dividing Range***

- ***often occurs upslope from River Red Gum communities, just above frequently inundated areas on the floodplain.***

Of the above supplementary descriptors, the *Fuzzy Box Woodland on alluvial soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions EEC* present in the Development Site occupies the clay loam soils of a slight depression in the floodplain upslope from recorded river red gum communities.

**Summary**

The Development Site supports a total of 1.88 hectares of *Fuzzy Box Woodland on alluvial soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions EEC* under the TSC Act represented by PCT201 (CW138, LA145) Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion - Moderate to Good condition.

## White Box Yellow Box Blakely's Red Gum Woodland EEC under the TSC Act

White Box Yellow Box – Blakely's Red Gum Woodland is listed as an EEC under the TSC Act. The community is known to occur from the Queensland border in the north, to the Victorian border in the south. It occurs in the tablelands and western slopes of NSW and is characterised by the presence or prior occurrence of white box (*Eucalyptus albens*), yellow box (*Eucalyptus melliodora*) and/or Blakely's red gum (*Eucalyptus blakelyi*).

A comprehensive analysis of this vegetation community was undertaken to determine if it conforms to the Final Determination for this community (NSW Scientific Committee 2002).

**Constituent Species**

The species recorded within *White Box Yellow Box Blakely's Red Gum Woodland EEC* in the Development Site comprise species, and/or taxa below species rank, as required by the Act.

This included the canopy species of yellow box (*Eucalyptus melliodora*) and white box (*Eucalyptus albens*).

**Assemblage of Species**

Due to the broad geographic range of this EEC, the NSW Scientific Committee (2002) lists 95 species as characterising the assemblage of species for *White Box Yellow Box Blakely's Red Gum Woodland* EEC. As part of ecological investigations for the proposal, eight systematic 20 metre x 50 metre quadrats were sampled in *White Box Yellow Box Blakely's Red Gum Woodland EEC* across the Development Site.

Within the Development Site, either yellow box (*Eucalyptus melliodora*) or white box (*Eucalyptus albens*) was recorded in all quadrats or nearby for the derived native grassland component. A total of 24 species (25.3 per cent) of the species listed in the Final Determination were present within this community across the Development Site.

**Particular Area**

In relation to the particular area of the *White Box Yellow Box Blakely's Red Gum Woodland* EEC, the NSW Scientific Committee (2002) states that 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.

The area in which this community occurs within the Development Site is situated within the NSW South Western Slopes Bioregion (refer to **Appendix A**).

**Supplementary Descriptors**

In relation to supplementary descriptors, the NSW Scientific Committee (2002) includes the following key information pertaining to the *White Box Yellow Box Blakely's Red Gum Woodland EEC*:

- ***occurs on relatively fertile soils, generally between 400 and 800 millimetre isohyets, and at an altitude of circa 170 metres to circa 1200 metres***

- ***the shrub layer is generally sparse or absent, though it may be locally common, and***

- ***condition states may range from relatively good to highly degraded, such as paddock remnants with a weedy understorey and only a few hardy natives left. The tree layer may be absent as a result of past clearing or thinning.***

Of the above supplementary descriptors, the *White Box Yellow Box Blakely's Red Gum Woodland EEC* present in the Development Site occurs on relatively fertile soil. This community was recorded at altitudes of approximately between 281 metres and 321 metres above sea level. The shrub layer is generally absent to sparse, and while some of this may have been as a result of past clearing and grazing management, shrubs were most likely always sparse. While the overstorey is relatively intact in the woodland components and absent in the derived native grasslands forms, the understorey comprises a mix of native grasses and herbs.

**Summary**

The Development Site supports a total of 24.93 hectares of *White Box Yellow Box Blakely's Red Gum Woodland EEC* under the TSC Act within PCT267 (CW213, LA218) White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion – Moderate to Good and Moderate to Good – Derived Native Grassland and PCT276 (CW226, LA226) Yellow Box grassy tall woodland

on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion – Moderate to Good and Moderate to Good – Derived Native Grassland.

## White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC under the EPBC Act

White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland is listed as a CEEC under the EPBC Act. This community occurs in an along the western slopes and tablelands of the Great Dividing Range from Southern Queensland through NSW to central Victoria. It is characterised by a species-rich understorey of native tussock grasses, herbs and scattered shrubs, and the dominance, or prior dominance, of white box, yellow box or Blakely's red gum trees.

A comprehensive analysis of this vegetation community was undertaken to determine if it conformed to Listing Advice provided by the Department of the Environment under the EPBC Act (TSSC 2006).

### Particular Area

In relation to the particular area of the *White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC*, the TSSC (2006) states that the community occurs within the Brigalow Belt South, Nandewar, New England Tableland, South Eastern Queensland, Sydney Basin, NSW North Coast, South Eastern Highlands, South East Corner, NSW South Western Slopes, Victorian Midlands and Riverina Bioregions.

The area in which this community occurs within the Development Site is situated within the NSW South Western Slopes Bioregion (refer to **Appendix A**).

### Additional Criteria

Detailed assessment of the vegetation communities described and mapped within the Development Site was undertaken to determine whether the vegetation present met the condition class thresholds identified in the Listing Advice (TSSC 2006). These thresholds have been incorporated into an identification flowchart for the CEEC within the EPBC Act Policy Statement (DEH 2006) for the community which was also utilised during the assessment.

- **Is, or was previously, at least one of the most common overstorey species white box, yellow box or Blakely's red gum?**

All vegetation in the Development Site assessed against the White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC criteria was identified as having or previously having either white box (*Eucalyptus albens*), yellow box (*Eucalyptus melliodora*) or Blakely's red gum (*Eucalyptus blakelyi*) as one of the dominant overstorey species.

