

Boggabri Coal Expansion Project

# Ecological Assessment for Boggabri Coal Project Modification

## Modification 5

30 October 2015






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# Glossary

Biodiversity	<p>The biological diversity of life is commonly regarded as being made up of the following three components:</p> <ul style="list-style-type: none"><li>▪ genetic diversity — the variety of genes (or units of heredity) in any population</li><li>▪ species diversity — the variety of species</li><li>▪ ecosystem diversity — the variety of communities or ecosystems.</li></ul>
Bioregion (region)	<p>A bioregion defined in a national system of bioregionalisation. The modification study area is in the Brigalow Belt South bioregion as defined in the Interim Biogeographic Regionalisation for Australia (Thackway &amp; Cresswell 1995).</p>
Critical habitat	<p>The whole or any part or parts of an area or areas of land comprising the habitat of an endangered species, an Endangered population or an endangered ecological community that is critical to the survival of the species, population or ecological community (Department of Environment and Conservation 2004). Critical habitat is listed under either the TSC Act or the EPBC Act and both the state (Office of Environment and Heritage) and Federal (Department of the Sustainability, Environment, Water, Population and Communities) Both of these departments maintain a register of this habitat. Capitalisation of the term 'Critical Habitat' in this report refers to the habitat listed specifically under the relevant state and Commonwealth legislation.</p>
Ecological community	<p>An assemblage of species occupying a particular area.</p>
EEC	<p>Endangered ecological community (TSC Act, EPBC Act).</p>
Environmental weed	<p>Any plant that is not native to a local area that has invaded native vegetation.</p>
EPBC Act	<p>Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i></p>
Exotic	<p>Introduced from outside the area (Ensbey &amp; Johnson 2009). Used in the context of this report to refer to species introduced from overseas.</p>
FM Act	<p><i>NSW Fisheries Management Act 1994.</i></p>
GPS	<p>Global positioning system- a navigational tool which uses radio receivers to pick up signals from four or more special satellites to provide precise determination of location.</p>
Habitat	<p>An area or areas occupied, or periodically or occasionally occupied, by a species, population or ecological community, including any biotic or abiotic components.</p>
Indigenous	<p>Native to the area: not introduced (Royal Botanic Gardens and Domain Trust 2013).</p>
Introduced	<p>Not native to the area: not indigenous (Ensbey &amp; Johnson 2009). Refers to both exotic and non-indigenous Australian native species of plants and animals.</p>
Key threatening processes	<p>A process that threatens, or could threaten, the survival, abundance or evolutionary development of native species, populations or ecological communities (Department of Environment and Conservation 2004). Key Threatening Processes are listed under the TSC Act, the FM Act and the EPBC Act. Capitalisation of the term 'Key Threatening Processes' in this report refers to those processes listed specifically under the relevant state and Commonwealth legislation.</p>
Likely	<p>Taken to be a real chance or possibility (Department of Environment and Conservation 2004).</p>
Local population	<p>The population that occurs within the site, unless the existence of contiguous</p>

or proximal occupied habitat and the movement of individuals or exchange of genetic material across the Boundary can be demonstrated as defined by Department of Environment and Climate Change (2007).

Locality	10 km within the vicinity of the modification study area boundary.
Migratory species	Species listed as migratory under the EPBC Act relating to international agreements to which Australia is a signatory. These include Japan-Australia Migratory Bird Agreement, China-Australia Migratory Bird Agreement, Republic of Korea-Australia Migratory Bird Agreement and the Bonn Convention on the Conservation of Migratory Species of Wild Animals. Capitalisation of the term 'Migratory' in this report refers to those species listed as Migratory under the EPBC Act.
MIA	Mine Infrastructure Area
modification study area	Proposed modifications that will occur outside the Project Boundary which have not been assessed under Project Approval (09_0182). These modifications will require the removal of native understorey vegetation and/or ground disturbance
Noxious weed	An introduced species listed under the NSW <i>Noxious Weeds Act 1993</i> . Under the Act, noxious weeds have specific control measure and reporting requirements.
NSW	New South Wales
Office of Environment and Heritage	Broadly, the Office of Environment works towards a healthy environment cared for and enjoyed by the whole NSW community: manages the state's natural resources, including biodiversity, soils and natural vegetation: manages natural and cultural heritage across the state's land: acts to minimise the impacts of climate change: promotes sustainable consumption, resource use and waste management: regulates activities to protect the environment: and conducts biodiversity, plant, environmental and cultural heritage research to improve decision making. Previously known as: <ul style="list-style-type: none"> <li>■ Department of Environment, Climate Change and Water (DECCW)</li> <li>■ Department of Environment and Climate Change (DECC).</li> </ul>
Project Boundary	Project Boundary describes the area approved under Project Approval 09_0182.
Protected species	Those species defined as protected under the <i>National Parks and Wildlife Act 1974</i> . Includes all native animals, as well as all native plants listed on Schedule 13 of the <i>National Parks and Wildlife Act 1974</i> .
Recovery plan	A plan prepared under the TSC Act, FM Act or the EPBC Act to assist the recovery of a Threatened species, population or ecological community.
Significant	Important, weighty or more than ordinary as defined by Department of Environment, Climate Change and Water (2007).
Species richness	Species richness is simply the number of species present in a sample, community, or taxonomic group. Species richness is one component of the concept of species diversity, which also incorporates evenness, that is, the relative abundance of species (Office of Environment and Heritage 2012a).
Subject site	The extent of direct impacts from the proposed modification. This includes the footprint of the modification related to infrastructure and potential construction work sites.
Threatened biodiversity	Threatened species, populations or ecological communities as listed under the TSC Act, FM Act or the EPBC Act.
Threatened species, populations and ecological communities	Species, populations and ecological communities listed as Vulnerable, endangered or critically endangered (collectively referred to as threatened) under the TSC Act, FM Act or the EPBC Act. Capitalisation of the terms 'vulnerable', 'endangered' or 'critically endangered' in this report refers to listing under the relevant state and/or Commonwealth legislation.

TSC Act	NSW <i>Threatened Species Conservation Act 1995</i> .
Viable local population	A population that has the capacity to live, develop and reproduce under normal conditions, unless the contrary can be conclusively demonstrated through analysis of records and references (Department of Environment and Climate Change 2007).
Weed	A plant growing out of place or where it is not wanted: often characterised by high seed production and the ability to colonise disturbed ground quickly (Ensbey & Johnson 2009). Weeds include both exotic and Australian native species of plant naturalised outside of their natural range.



# 1. Introduction

Boggabri Coal Operations Pty Limited (BCOPL) is majority owned (80%) by Idemitsu Australia Resources Pty Limited (Idemitsu), a subsidiary of Japanese company Idemitsu Kosan Pty Ltd which operate the Boggabri Coal Mine. The Boggabri Coal Mine (BCM) is located 15 kilometres (km) north-east of the township of Boggabri in the north-west Region of NSW Following the grant of PA 09\_0182 (the Project Approval), Boggabri Coal has conducted detailed design studies for the infrastructure required to facilitate the Boggabri Coal Project (the Project). These studies have identified the need for amendments to the conceptual Project layout for which the Project approval was originally granted, including installation and operation of groundwater bores and associated infrastructure (the proposed modification).

Parsons Brinckerhoff Australia Pty Ltd (Parsons Brinckerhoff) was commissioned by Boggabri Coal to prepare an Environmental Assessment (EA) to modify the Project Approval under section 75W of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

This report provides an ecological assessment of the proposed modification. This report outlines field survey methods, the existing environment of the modification study area, potential impacts on threatened biodiversity associated with the proposed modification.