- **Does the patch have predominantly native understorey?**

A patch of Zone 12 – CW213, LA218– White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion – Moderate to Good Condition in the southern portion of the Development Site was assessed as not having a predominantly native understorey. This patch had been heavily grazed and pasture improved. All other patches of vegetation in the Development Site assessed against the White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC criteria had a predominantly native understorey.

- **Is the patch 0.1 hectare or greater in size?**

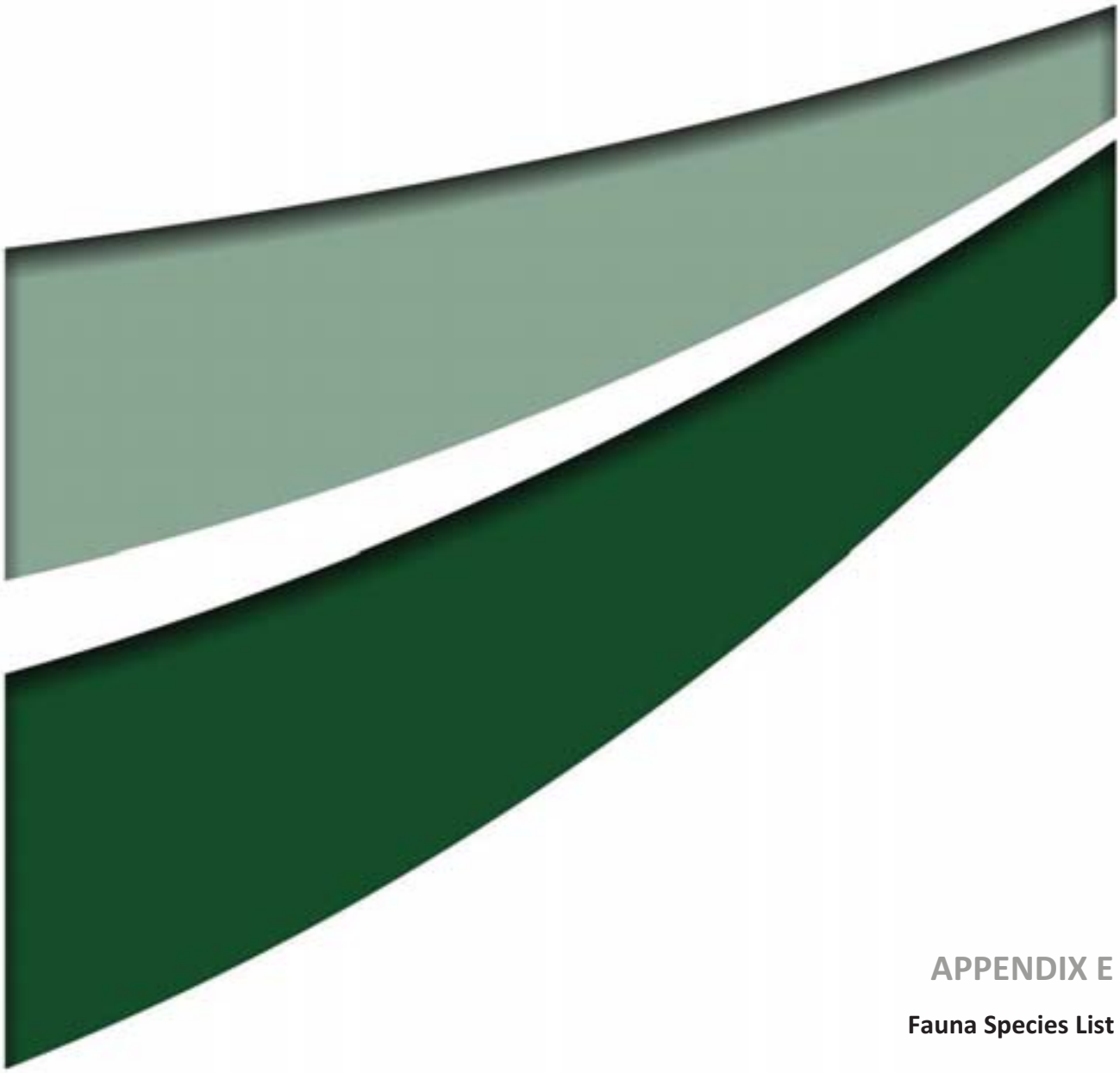
Due to the restricted nature of the Development Site, a majority of patches strictly within the Development Site were smaller than the required 0.1 hectare size. A process was undertaken to identify which patches extended outside the bounds of the Development Site and therefore met the area patch requirements of the EPBC Act community.

- **Are there 12 or more native understorey species present (excluding grasses), of which at least one is deemed an important species.**

A patch of Zone 12 – CW213, LA218– White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion – Moderate to Good Condition in the southern portion of the Development Site was assessed as not having 12 native understorey species present (excluding grasses). All other patches of vegetation in the Development Site assessed against the White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC criteria were identified as containing at least 12 or more native understorey species.

**Summary**

The Development Site is considered to support 22.79 hectares of *White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC* within PCT267 (CW213, LA218) White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion (Moderate to Good – in part and Moderate to Good_DNG condition) and PCT276 (CW226, LA226) Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion (Moderate to Good and Moderate to Good_DNG condition).



# APPENDIX E

**Fauna Species List**

## Appendix E - Fauna Species List

The following fauna list was developed from surveys of the Development Site.

The following abbreviations or symbols are used in the list:

| | |
|---|---|
| asterisk (*) | Denotes species not indigenous to the Development Site |
| subsp. | Subspecies |
| M | Listed migratory species under the EPBC Act |
| V | Vulnerable under the TSC and/or EPBC Acts |

Birds recorded were identified using descriptions in Pizzey and Knight (2012) and the scientific and common name nomenclature of Birdlife Australia (Birdlife International 2015). Reptiles recorded were identified using keys and descriptions in Cogger (2014) and Wilson & Swan (2008) and the scientific and common name nomenclature of Cogger (2014).

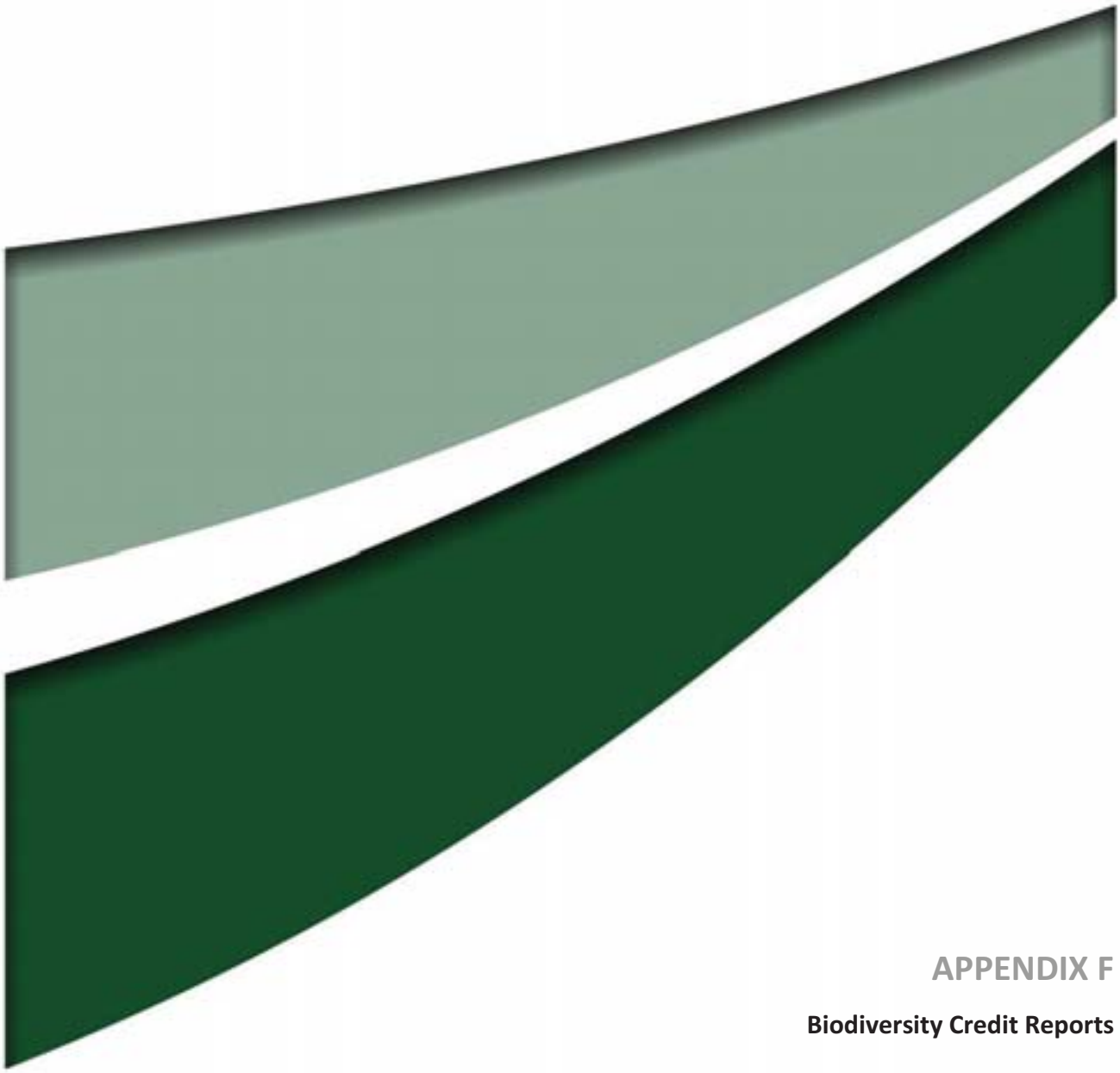
Amphibians recorded were identified using keys and descriptions in Cogger (2014), Robinson (1998), Anstis (2013) and Barker *et al*. (1995) and the scientific and common name nomenclature of Cogger (2014). Mammals recorded were identified using keys and descriptions in Van Dyck and Strahan (2008), and Menkhorst and Knight (2010) and the scientific and common name nomenclature of Van Dyck and Strahan (2008).

| Scientific Name | Common Name | TSC Act | EPBC Act |
|---|---|---|---|
| **AMPHIBIA** | | | |
| **Myobatrachidae** | | | |
| *Crinia parinsignifera* | eastern sign-bearing froglet | | |
| *Crinia signifera* | common froglet | | |
| *Limnodynastes fletcheri* | marsh frog | | |
| *Limnodynastes tasmaniensis* | spotted grass frog | | |
| **Hylidae** | | | |
| *Litoria peronii* | Peron's tree frog | | |
| **AVES** | | | |
| **Podargidae** | | | |
| *Podargus strigoides* | tawny frogmouth | | |
| **Columbidae** | | | |
| *Ocyphaps lophotes* | crested pigeon | | |
| *Phaps chalcoptera* | common bronzewing | | |
| **Alcedinidae** | | | |
| *Dacelo novaeguineae* | laughing kookaburra | | |
| **Cacatuidae** | | | |
| *Eolophus roseicapillus* | galah | | |