The proposed modification will involve the construction and operation of production bores and associated infrastructure on the Heathcliffe, Cooboobindi, Roma, Belleview and Victoria Park properties including 11kV power lines, above and below ground pipelines and access tracks.

The proposed modification occurs within agricultural tenures, the Namoi Biodiversity Offset Area and within the mine infrastructure area (MIA). Within the Namoi Biodiversity Offset Area the proposed modification largely occurs in areas mapped for habitat restoration, but also includes areas of corridor enhancement and habitat management (refer to Figure 1.1).

This report examines flora and fauna assemblages as well as habitats within the modification study area and identifies impacts to the ecological aspects including species, populations and communities within the Project modification. The report looks at impacts associated with construction and operation of the modification. This report also outlines the mitigation measures and provides assessments of significance required under EP&A Act and the (Commonwealth) *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Providing background to this EA is a number of related ecological studies which were undertaken for the Boggabri Coal Project and are listed in Section 2.3. This includes assessments completed for the continuation of Boggabri Coal Mine – Biodiversity Impact Assessment (Parsons Brinckerhoff 2010a) and the Boggabri Coal Mine – Biodiversity Offsets Strategy (Parsons Brinckerhoff 2010b), which included broad vegetation mapping conducted over the modification study area.

## 1.1 Legislative context

This report supports an EA for the modification, which will assess the environmental impacts of the proposed modification to Project Approval (09\_0182) for the Boggabri Coal Project under section 75W of the EP&A Act.

This EA has been completed in consideration of Commonwealth and state legislation and planning policies relevant to the protection of flora, fauna and biodiversity, including:

- *Environmental Planning & Assessment Act 1979* (EP&A Act)
- *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act)

- *Threatened Species Conservation Act 1995* (TSC Act)
- *Native Vegetation Act 2003* (NV Act)
- *Water Management Act 2000* (WM Act)
- *Fisheries Management Act 1994* (FM Act)
- *National Parks and Wildlife Act 1974* (NPW Act)
- *Noxious Weeds Act 1999* (NW Act)
- Boggabri Coal Mine Project Approval (09\_0182).

These Acts and policies have been addressed where they apply either in this assessment or in the EA.

## 1.2 Biodiversity offsets

A Biodiversity Offsets Strategy (BOS) was prepared for the continuation of Boggabri Coal Mine (2010b). Consideration of biodiversity offsets included surveys completed in accordance with the quantitative site assessment methodology of the BioBanking Operation Manual (Department of Environment Climate Change 2009) as well as in consideration of the 13 principles for the use of biodiversity offsets in NSW (Department of Environment and Climate Change 2008a) and the objectives of the National Recovery Plan for White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (Box-Gum Grassy Woodland).

Some components of the modification are within the identified biodiversity offsets in the Boggabri Coal Mine BOS (2010b). The modification will result in new impacts outside the current project boundary (refer to Figure 1.1). These are associated with the construction and operation of production bores and associated infrastructure on the Heathcliffe, Cooboobindi, Roma, Belleview and Victoria Park properties) not subject to assessment under the existing PA 09\_0182. These new impacts will require additional offsets and are discussed in detail in Section 7. These proposed Project Boundary modifications require revisions to the Biodiversity Offset Strategy approved under Project Approval 09\_0182.

While Boggabri Coal is committed to providing offsets for the impacts of the modification in accordance with the approved BOS, the recent NSW Biodiversity Offsets Policy for Major Projects (Offset Policy 2014) has been considered and is discussed in Section 7.

## 1.3 Proposed modification

The proposed modification will involve an extension of the Project Boundary for the construction and operation of permanent production bores and associated infrastructure (i.e. access tracks, 11kV power lines and above and below ground water pipelines).

The production bores will supply water resources to meet Boggabri Coal Mine's water demands. The locations of the proposed production bores are illustrated in Figure 1.2. The installation of the proposed bores will involve the following activities:

- **Establishment of access tracks** — generally located in existing farm access tracks, in some locations some grading or stabilisation works may be required to ensure the tracks are suitable for use by construction equipment and ongoing maintenance.
- **Establishment of bore compounds** — involves installation of temporary fencing, erosion and sediment controls and equipment storage areas.
- **Drilling of bores** — at each nominated bore site, a temporary test production bore and monitoring piezometer has been installed with approval from NSW Department of Primary Industries, Office of

Water. This assessment is being undertaken to convert the existing bore into a permanent groundwater production bore and monitoring piezometer.

- **Installation of power lines** — overhead 11 kV power lines will be installed to each bore from existing power lines located throughout the modification study area. Overhead 11kV power lines will be constructed on wooded support poles along each transfer pipeline to power the production bores and transfer pumps. These power lines will connect to the closest existing 11 kV power lines. A small section of underground power line will be installed within the Roma property (refer Figure 1.2).
- **Installation of water pipelines** — above and below ground water pipelines will be installed between each bore and the proposed tank farm or the MIA. The above ground pipelines are polyvinyl (PVC) pipelines of 280 mm notional diameter and will be installed in the majority of the non-flood prone land between the groundwater bores and the existing water transfer pipeline running along the haul road.
- **Construction of the tank farm** — established at a site on the private haul road (refer to Figure 1.2) and this will consist of several above ground water storage tanks and a water transfer pump that will pump water collected from the production bores to the MIA.

## 1.4 Definitions used in this report

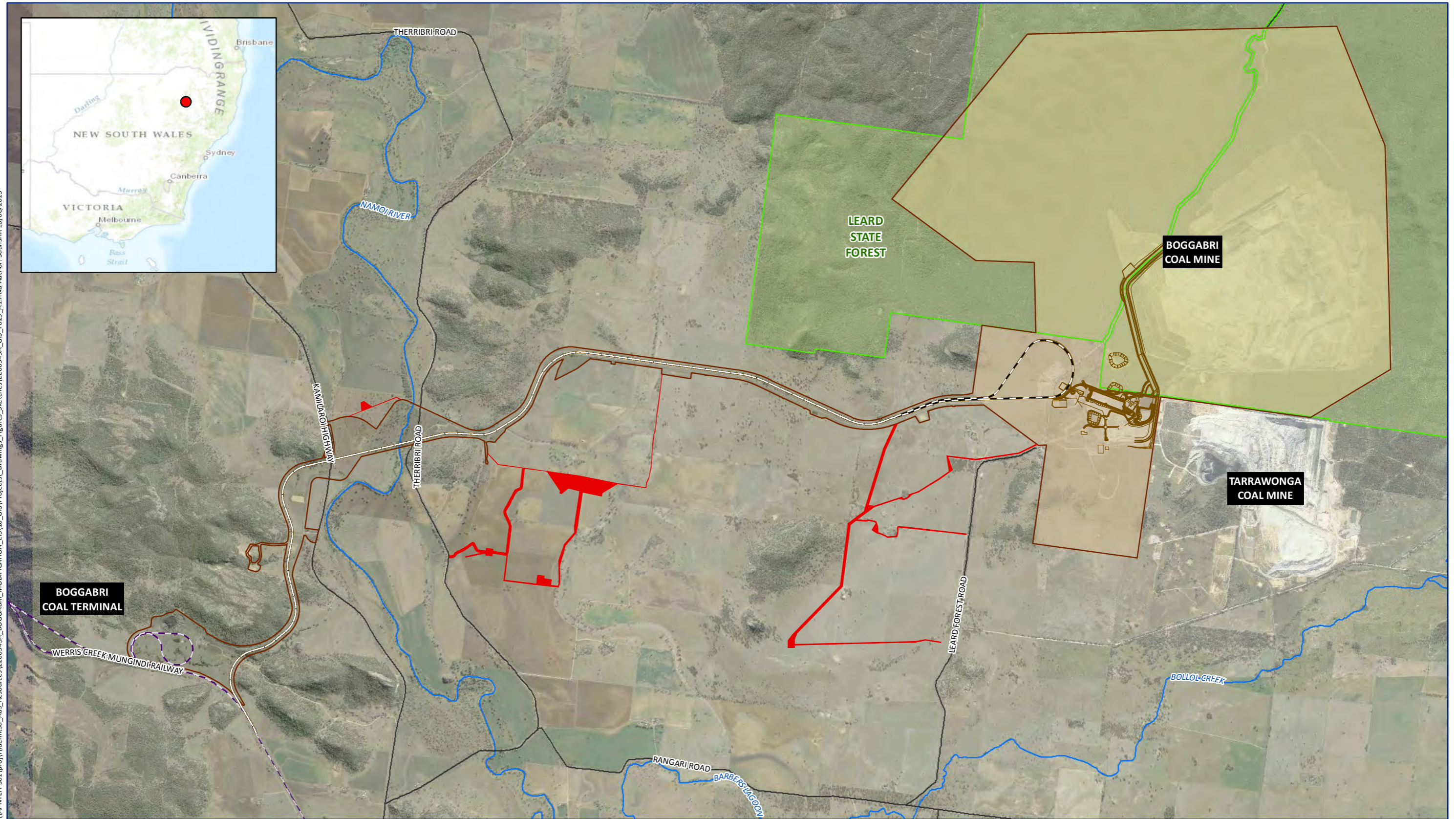
For the purpose of this report the following definitions apply:

- **Project Boundary** area approved under Project Approval (09\_0182).
- **Modification study area** proposed modifications that will occur outside the Project Boundary which have not been assessed under Project Approval (09\_0182). These modifications will require the removal of native understorey vegetation and/or ground disturbance.
- **Locality** 10 km within the vicinity of the modification study area boundary.
- **Region** is a bioregion defined in a national system of bioregionalisation. For this study this is the Brigalow Belt South bioregion as defined in the Interim Biogeographic Regionalisation for Australia (Thackway & Cresswell 1995).

Location information for the modification study area is outlined in Table 1.1.

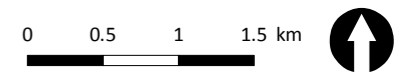
**Table 1.1 Modification study area location information**

Location information	Modification study area
Bioregion	Brigalow Belt South, Namoi sub-region (Thackway & Cresswell 1995)
Botanical subregion	North Western Slopes
Local government area	Narrabri Shire
Catchment Management Authority, subregion	Namoi CMA, Maules sub-catchment
Mitchell landscapes	Bugaldie uplands and Liverpool Plains landscape

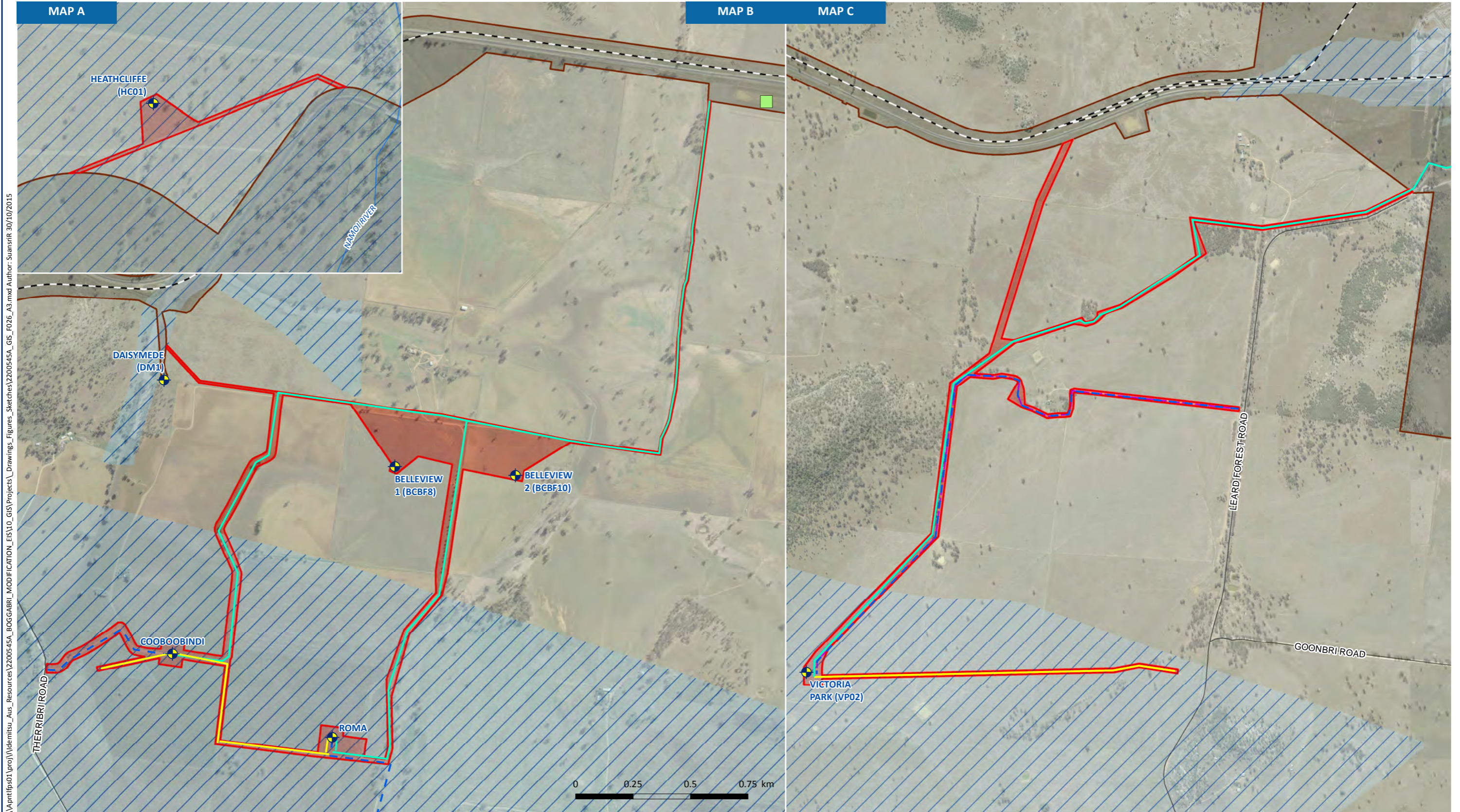


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- |                              |                                |
|------------------------------|--------------------------------|
| Existing mine infrastructure | MOD 5 study area               |
| Existing/operational rail    | Boggabri Project Approval Area |
| Proposed rail                | Boggabri Coal Mine             |
| Road                         | State Forest                   |
| River/creek                  | Leard State Conservation Area  |

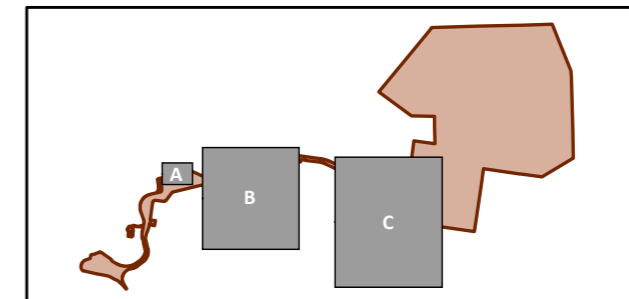


**Figure 1.1**  
Project location



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- |                     |                                |
|---------------------|--------------------------------|
| Groundwater bores   | Road                           |
| Tank farm           | Drainage                       |
| Proposed Power line | Rail line                      |
| Proposed pipeline   | MOD 5 study area               |
| Access road         | Boggabri Project Approval Area |
|                     | Flood prone land               |



**Figure 1.2**  
Modification study area  
and impacts

## 1.5 Study aims

The overall objective of this study was to assess the impacts on the biodiversity values of the proposed modification within the modification study area. Specifically, this ecological assessment aimed to:

- determine and describe the characteristics and condition of the vegetation communities and flora and fauna habitats
- determine the occurrence or likelihood of occurrence of threatened species, populations and communities (biodiversity) listed under the FM Act, TSC Act and EPBC Act within the modification study area.
- undertake significance assessments for threatened biodiversity that occur or have potential habitat within the modification study area.
- propose mitigation measures to minimise impacts on the ecological values associated with the construction and operation phases of the modification.