| Scientific Name | Common Name | TSC Act | EPBC Act |
|---|---|---|---|
| *Nymphicus hollandicus* | cockatiel | | |
| **Psittacidae** | | | |
| *Barnardius zonarius barnardi* | Australian ringneck (barnardi) | | |
| *Northiella haematogaster* | bluebonnet | | |
| *Platycercus eximius* | eastern rosella | | |
| *Psephotus haematonotus* | red-rumped parrot | | |
| *Polytelis swainsonii* | superb parrot | V | V |
| **Tytonidae** | | | |
| *Tyto alba* | eastern barn owl | | |
| **Anatidae** | | | |
| *Anas superciliosa* | pacific black duck | | |
| *Anas gracilis* | grey teal | | |
| **Ardeidae** | | | |
| *Ardea pacifica* | white-necked heron | | |
| **Threskiornithidae** | | | |
| *Platalea flavipes* | yellow-billed spoonbill | | |
| *Plegadis falcinellus* | glossy ibis | | M |
| *Threskiornis molucca* | Australian white ibis | | |
| *Threskiornis spinicollis* | straw-necked ibis | | |
| **Accipitridae** | | | |
| *Milvus migrans* | black kite | | |
| *Aquila audax* | wedge-tailed eagle | | |
| *Haliastur sphenurus* | whistling kite | | |
| **Falconidae** | | | |
| *Falco peregrinus* | peregrine falcon | | |
| *Falco cenchroides* | nankeen kestrel | | |
| **Charadriidae** | | | |
| *Erythrogonys cinctus* | red-kneed dotterel | | |
| *Vanellus miles* | masked lapwing | | |
| **Recurvirostridae** | | | |
| *Himantopus himantopus* | black-winged stilt | | |
| **Scolopacidae** | | | |
| *Calidris ruficollis* | red-necked stint | | M |
| *Tringa stagnatilis* | marsh sandpiper | | M |
| **Pardalotidae** | | | |
| *Pardalotus striatus* | striated pardalote | | |

| Scientific Name | Common Name | TSC Act | EPBC Act |
|---|---|---|---|
| **Meliphagidae** | | | |
| *Acanthagenys rufogularis* | spiny-cheeked honeyeater | | |
| *Lichenostomus penicillatus* | white-plumed honeyeater | | |
| *Manorina melanocephala* | noisy miner | | |
| *Philemon corniculatus* | noisy friarbird | | |
| **Acanthizidae** | | | |
| *Gerygone fusca* | western gerygone | | |
| **Pomatostomidae** | | | |
| *Pomatostomus superciliosus* | white-browed babbler | | |
| *Pomatostomus temporalis temporalis* | grey-crowned babbler (eastern subsp.) | V | |
| **Artamidae** | | | |
| *Artamus superciliosus* | white-browed woodswallow | | |
| *Cracticus tibicen* | Australian magpie | | |
| *Cracticus nigrogularis* | pied butcherbird | | |
| *Cracticus torquatus* | grey butcherbird | | |
| **Campephagidae** | | | |
| *Coracina novaehollandiae* | black-faced cuckoo-shrike | | |
| **Corcoracidae** | | | |
| *Corcorax melanorhamphos* | white-winged chough | | |
| *Struthidea cinerea* | apostlebird | | |
| **Corvidae** | | | |
| *Corvus mellori* | little raven | | |
| **Rhipiduridae** | | | |
| *Rhipidura leucophrys* | willie wagtail | | |
| **Monarchidae** | | | |
| *Grallina cyanoleuca* | magpie-lark | | |
| **Maluridae** | | | |
| *Malurus cyaneus* | superb fairy-wren | | |
| **Megaluridae** | | | |
| *Cincloramphus mathewsi* | rufous songlark | | |
| **Estrildidae** | | | |
| *Taeniopygia guttata* | zebra finch | | |
| **Phasianidae** | | | |
| *Coturnix sp.* | a quail | | |

| Scientific Name | Common Name | TSC Act | EPBC Act |
|---|---|---|---|
| **MAMMALIA** | | | |
| **Macropodidae** | | | |
| *Macropus giganteus* | eastern grey kangaroo | | |
| **Phalangeridae** | | | |
| *Trichosurus vulpecula* | common brushtail possum | | |
| **Molossidae** | | | |
| *Mormopterus planiceps* | southern freetail-bat | | |
| **Vespertilionidae** | | | |
| *Chalinolobus gouldii* | Gould's wattled bat | | |
| *Chalinolobus morio* | chocolate wattled bat | | |
| *Scotorepens greyii* | little broad-nosed bat | | |
| *Vespadelus vulturnus* | little forest bat | | |
| **Canidae** | | | |
| **Canis lupus familiaris* | domestic dog | | |
| **Leporidae** | | | |
| **Lepus capensis* | brown hare | | |
| **Bovidae** | | | |
| **Ovis aries* | sheep | | |



# APPENDIX F

**Biodiversity Credit Reports**

# *Biodiversity credit report*

**This report identifies the number and type of biodiversity credits required for a major project.**

Date of report: 21/07/2016 Time: 3:09:04PM Calculator version: v4.0

## Major Project details

| | |
|---|---|
| **Proposal ID:** | 0113/2016/3641MP |
| **Proposal name:** | P2N Assessment Area 1 - Lachlan CMA/Lower Slopes IBRA SR |
| **Proposal address:** | na Parkes NSW 2870 |
| **Proponent name:** | ARTC |
| **Proponent address:** | |
| **Proponent phone:** | na |
| **Assessor name:** | Ryan Parsons |
| **Assessor address:** | 75 York Street TERALBA NSW 2284 |
| **Assessor phone:** | 02 4950 5322 |
| **Assessor accreditation:** | 0113 |

## Summary of ecosystem credits required

| Plant Community type | Area (ha) | Credits created |
|---|---|---|
| Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions | 14.74 | 488.39 |
| White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion | 2.87 | 152.00 |
| White Cypress Pine woodland on sandy loams in central NSW wheatbelt | 0.92 | 22.00 |
| Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion | 6.75 | 255.80 |
| **Total** | 25.28 | 918 |