## 2. Methodology

This ecological assessment is largely based on a series of field inspections within the modification study area and surrounding landscape, a desktop review of available information for the mine and surrounding area, and a review of previous studies (refer to Section 2.3).

### 2.1 Nomenclature

Names of plants used in this document follow Harden (Harden 1992, 1993, 2000, 2002) with updates from PlantNet (Royal Botanic Gardens 2015). Scientific names are used in this report for species of plant. Scientific and common names are provided in plant lists in Appendix A.

Names of vegetation communities used in this report are based on the Parsons Brinckerhoff vegetation mapping of the study area (2010a) adapted from the broad scale vegetation mapping of the Vegetation of the Namoi Catchment Management Authority (Eco Logical Australia 2008) and the threatened ecological community names where applicable. Flora species that are not native are marked with an asterisk.

Names of vertebrates used in this document follow the Australian Faunal Directory (Department of the Environment 2015) and as used in the Bionet Atlas of NSW Wildlife (Office of Environment and Heritage 2015). Common names are used in the report for species of animal. Scientific and common names are provided in the list of animals recorded in Appendix B.

### 2.2 Personnel

The contributors to the preparation of this report, their qualifications and roles are listed in Table 2.1.

**Table 2.1 Contributors and their roles**

Name	Qualification	Role
Tanya Bangel	BEnvSc (Hons)	Ecologist – botanical and fauna surveys, report preparation
Debbie Landenberger	BSc (Hons)	Technical review
Alex Cockerill	BSc (Hons)	Project manager, technical input and review
Rob Suansri	BSc, BEco	Geospatial consultant

All work was carried out under the appropriate licences, including scientific licences as required under Clause 22 of the National Parks and Wildlife Regulations 2002, Section 132C of the *National Parks and Wildlife Act 1974*, as well as animal research authorities issued by the Department of Trade Investment, Regional Infrastructure and Services.

### 2.3 Desktop assessment

The aim of the desktop background research was to identify threatened flora and fauna species, populations and ecological communities; Commonwealth listed Migratory species or critical habitat recorded previously or predicted to occur in the vicinity of the modification study area.

This allowed the known habitat characteristics to be compared with those of the modification study area to determine the likelihood of occurrence of each species or population. These results informed the identification of appropriate field survey effort to focus on the groups most likely to be present.

The desktop assessment included a review of:

- research papers, books and other published data
- aerial photographs and topography maps
- the 'A Vegetation Map for the Namoi Catchment Management Authority' (Eco Logical Australia 2008)
- OEH Vegetation Types Database (Office of Environment and Heritage 2012b)
- database searches (refer to Table 2.2 and Appendices C and D)
- existing documentation for the continuation of Boggabri Coal Mine and the surrounding area including:
  - ▶ Due Diligence Assessment – Proposed Pipeline and Power Infrastructure Alignment (2014b)
  - ▶ Ecological Assessment for Boggabri Coal Project modification (2013)
  - ▶ Continuation of Boggabri Coal Mine – Biodiversity Impact Assessment (2010a).
  - ▶ Boggabri Coal – Biodiversity Management Plan (2012)
  - ▶ Preliminary vegetation mapping and survey report for Boggabri Coal lease (2009)
  - ▶ Flora and Fauna Summary of the Boggabri Coal Project (2005)
  - ▶ Results of Fauna survey work undertaken by the NSW National Parks and Wildlife Service within Leard State Forest (Pennay 2001)
  - ▶ Report on the botany, wildlife and ecology of the Leard State Forest. Draft Environmental Impact Statement for Amax-BHP Joint Venture Boggabri Coal Project (James B. Croft and Associates 1983)
  - ▶ Continuation of Boggabri Coal Mine – Biodiversity Offset Strategy (2010b)
  - ▶ Continuation of Boggabri Coal Mine – Worst Case Cumulative Impact Scenario for Biodiversity (2010c)
  - ▶ Continuation of Boggabri Coal Mine – Response to Submissions (2011b)
  - ▶ Continuation of Boggabri Coal Mine – Matters of National Environmental Significance (2011c)
  - ▶ Boggabri Coal Expansion Project: Ecological Assessment for Boggabri Coal Project modification - modification 4 (2014a).



**Table 2.2 Database searches**

Database	Date of search	Search area	Reference
Bionet Atlas of NSW Wildlife	17 June 2015	10 km locality search	Office of Environment and Heritage (2015)
PlantNet Database	17 June 2015	10 km locality search around Narrabri Shire Council	Royal Botanic Gardens (2015)
EPBC Protected Matters Search Tool	17 June 2015	10 km locality search	Department of Environment (2015)
NSW Fisheries Threatened and Protected Species – records viewer	17 June 2015	Namoi Catchment Management Authority	Department of Trade & Investment Regional Infrastructure & Services (2015)
Noxious Weeds Database	17 June 2015	Narrabri Shire Council	Department of Primary Industries (2015)

## 2.4 Field survey

The modification study area (refer Figure 1.1) was inspected during daylight hours by a suitably qualified ecologist on 10 June 2015, 28 January 2014, 18 March 2014, 13 October 2014 and 24, 25 and 26 November 2014. These surveys sought to assess the extent and condition of vegetation and fauna habitat contained within the modification study area, specifically threatened species, populations and ecological communities, and assess the impacts associated with the proposal in regards to the identified biodiversity.

### 2.4.1 Flora surveys

#### 2.4.1.1 Species of plant and vegetation communities

A walk over inspection, conducted throughout the proposed modification study, identified area with floristic composition and structure, dominant species and vegetation communities. The floristic diversity, possible presence of threatened species and identity of vegetation communities was assessed using quadrat and random meander surveys.

The inspections and field surveys sought primarily to provide ground-truthing of information provided by the desk-based review, particularly in relation to:

- threatened ecological communities and flora listed under the EPBC Act, TSC Act or FM Act
- potential flora and fauna habitat related to flora values present on site
- significant habitat for threatened and migratory species or locally significant species.

The presence of threatened species was assessed during random meanders within the modification study area. Random meander surveys are a variation of the transect type survey and were completed in accordance with the technique described by Cropper (1993), whereby the recorder walks in a random manner recording all species observed, boundaries between various vegetation communities and condition of vegetation. The time spent in each vegetation community was generally proportional to the size of the community and its species richness.

Targeted threatened flora searches for *Tylophora linearis* were undertaken in habitat within the proposed modification study area in accordance with the random meander technique (Cropper 1993). These surveys were undertaken within the May – November flowering period for this species.

Twelve (12) flora quadrats (20 X 20 m) were used within the modification study area (refer Figure 3.1) to identify the presence/absence of the native vegetation communities present. The flora quadrats were in accordance with the BioBanking Operation Manual (Office of Environment and Heritage 2014). Attributes recorded during the random meander transects included variation in species composition and vegetation structure, the presence or absence of threatened or noxious species of plant and boundaries between vegetation communities.

#### 2.4.1.2 Vegetation condition

The condition of vegetation was assessed using parameters such as structural intactness, native species diversity, evidence of disturbance, weed invasion and plant health. Random meander surveys were the primary method of data collection for the vegetation community identification and condition assessment.

Three categories were used to describe the condition of vegetation communities:

- **Good:** vegetation still retains the species complement and structural characteristics of the pre-European equivalent. Such vegetation has usually changed very little over time and displays resilience to weed invasion due to intact groundcover, shrub and canopy layers.
- **Moderate:** vegetation generally still retains its structural integrity, but has been disturbed and has lost some component of its original species complement. Weed invasion can be significant in such remnants.
- **Poor:** vegetation that has lost most of its species and is significantly modified structurally. Often such areas have a discontinuous canopy of the original tree cover, with very few shrubs. Exotic species, such as introduced pasture grasses or weeds, replace much of the indigenous ground cover. Environmental weeds are often co dominant with the original indigenous species.

### 2.4.2 Fauna surveys

Fauna survey was conducted via opportunistic surveys, hollow tree survey and habitat assessment. Each of the survey techniques is described in further detail in the following sections.

#### 2.4.3 Opportunistic surveys

Opportunistic surveys consisted of random meanders across the modification study area and while completing other survey techniques, including habitat assessments and hollow-bearing tree surveys. Opportunistic surveys included herpetofauna searches throughout the modification study area wherever potential habitat (fallen logs, debris, drainage lines and rock outcropping) was found. Searches included turning over suitable ground shelter, such as fallen timber, sheets of iron and exposed rock, timber railway sleepers, and peeling decorticating bark where appropriate. Specimens were either identified visually, by aural recognition of calls (frogs and birds) or were collected and identified with reference to (Swan *et al.* 2004) or (Robinson 1998). All inspected ground shelter was returned to its original position.

##### 2.4.3.1 Hollow-bearing tree survey

Hollow-bearing trees were recorded on a hand held GPS whereby the number of tree hollows was based on visual inspection.

##### 2.4.3.2 Fauna habitat assessment

Fauna habitat assessments were undertaken to assess the likelihood of threatened species of animal (those species identified to occur within the locality from the literature and database review) occurring within the modification study area. Fauna habitat characteristics assessed included:

- Structure and floristics of the canopy, understorey and ground vegetation, including the presence of flowering and fruiting trees providing potential foraging resources.
- Presence of hollow-bearing trees providing roosting and breeding habitat for arboreal mammals, birds and reptiles.
- Presence of the ground cover vegetation, leaf litter, rock outcrops and fallen timber and potential to provide protection for ground-dwelling mammals, reptiles and amphibians.
- Presence of waterways (ephemeral or permanent) and water bodies.

A general fauna habitat features traverse was undertaken throughout the modification study area during the survey covering all major native vegetation occurrences. During the traverse, opportunistic recordings of species were made through incidental sightings, aural recognition of calls and observing indirect evidence of species presence (such as scats, feathers, hair, tracks, diggings and burrows).

### 2.4.3.3 Fauna habitat condition

The following criteria were used to evaluate the condition of habitat values:

- **Good:** a full range of fauna habitat components are usually present (for example, old growth trees, fallen timber, feeding and roosting resources) and habitat linkages to other remnant ecosystems in the landscape are intact.
- **Moderate:** some fauna habitat components are missing or greatly reduced (for example, old-growth trees and fallen timber), although linkages with other remnant habitats in the landscape are usually intact, but sometimes degraded.
- **Poor:** many fauna habitat elements in low quality remnants have been lost, including old growth trees (for example, due to past timber harvesting or land clearing) and fallen timber, and tree canopies are often highly fragmented. Habitat linkages with other remnant ecosystems in the landscape have usually been severely compromised by extensive clearing in the past.

## 2.5 Likelihood of occurrence assessment

The likelihood of threatened and migratory species and threatened populations occurring within the modification study area were assessed against the criteria outlined in Table 2.3.

Species subject to likelihood of occurrence assessments were those identified during the desk-top and field based investigations and/or the professional opinion of contributors to this assessment.

**Table 2.3 Likelihood of occurrence assessment**

Likelihood-of-occurrence	Criteria
Low	<ul style="list-style-type: none"> <li>■ have not been recorded previously in the modification study area and surrounds which are beyond the current known geographic range</li> <li>■ are dependent on specific habitat types or resources that are not present in the modification study area</li> <li>■ are considered extinct in the locality</li> </ul>
Moderate	<ul style="list-style-type: none"> <li>■ have been recorded previously in the modification study area and surrounds infrequently (i.e. vagrant individuals)</li> <li>■ use habitat types or resources that are present in the modification study area, although generally in a poor or modified condition</li> <li>■ are unlikely to maintain sedentary populations, however may seasonally utilise resources within the modification study area opportunistically during variable seasons or migration</li> </ul>

Likelihood-of-occurrence	Criteria
High	<ul style="list-style-type: none"> <li>■ have been previously recorded in the modification study area</li> <li>■ are dependent on habitat types or resources that are present in the modification study area that are abundant and/or in good condition within the modification study area</li> <li>■ are known or likely to maintain resident populations surrounding the modification study area</li> <li>■ are known or likely to visit the modification study area or surrounds during regular seasonal movements or migration</li> </ul>
Recorded	<ul style="list-style-type: none"> <li>■ recorded in the modification study area during current field study</li> </ul>

## 2.6 Significance assessments

Significance assessments were carried out for threatened species, populations or communities listed under the *Threatened Species Conservation Act 1995* (TSC Act), *Fisheries Management Act 1994* (FM Act) or *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) that were known or predicted to occur in the proposal locality (within a 10 km radius from the modification study area), with a moderate to high likelihood of occurring within the modification study area, based on suitable habitat and were likely to be impacted by the construction.

For species or communities listed under the TSC Act, significance assessments were completed by addressing the factors of Part 5A of the *Threatened species assessment guidelines The assessment of significance* (Department of Environment and Climate Change 2007) (refer to Section 8 and Appendix E) . For species or communities listed under the FM Act, significance assessments were completed by addressing the factors outlined in *Threatened species assessment guidelines, The assessment of significance* (NSW Department of Primary Industries 2008). For species or communities listed under the EPBC Act, significance assessments were completed in accordance with the *Significant Impact Guidelines 1.1 Matters of National Environmental Significance* (Department of Environment 2013).

## 2.7 Limitations

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

Where surveys were conducted outside the optimal time for detecting a particular species, or field surveys were of limited scope, a precautionary approach was taken and we assumed the species was present if suitable habitat was observed.

## 3. Landscape context

### 3.1.1 Bioregion

The modification study area is located in the Brigalow Belt South bioregion. The region forms the southern extremity of the Brigalow Belt, however is not dominated by Brigalow (*Acacia harpophylla*). The signature trees occurring throughout the Brigalow Belt South bioregion are White Box, White Cypress Pines and various Ironbarks. These species also dominate the communities that occur in the approved area of impact of the Project.

### 3.1.2 Brigalow and Nandewar Western Regional assessment

The modification is located within an area previously assessed at a broad scale under the Brigalow and Nandewar Western Regional Assessments (WRA). The Boggabri Coal Project is largely restricted to Leard State Forest, which was not identified for conservation in the WRA regional assessments.

## 3.2 Vegetation communities

The field survey and desktop assessment identified that the vegetation within the modification study area was comprised of five (5) native vegetation communities previously described by (2009), the distribution of which is related to geological, topographical, and geomorphological characteristics and previous land use (refer to Table 3.1 and Figure 3.1). In addition, one (1) non-native vegetation community was recorded. The vegetation communities identified in the modification study area are listed in Table 3.1.