## Credit profiles

**1. White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion, (LA218)**

| | |
|---|---|
| Number of ecosystem credits created | 152 |
| IBRA sub-region | Lower Slopes - Lachlan |

| Offset options - Plant Community types | Offset options - IBRA sub-regions |
|---|---|
| White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion, (LA218)<br><br>White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion, (LA219)<br><br>Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion, (LA226)<br><br>Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion, (LA120)<br><br>Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion, (LA145)<br><br>Red Box - White Box +/- Red Stringybark hill woodland in the NSW South Western Slopes Bioregion, (LA252) | Lower Slopes - Lachlan<br>and any IBRA subregion that adjoins the IBRA subregion in which the development occurs |

**2. White Cypress Pine woodland on sandy loams in central NSW wheatbelt, (LA223)**

| | |
|---|---|
| Number of ecosystem credits created | 22 |
| IBRA sub-region | Lower Slopes - Lachlan |

| Offset options - Plant Community types | Offset options - IBRA sub-regions |
|---|---|
| White Cypress Pine woodland on sandy loams in central NSW wheatbelt, (LA223)<br><br>Western Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion, (LA152)<br><br>Western Grey Box - White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion, (LA153)<br><br>Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions, (LA154)<br><br>Mixed box eucalypt woodland on low sandy-loam rises on alluvial plains in central western NSW, (LA162)<br><br>Mixed Eucalypt woodlands of floodplains in the southern-eastern Cobar Peneplain Bioregion, (LA163)<br><br>Poplar Box - Belah woodland on clay-loam soils on alluvial plains of north-central NSW, (LA175)<br><br>Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt)., (LA178)<br><br>Riverine Western Grey Box grassy woodland of the semi-arid (warm) climate zone, (LA194)<br><br>Yellow Box - River Red Gum tall grassy riverine woodland of NSW South Western Slopes Bioregion and Riverina Bioregion, (LA195) | Lower Slopes - Lachlan<br>and any IBRA subregion that adjoins the IBRA subregion in which the development occurs |

**3. Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion, (LA226)**

| | |
|---|---|
| Number of ecosystem credits created | 256 |
| IBRA sub-region | Lower Slopes - Lachlan |

| Offset options - Plant Community types | Offset options - IBRA sub-regions |
|---|---|
| Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion, (LA226)<br><br>White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion, (LA218)<br><br>White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion, (LA219)<br><br>Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion, (LA120)<br><br>Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion, (LA145)<br><br>Red Box - White Box +/- Red Stringybark hill woodland in the NSW South Western Slopes Bioregion, (LA252) | Lower Slopes - Lachlan<br>and any IBRA subregion that adjoins the IBRA subregion in which the development occurs |

**4. Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions, (LA154)**

| | |
|---|---|
| Number of ecosystem credits created | 488 |
| IBRA sub-region | Lower Slopes - Lachlan |

| Offset options - Plant Community types | Offset options - IBRA sub-regions |
|---|---|
| Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions, (LA154)<br><br>Riverine Western Grey Box grassy woodland of the semi-arid (warm) climate zone, (LA194) | Lower Slopes - Lachlan<br>and any IBRA subregion that adjoins the IBRA subregion in which the development occurs |

## Summary of species credits required

| Common name | Scientific name | Extent of impact Ha or individuals | Number of species credits created |
|---|---|---|---|
| Koala | Phascolarctos cinereus | 18.88 | 491 |

# *Biodiversity credit report*

**This report identifies the number and type of biodiversity credits required for a major project.**

Date of report: 21/07/2016 Time: 3:11:00PM Calculator version: v4.0

## Major Project details

| | |
|---|---|
| **Proposal ID:** | 0113/2016/3632MP |
| **Proposal name:** | P2N Assessment Area 2 - Central West CMA/Lower Slopes IBRA SR |
| **Proposal address:** | na Parkes NSW 2870 |
| **Proponent name:** | ARTC |
| **Proponent address:** | |
| **Proponent phone:** | na |
| **Assessor name:** | Ryan Parsons |
| **Assessor address:** | 75 York Street TERALBA NSW 2284 |
| **Assessor phone:** | 02 4950 5322 |
| **Assessor accreditation:** | 0113 |

## Summary of ecosystem credits required

| Plant Community type | Area (ha) | Credits created |
|---|---|---|
| Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions | 0.23 | 11.00 |
| Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion | 1.43 | 67.00 |
| Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt). | 0.34 | 19.00 |
| River Red Gum tall to very tall open forest / woodland wetland on rivers on floodplains mainly in the Darling Riverine Plains Bioregion | 1.49 | 53.97 |
| Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion | 1.54 | 71.31 |
| Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions | 15.55 | 443.30 |
| White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion | 0.70 | 33.18 |
| White Cypress Pine woodland on sandy loams in central NSW wheatbelt | 0.15 | 3.00 |
| Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion | 6.97 | 328.74 |
| **Total** | 28.40 | 1,031 |

## Credit profiles

**1. Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion, (CW138)**

| | |
|---|---|
| Number of ecosystem credits created | 67 |
| IBRA sub-region | Lower Slopes - Central West |

| Offset options - Plant Community types | Offset options - IBRA sub-regions |
|---|---|
| Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion, (CW138)<br><br>Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion, (CW112)<br><br>White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion, (CW215)<br><br>White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion, (CW216)<br><br>Red Box - White Box +/- Red Stringybark hill woodland in the NSW South Western Slopes Bioregion, (CW280) | Lower Slopes - Central West<br>and any IBRA subregion that adjoins the IBRA subregion in which the development occurs |

**2. Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions, (CW145)**

| | |
|---|---|
| Number of ecosystem credits created | 443 |
| IBRA sub-region | Lower Slopes - Central West |

| Offset options - Plant Community types | Offset options - IBRA sub-regions |
|---|---|
| Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions, (CW145) | Lower Slopes - Central West<br>and any IBRA subregion that adjoins the IBRA subregion in which the development occurs |

**3. Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt)., (CW172)**

| | |
|---|---|
| Number of ecosystem credits created | 19 |
| IBRA sub-region | Lower Slopes - Central West |

| Offset options - Plant Community types | Offset options - IBRA sub-regions |
|---|---|
| Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt)., (CW172)<br><br>Western Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion, (CW144)<br><br>Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions, (CW145)<br><br>Mixed box eucalypt woodland on low sandy-loam rises on alluvial plains in central western NSW, (CW152)<br><br>Poplar Box - Belah woodland on clay-loam soils on alluvial plains of north-central NSW, (CW167)<br><br>Western Grey Box - cypress pine shrub grass shrub tall woodland in the Brigalow Belt South Bioregion, (CW317) | Lower Slopes - Central West<br>and any IBRA subregion that adjoins the IBRA subregion in which the development occurs |

**4. White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion, (CW213)**

| | |
|---|---|
| Number of ecosystem credits created | 33 |
| IBRA sub-region | Lower Slopes - Central West |

| Offset options - Plant Community types | Offset options - IBRA sub-regions |
|---|---|
| White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion, (CW213)<br><br>Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion, (CW112)<br><br>Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion, (CW138)<br><br>Fuzzy Box woodland on colluvium and alluvial flats in the Brigalow Belt South Bioregion (including Pilliga) and Nandewar Bioregion, (CW139)<br><br>White Box - Rough-barked Apple alluvial woodland of the NSW central western slopes including in the Mudgee region, (CW211)<br><br>White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion, (CW215)<br><br>White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion, (CW216)<br><br>Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion, (CW226)<br><br>Apple Box - Rough-barked Apple terrace flats woodland of the southern Brigalow Belt South Bioregion, (CW231)<br><br>Red Box - White Box +/- Red Stringybark hill woodland in the NSW South Western Slopes Bioregion, (CW280) | Lower Slopes - Central West<br>and any IBRA subregion that adjoins the IBRA subregion in which the development occurs |

**5. White Cypress Pine woodland on sandy loams in central NSW wheatbelt, (CW220)**

| | |
|---|---|
| Number of ecosystem credits created | 3 |
| IBRA sub-region | Lower Slopes - Central West |

| Offset options - Plant Community types | Offset options - IBRA sub-regions |
|---|---|
| White Cypress Pine woodland on sandy loams in central NSW wheatbelt, (CW220)<br><br>Western Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion, (CW144)<br><br>Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions, (CW145)<br><br>Mixed box eucalypt woodland on low sandy-loam rises on alluvial plains in central western NSW, (CW152)<br><br>Poplar Box - Belah woodland on clay-loam soils on alluvial plains of north-central NSW, (CW167)<br><br>Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt)., (CW172)<br><br>Western Grey Box - cypress pine shrub grass shrub tall woodland in the Brigalow Belt South Bioregion, (CW317) | Lower Slopes - Central West<br>and any IBRA subregion that adjoins the IBRA subregion in which the development occurs |

**6. Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion, (CW226)**

| | |
|---|---|
| Number of ecosystem credits created | 329 |
| IBRA sub-region | Lower Slopes - Central West |

| Offset options - Plant Community types | Offset options - IBRA sub-regions |
|---|---|
| Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion, (CW226)<br><br>Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion, (CW112)<br><br>Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion, (CW138)<br><br>Fuzzy Box woodland on colluvium and alluvial flats in the Brigalow Belt South Bioregion (including Pilliga) and Nandewar Bioregion, (CW139)<br><br>White Box - Rough-barked Apple alluvial woodland of the NSW central western slopes including in the Mudgee region, (CW211)<br><br>White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion, (CW213)<br><br>White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion, (CW215)<br><br>White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion, (CW216)<br><br>Apple Box - Rough-barked Apple terrace flats woodland of the southern Brigalow Belt South Bioregion, (CW231)<br><br>Red Box - White Box +/- Red Stringybark hill woodland in the NSW South Western Slopes Bioregion, (CW280) | Lower Slopes - Central West<br>and any IBRA subregion that adjoins the IBRA subregion in which the development occurs |

**7. Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions, (CW104)**

| | |
|---|---|
| Number of ecosystem credits created | 11 |
| IBRA sub-region | Lower Slopes - Central West |

| Offset options - Plant Community types | Offset options - IBRA sub-regions |
|---|---|
| Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions, (CW104)<br><br>Coolabah - River Coobah - Lignum woodland wetland of frequently flooded floodplains mainly in the Darling Riverine Plains Bioregion, (CW125)<br><br>Coolabah open woodland wetland with chenopod/grassy ground cover on grey and brown clay floodplains, (CW126) | Lower Slopes - Central West<br>and any IBRA subregion that adjoins the IBRA subregion in which the development occurs |

**8. Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion, (CW205)**

| | |
|---|---|
| Number of ecosystem credits created | 71 |
| IBRA sub-region | Lower Slopes - Central West |

| Offset options - Plant Community types | Offset options - IBRA sub-regions |
|---|---|
| Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion, (CW205)<br><br>Weeping Myall open woodland of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion, (CW204) | Lower Slopes - Central West<br>and any IBRA subregion that adjoins the IBRA subregion in which the development occurs |