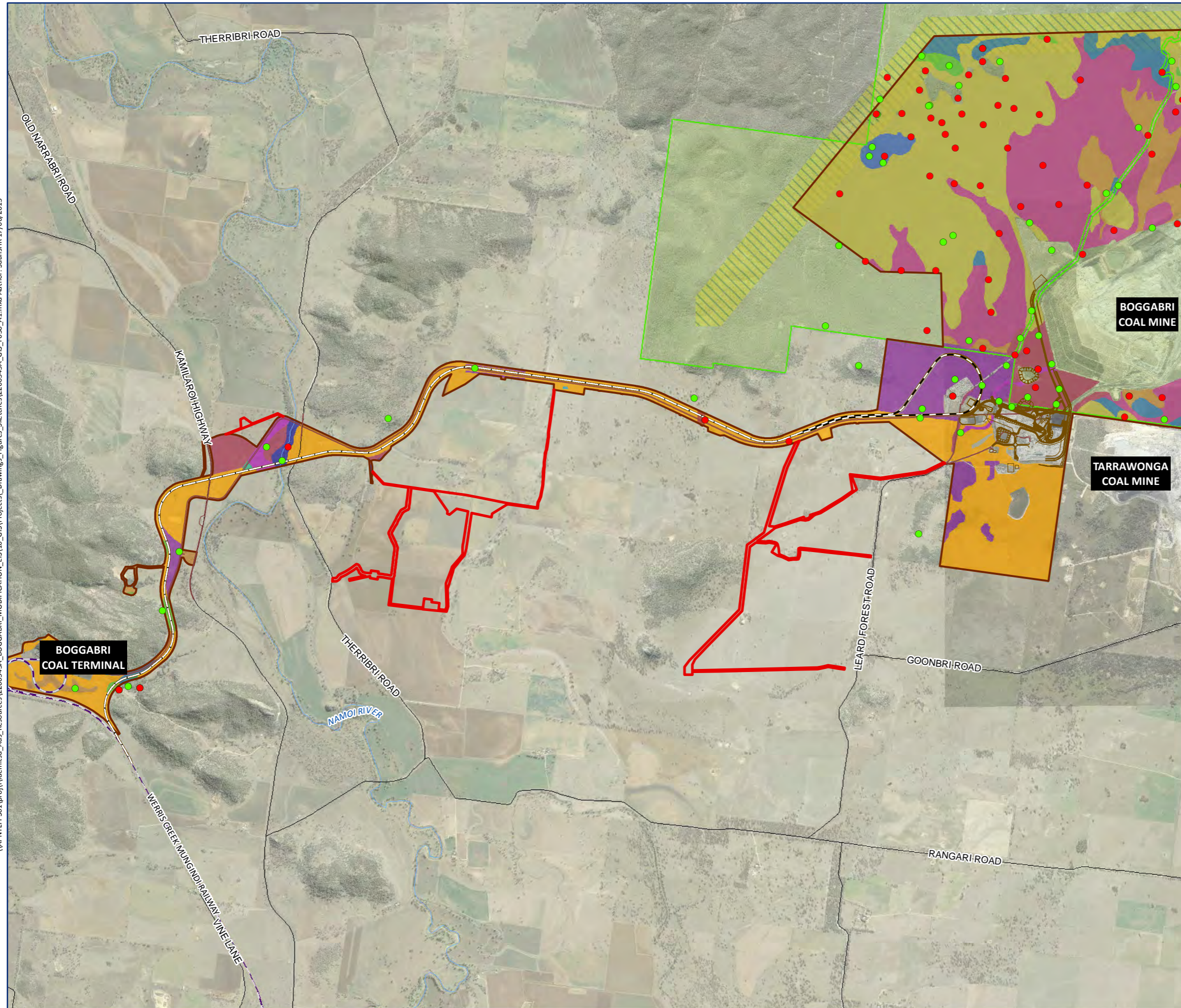
Detailed summaries of these communities including structure and dominant species recorded and vegetation habitat assessments are provided below. Copies of the field data sheets for the 12 BioBanking quadrats and transects are provided in Appendix F.

**Table 3.1 Identified vegetation communities**

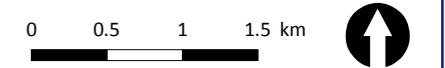
Existing vegetation mapping community equivalent (Parsons Brinckerhoff 2009)	Field Verified Vegetation community (Office of Environment and Heritage 2012b) <sup>5</sup>	Local broad-scale mapping (Eco Logical Australia 2008)	Threatened ecological community	OEH Vegetation class (Gibbons <i>et al.</i> 2008)	OEH Vegetation formation class (Gibbons <i>et al.</i> 2008)
Weeping Myall Woodland <sup>1</sup>	NA219: Weeping Myall open woodland of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion (PCT27)	RVC75: Weeping Myall open woodland, Darling Riverine Plains, Brigalow Belt South and Nandewar	E	Riverine Plain Woodlands	Semi-arid Woodlands (Grassy sub-formation)
Pilliga Box – Poplar Box – White Cypress Pine grassy woodland	NA179: Pilliga Box - Poplar Box- White Cypress Pine grassy open woodland on alluvial loams mainly of the temperate (hot summer) climate zone (PCT88)	RVC32: Pilliga Box – Poplar Box – White Cypress Pine/grass woodland on sandy loams, Darling Riverine Plains and Brigalow Belt South	-	Dry Sclerophyll Forests (Shrub/grass subformation)	Pilliga Outwash Dry Sclerophyll Forests

Existing vegetation mapping community equivalent (Parsons Brinckerhoff 2009)	Field Verified Vegetation community (Office of Environment and Heritage 2012b) <sup>5</sup>	Local broad-scale mapping (Eco Logical Australia 2008)	Threatened ecological community	OEH Vegetation class (Gibbons <i>et al.</i> 2008)	OEH Vegetation formation class (Gibbons <i>et al.</i> 2008)
River Red Gum riparian woodlands and forests & derived native grasslands <sup>2</sup>	NA336: River Red Gum riparian tall woodland wetland on basaltic alluvial soils mainly in the Liverpool Plains sub-region, Brigalow Belt South Bioregion (PCT438)	RVC73: River Red Gum riverine woodlands and forests, Darling Riverine Plains, Brigalow Belt South and Nandewar.	E	Inland Floodplain Woodlands	Semi-arid Woodlands (Grassy sub-formation)
Derived Native Grasslands <sup>3</sup>	NA179: Pilliga Box - Poplar Box- White Cypress Pine grassy open woodland on alluvial loams mainly of the temperate (hot summer) climate zone (PCT88)	RVC32: Pilliga Box – Poplar Box – White Cypress Pine/grass woodland on sandy loams, Darling Riverine Plains and Brigalow Belt South	-	Dry Sclerophyll Forests (Shrub/grass subformation)	Pilliga Outwash Dry Sclerophyll Forests
Plains Grassland <sup>4</sup>	NA181: Plains Grass - Bluegrass grassland of the Nandewar and Brigalow Belt South Bioregions (PCT27)	RVC26: Dry grasslands of alluvial plains, Darling Riverine Plains and Brigalow Belt South		Western slopes grassland	Grasslands
Exotic grassland with scattered trees	-	-	-	-	-

- (1) E = Endangered ecological community, Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions (TSC Act)  
E = Endangered Ecological Community Weeping Myall Woodland (EPBC Act).
- (2) E = Endangered under the Fisheries Management Act 1994, Natural Drainage System of the Lowland Catchment of the Darling River.
- (3) This community generally occurred as native grassland with scattered trees.
- (4) This community does not meet criteria for Native Vegetation on Cracking Clay Soils of the Liverpool Plains (TSC Act) or Critically Endangered ecological community, Natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland (EPBC Act).
- (5) NA refers to Biometric Type for the Namoi CMA, and PCT refers to Plant Community Types as set out by OEH.