**9. River Red Gum tall to very tall open forest / woodland wetland on rivers on floodplains mainly in the Darling Riverine Plains Bioregion, (CW183)**

| | |
|---|---|
| Number of ecosystem credits created | 46 |
| IBRA sub-region | Lower Slopes - Central West |

| Offset options - Plant Community types | Offset options - IBRA sub-regions |
|---|---|
| River Red Gum tall to very tall open forest / woodland wetland on rivers on floodplains mainly in the Darling Riverine Plains Bioregion, (CW183)<br><br>River Red Gum swampy woodland wetland on cowals (lakes) and associated flood channels in central NSW, (CW181)<br><br>River Red Gum riparian tall woodland / open forest wetland in the Nandewar Bioregion and Brigalow Belt South Bioregion, (CW184)<br><br>Black Tea-tree - River Oak - Wilga riparian low forest/shrubland wetland of rich soil depressions in the Brigalow Belt South Bioregion, (CW237)<br><br>Blakely's Red Gum x Dirty Gum - White Cypress Pine tall riparian woodland, NSW South Western Slopes Bioregion, (CW240) | Lower Slopes - Central West<br>and any IBRA subregion that adjoins the IBRA subregion in which the development occurs |

**10. River Red Gum tall to very tall open forest / woodland wetland on rivers on floodplains mainly in the Darling Riverine Plains Bioregion, (CW183)**

| | |
|---|---|
| Number of ecosystem credits created | 8 |
| IBRA sub-region | Lower Slopes - Central West |

| Offset options - Plant Community types | Offset options - IBRA sub-regions |
|---|---|
| River Red Gum swampy woodland wetland on cowals (lakes) and associated flood channels in central NSW, (CW181)<br><br>River Red Gum tall to very tall open forest / woodland wetland on rivers on floodplains mainly in the Darling Riverine Plains Bioregion, (CW183)<br><br>River Red Gum riparian tall woodland / open forest wetland in the Nandewar Bioregion and Brigalow Belt South Bioregion, (CW184)<br><br>Black Tea-tree - River Oak - Wilga riparian low forest/shrubland wetland of rich soil depressions in the Brigalow Belt South Bioregion, (CW237)<br><br>Blakely's Red Gum x Dirty Gum - White Cypress Pine tall riparian woodland, NSW South Western Slopes Bioregion, (CW240) | Lower Slopes - Central West<br>and any IBRA subregion that adjoins the IBRA subregion in which the development occurs |

## Summary of species credits required

# *Biodiversity credit report*

**This report identifies the number and type of biodiversity credits required for a major project.**

Date of report: 21/07/2016 Time: 3:12:20PM Calculator version: v4.0

## Major Project details

| | |
|---|---|
| **Proposal ID:** | 0113/2016/3640MP |
| **Proposal name:** | P2N Assessment Area 3 - Central West CMA/Bogan Macquarie IBRA SR |
| **Proposal address:** | na Parkes NSW 2870 |
| **Proponent name:** | ARTC |
| **Proponent address:** | |
| **Proponent phone:** | na |
| **Assessor name:** | Ryan Parsons |
| **Assessor address:** | 75 York Street TERALBA NSW 2284 |
| **Assessor phone:** | 02 4950 5322 |
| **Assessor accreditation:** | 0113 |

## Summary of ecosystem credits required

| Plant Community type | Area (ha) | Credits created |
|---|---|---|
| Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions | 6.83 | 331.00 |
| Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion | 0.07 | 3.28 |
| Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt). | 2.27 | 95.00 |
| Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion | 1.62 | 75.01 |
| Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions | 1.77 | 98.00 |
| White Cypress Pine woodland on sandy loams in central NSW wheatbelt | 0.48 | 13.00 |
| **Total** | 13.04 | 615 |

## Credit profiles

**1. Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion, (CW138)**

| | |
|---|---|
| Number of ecosystem credits created | 3 |
| IBRA sub-region | Bogan-Macquarie - Central West |

| Offset options - Plant Community types | Offset options - IBRA sub-regions |
|---|---|
| Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion, (CW138)<br><br>Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion, (CW112)<br><br>White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion, (CW215)<br><br>White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion, (CW216)<br><br>Red Box - White Box +/- Red Stringybark hill woodland in the NSW South Western Slopes Bioregion, (CW280) | Bogan-Macquarie - Central West<br>and any IBRA subregion that adjoins the IBRA subregion in which the development occurs |

**2. Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions, (CW145)**

| | |
|---|---|
| Number of ecosystem credits created | 98 |
| IBRA sub-region | Bogan-Macquarie - Central West |

| Offset options - Plant Community types | Offset options - IBRA sub-regions |
|---|---|
| Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions, (CW145) | Bogan-Macquarie - Central West<br>and any IBRA subregion that adjoins the IBRA subregion in which the development occurs |

**3. Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt)., (CW172)**

| | |
|---|---|
| Number of ecosystem credits created | 95 |
| IBRA sub-region | Bogan-Macquarie - Central West |

| Offset options - Plant Community types | Offset options - IBRA sub-regions |
|---|---|
| Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt)., (CW172)<br><br>Western Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion, (CW144)<br><br>Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions, (CW145)<br><br>Mixed box eucalypt woodland on low sandy-loam rises on alluvial plains in central western NSW, (CW152)<br><br>Poplar Box - Belah woodland on clay-loam soils on alluvial plains of north-central NSW, (CW167)<br><br>Western Grey Box - cypress pine shrub grass shrub tall woodland in the Brigalow Belt South Bioregion, (CW317) | Bogan-Macquarie - Central West<br>and any IBRA subregion that adjoins the IBRA subregion in which the development occurs |

**4. White Cypress Pine woodland on sandy loams in central NSW wheatbelt, (CW220)**

| | |
|---|---|
| Number of ecosystem credits created | 13 |
| IBRA sub-region | Bogan-Macquarie - Central West |

| Offset options - Plant Community types | Offset options - IBRA sub-regions |
|---|---|
| White Cypress Pine woodland on sandy loams in central NSW wheatbelt, (CW220)<br><br>Western Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion, (CW144)<br><br>Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions, (CW145)<br><br>Mixed box eucalypt woodland on low sandy-loam rises on alluvial plains in central western NSW, (CW152)<br><br>Poplar Box - Belah woodland on clay-loam soils on alluvial plains of north-central NSW, (CW167)<br><br>Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt)., (CW172)<br><br>Western Grey Box - cypress pine shrub grass shrub tall woodland in the Brigalow Belt South Bioregion, (CW317) | Bogan-Macquarie - Central West<br>and any IBRA subregion that adjoins the IBRA subregion in which the development occurs |

**5. Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions, (CW104)**

| | |
|---|---|
| Number of ecosystem credits created | 331 |
| IBRA sub-region | Bogan-Macquarie - Central West |

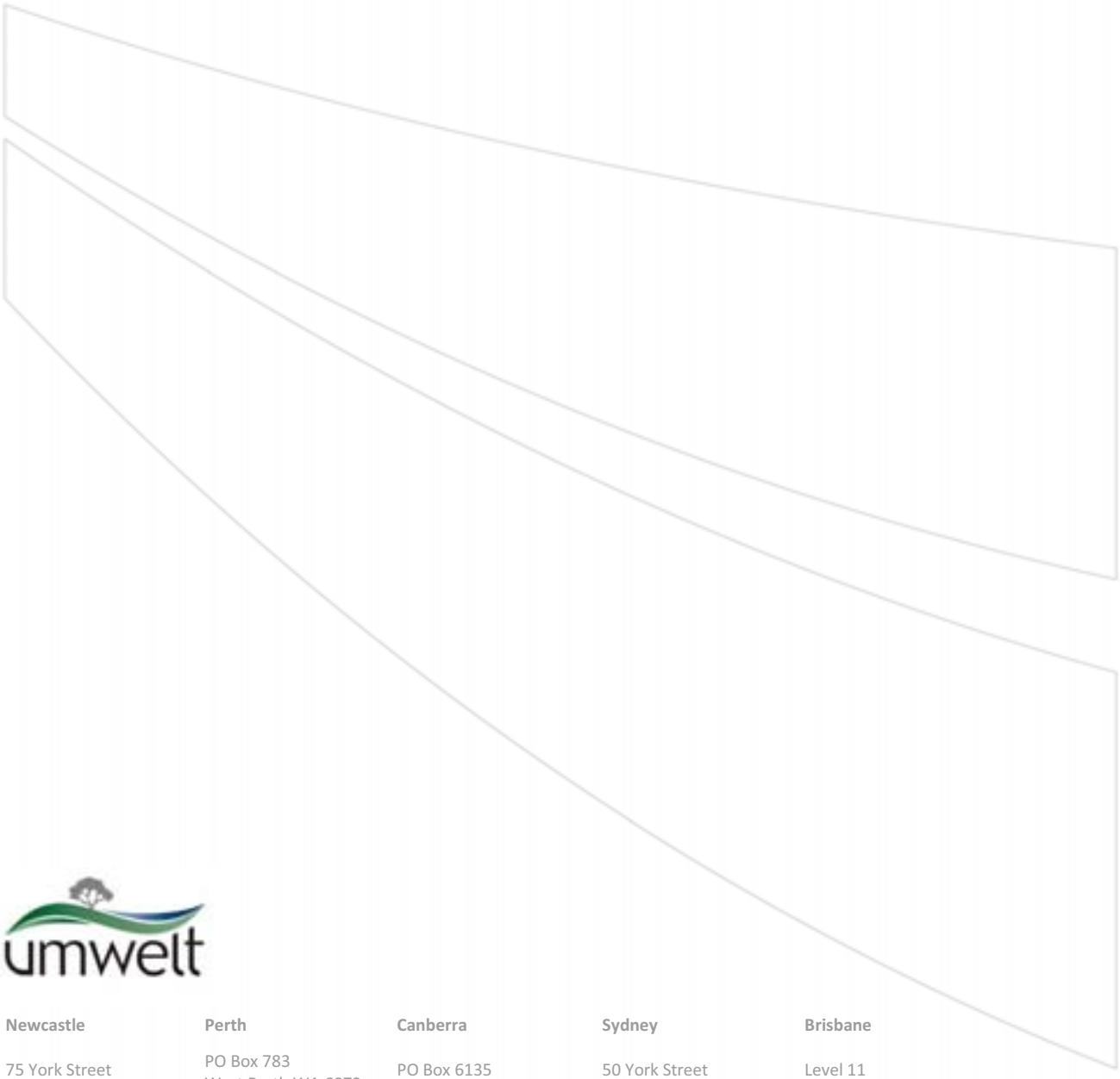
| Offset options - Plant Community types | Offset options - IBRA sub-regions |
|---|---|
| Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions, (CW104)<br><br>Coolabah - River Coobah - Lignum woodland wetland of frequently flooded floodplains mainly in the Darling Riverine Plains Bioregion, (CW125)<br><br>Coolabah open woodland wetland with chenopod/grassy ground cover on grey and brown clay floodplains, (CW126) | Bogan-Macquarie - Central West<br>and any IBRA subregion that adjoins the IBRA subregion in which the development occurs |

**6. Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion, (CW205)**

| | |
|---|---|
| Number of ecosystem credits created | 75 |
| IBRA sub-region | Bogan-Macquarie - Central West |

| Offset options - Plant Community types | Offset options - IBRA sub-regions |
|---|---|
| Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion, (CW205)<br><br>Weeping Myall open woodland of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion, (CW204) | Bogan-Macquarie - Central West<br>and any IBRA subregion that adjoins the IBRA subregion in which the development occurs |

## Summary of species credits required

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