- Flora Survey Quadrats (Jan 2009)
- Flora Survey Quadrats (April 2009)
- Mine infrastructure
- Road
- Existing/operational rail
- Proposed rail
- ▭ MOD 5 study area
- ▭ Boggabri Project Approval Area
- ▨ Biodiversity offset corridor
- ▨ Leard State Forest
- ▨ Leard State Conservation Area
- Blue-leaved Ironbark  
heathy woodland
- Derived native grassland
- Exotic grassland
- Farm dams
- Narrow-leaved Ironbark - Brown Bloodwood -  
White Cypress Pine shrubby open forest
- Narrow-leaved Ironbark - White Cypress  
Pine shrubby open forest
- Pilliga Box - Poplar Box - White Cypress  
Pine grassy open woodland
- Plains Grassland
- River Red Gum riparian  
woodlands and forests
- Silver-leaved Ironbark  
heathy woodland
- Weeping Myall grassy  
open woodland
- White Box - Blakelys Red  
Gum - Melaleuca riparian forest
- White Box - Narrow-leaved Ironbark -  
White Cypress Pine grassy open forest
- White Box - Narrow-leaved Ironbark -  
White Cypress Pine shrubby open forest
- White Pine - Narrow-leaved Ironbark  
Shrub - Grass Open Forest (SW)
- Yellow Box - Blakelys Red  
Gum grassy woodland



**Figure 2.1**  
Flora values within the  
project boundary

\\PNTLFP501\pro\l\demitsu\_Aus\_Resources\2200545A\_BOOGABRI\_MODIFICATION\_EIS\10\_GIS\Projects\Drawings\_Figures\_Sketches\2200545A\_GS\_F030\_A1.mxd Author: Suansrir 17/06/2015

### 3.2.1 Weeping Myall Woodland

Weeping Myall Woodland is a native low open woodland vegetation community that reaches approximately 10 m in height. This community was recorded as isolated two patches of remnant vegetation which has been subjected to heavy disturbance as a result of agricultural activities and road infrastructure. This vegetation community was recorded immediately adjacent Therribri Road (refer to Figure 3.1).

The disturbance of much of this community has resulted in the ground layers containing both native and exotic grasses and forbs. The community does however contain a native canopy cover characteristic of the Weeping Myall Woodland (Table 3.2) which is listed as an Endangered Ecological Community under both the TSC Act and EPBC Act.

**Table 3.2 Vegetation Characteristics of Weeping Myall Woodland**

Weeping Myall Woodland			
Description			
<b>Conservation significance</b>	<b>High.</b> This community is representative of the Endangered Weeping Myall Woodlands listed under both the TSC Act and EPBC Act. Refer to Section 4.1 for further detailed assessment.		
<b>Condition</b>	<p><b>Moderate.</b> This community is subject to high disturbance from previous and current land use including agricultural activities, neighbouring road infrastructure, vegetation clearing, edge effects and weed invasion.</p> <p>This community contains a canopy of remnant mature and juvenile <i>Acacia pendula</i>. The ground layer was generally dominated by native groundcover species and some exotic species including numerous perennial grasses and herbs.</p>		
Strata	Height range (m)	Foliage cover (%)	Dominant species
<b>Canopy</b>	4-8	0-40	<i>Acacia pendula</i> .
<b>Shrub layer</b>	0.4-2	0-10	Juvenile <i>Acacia pendula</i> and in some areas (predominantly on the periphery of the community) <i>Sclerolaena muricata</i> and <i>Lycium ferocissimum</i> *.
<b>Ground cover</b>	0.1-1.6	40-90	<i>Austrostipa verticillata</i> , <i>Austrostipa aristiglumis</i> , <i>Enteropogon articularis</i> , <i>Sporobolus creber</i> , <i>Vittadinia sulcata</i> , <i>Euchiton sphaericus</i> , <i>Chloris truncata</i> , <i>Rytidosperma bipartitum</i> , <i>Dichanthium sericeum</i> , and exotic pasture grasses and herbaceous weeds including <i>Sida rhombifolia</i> *, <i>Hypochaeris radicata</i> *, <i>Cirsium vulgare</i> *, <i>Brassica sp.</i> *, <i>Echium plantagineum</i> *, <i>Avena fatua</i> *, <i>Plantago lanceolata</i> * and <i>Bidens pilosa</i> *.



### Weeping Myall Woodland



### 3.2.2 Pilliga Box – Poplar Box – White Cypress Pine grassy Woodland


Pilliga Box – Poplar Box – White Cypress Pine grassy Woodland is a native open woodland vegetation community that was recorded as isolated patches of remnant trees within a heavily disturbed landscape as a result of agricultural activities. This community occurred as isolated patches of remnant vegetation near the Roma, Belleview and Victoria Park bore pipelines (refer to Figure 3.1 and Table 3.3). The pipeline will be installed above ground through these sections and therefore no ground penetration will be required.

The majority of this community was heavily disturbed by agriculture and as a result is dominated by a combination of both native and exotic grasses and forbs. The community does however contain a native canopy cover characteristic of the Pilliga Box – Poplar Box – White Cyprus Pine grassy woodland.

**Table 3.3 Vegetation Characteristics of Pilliga Box – Poplar Box – White Cypress Pine Grassy Woodland**

Pilliga Box – Poplar Box – White Cyprus Pine grassy Woodland			
Description			
<b>Conservation significance</b>	Not consistent with any endangered ecological communities.		
<b>Condition</b>	<p><b>Low - Moderate.</b> This community is subject to high disturbance from previous and current land use including agricultural activities, vegetation clearing, edge effects and weed invasion.</p> <p>This community contains a sparse canopy of remnant and occasional planted species such as <i>Eucalyptus pilligaensis</i> and <i>Eucalyptus populnea</i> subsp. <i>bimbil</i>. The ground layer was generally dominated by native and exotic groundcover species including numerous perennial grasses and herbs.</p>		
Strata	Height range (m)	Foliage cover (%)	Dominant species
<b>Canopy</b>	6-14	0-30	<i>Eucalyptus pilligaensis</i> and <i>Eucalyptus populnea</i> subsp. <i>bimbil</i> .
<b>Shrub layer</b>	0.4-2	0-10	Occasional exotic shrub species such as <i>Sclerolaena birchii</i> * and juvenile <i>Eucalyptus populnea</i> subsp. <i>bimbil</i> *

Pilliga Box – Poplar Box – White Cyprus Pine grassy Woodland			
Ground cover	0.1-1.8	0-100	<i>Austrostipa bigeniculata</i> , <i>Austrostipa verticillata</i> , <i>Austrostipa aristiglumis</i> , <i>Chloris truncata</i> , <i>Panicum effusum</i> , <i>Rytidosperma bipartitum</i> , <i>Dichanthium sericeum</i> , and exotic pasture grasses and herbaceous weeds including <i>Sida rhombifolia</i> *, <i>Hypochaeris radicata</i> *, <i>Cirsium vulgare</i> *, <i>Brassica sp.</i> *, <i>Echium plantagineum</i> *, <i>Avena fatua</i> *, <i>Plantago lanceolata</i> *, <i>Centaurea calcitrapa</i> * and <i>Bidens pilosa</i> *



### 3.2.3 River Red Gum riparian woodlands and forests

This community was recorded within the study area as part of the Boggabri Coal Mine Biodiversity Offsets Audit (Niche Environment and Heritage 2015). This community occurred predominantly as derived native grassland in proximity to the Heathcliffe groundwater bore along the Namoi River and as two additional patches located near the Daisymede and Belleview groundwater bores. The community occurred predominantly as derived native grassland and a small area of remnant trees within floodplain depressions throughout the areas described above (refer to Figure 3.1). Agricultural activities such as grazing, cropping and vegetation clearance have heavily disturbed the community, which generally occurred adjacent to exotic grassland.

The majority of this community is dominated by a combination of native and exotic grasses and forb but retains a native canopy cover in some areas characteristic of the River Red Gum riparian woodlands and forest. This community occurred on the floodplains of the Namoi River and therefore is considered to be part of the endangered community listed under the FM Act of Natural Drainage System of the Lowland Catchment of the Darling River.

**Table 3.4 Vegetation Characteristics of River Red Gum riparian woodland**

River Red Gum riparian woodlands and forests			
Description			
<b>Conservation significance</b>	<b>High.</b> This community is representative of the endangered ecological community listed under the <i>Fisheries Management Act 1994</i> , Natural Drainage System of the Lowland Catchment of the Darling River.		
<b>Condition</b>	<p>The community is subject to high disturbance from previous and current land use including agricultural activities, vegetation clearing, edge effects and weed invasion.</p> <p><b>Low.</b> Derived native grassland characterised by groundcover species characteristic of this community.</p> <p><b>Moderate.</b> Highly disturbed vegetation community with a sparse canopy of remnant <i>Eucalyptus camaldulensis</i> and the occasional <i>Eucalyptus melliodora</i>. The ground layer was dominated by exotic groundcover species as a result of pasture grassing including numerous perennial grasses and herbs such as <i>Vicia sativa</i> subsp. <i>nigra</i>*, <i>Hypochaeris radicata</i>*, <i>Cirsium vulgare</i>*, <i>Sonchus oleraceus</i> *and <i>Bidens pilosa</i>*.</p>		
Strata	Height range (m)	Foliage cover (%)	Dominant species
<b>Canopy</b>	4-22	0-25%	<i>Eucalyptus camaldulensis</i> and the occasional <i>Eucalyptus melliodora</i> .
<b>Shrub layer</b>	0.4-2	0-10	Occasional exotic shrub species such as <i>Sclerolaena birchii</i> * and <i>Vachellia farnesiana</i> *
<b>Ground cover</b>	0.1-1	50-90	<i>Hypochaeris radicata</i> *, <i>Cirsium vulgare</i> *, <i>Brassica</i> spp. *, <i>Silybum marianum</i> *, <i>Lolium perenne</i> *, <i>Echium plantagineum</i> *, <i>Avena fatua</i> *, <i>Trifolium arvensis</i> *, <i>Vulpia myuros</i> *, <i>Rumex crispus</i> *, <i>Anagallis arvensis</i> *, <i>Trifolium sativa</i> *, <i>Chloris gayana</i> *, <i>Plantago lanceolata</i> *, <i>Centaurea calcitrapa</i> * and <i>Bidens pilosa</i> *. The community also comprised the occasional native plant species such as <i>Austrostipa aristiglumis</i> , <i>Chloris truncate</i> , <i>Carex appressa</i> and <i>Cyperus</i> spp.

**River Red Gum riparian woodlands and forests**



Note: Photo of River Red Gum riparian woodlands and forests from within the Project Area Boundary

### 3.2.4 Derived native grassland

The derived native grassland is a highly modified native vegetation community that occurs immediately adjacent the Pilliga Box – Poplar Box – White Cypress Pine grassy woodland. Specifically the community occurs in the southern sections of the modification study area and along the majority of the Haul Road (Sites 4-9). The community is associated with areas of recent clearing for agricultural land uses and Boggabri Coal Mine. Given the floristic composition and presence of regrowth Poplar Box – White Cypress Pine this community is likely to have comprised the Pilliga Box – Poplar Box – White Cypress Pine grassy woodland prior to the clearing.

The majority of this community was dominated by a variety of exotic and cultivated native pasture grasses and exotic herbs. Most of the canopy and shrub layer within the community had been previously cleared and its condition class was considered to be poor. Isolated paddock trees of *Eucalyptus populnea subsp. bimbil* were scattered throughout this community.

**Table 3.5 Vegetation Characteristics of Derived native grassland**

Derived native grassland	
Description	
<b>Conservation significance</b>	Not consistent with any endangered ecological communities.
<b>Condition</b>	<b>Low to moderate.</b> Subject to high disturbance from previous and current land use including vegetation clearing, infrastructure, edge effects and weed invasion. This community generally did not contain a canopy or shrub layer aside from the occasional

Derived native grassland			
	planted or remnant plant species ( <i>Eucalyptus populnea</i> subsp. <i>bimbil</i> ). The ground layer was dominated by native and exotic groundcover species including numerous perennial grasses (including crops) and herbs.		
Strata	Height range (m)	Foliage cover (%)	Dominant species
Canopy	4-18	0-30	Isolated paddock trees of <i>Eucalyptus populnea</i> subsp. <i>bimbil</i>
Shrub layer	0.4-1	0-20	Occasional <i>Sclerolaena birchii</i> *
Ground cover	0.1-1.8	80-100	<i>Enchylaena tomentosa</i> , <i>Einadia nutans</i> subsp. <i>linifolia</i> , <i>Austrostipa scabra</i> subsp. <i>scabra</i> , <i>Austrostipa verticillata</i> , <i>Calotis cuneifolia</i> , <i>Vittadinia cervicalis</i> var. <i>cervicalis</i> .



### 3.2.5 Plains grassland

Plains grassland has been recorded within the modification study area as part of the Boggabri Coal Mine Biodiversity Offsets Audit (Niche Environment and Heritage 2015). Specifically the community occurred to the north-east of Belleview, and is associated with areas of recent clearing for agricultural land uses and Boggabri Coal Mine. Plains grassland usually occurs within the Namoi floodplain on black cracking fine textured clays soils which are Quaternary alluvial derived from Tertiary basalts.

The plains grassland within the study area occurs on Namoi River Meander Plains, which are composed of recent Quaternary alluvial deposits rather than from Tertiary Basalt geology (Duggin & Allison 1984). Therefore the Plains grassland is not consistent with the Native Vegetation on Cracking Clay Soil of the

Liverpool Plains listed as under the TSC Act and/or the EPBC Act. Further discussion on this is provided in Section 4.1.

This community contained a variety of exotic and cultivated native pasture grasses and exotic herbs. The majority of the groundcover, however, was dominated by native species and the occasional isolated paddock tree.

**Table 3.6 Vegetation Characteristics of Plains Grassland**

Plains grassland			
Description			
<b>Conservation significance</b>	<b>Moderate.</b> This community is not consistent with any threatened ecological communities (refer Section 4.1), however it does have habitat for threatened biodiversity.		
<b>Condition</b>	<b>Low to moderate.</b> Subject to high disturbance from previous and current land use including vegetation clearing, infrastructure, edge effects and weed invasion.		
Strata	Height range (m)	Foliage cover (%)	Dominant species
<b>Canopy</b>	4-18	0-30	Occasional scattered tree of <i>Eucalyptus melliodora</i> , <i>Eucalyptus populnea</i> subsp. <i>Bimbil</i> and <i>Eucalyptus albens</i>
<b>Shrub layer</b>	0.4-2	0-5	Occasional <i>Vachellia farnesiana</i> * and <i>Sclerolaena birchii</i> *
<b>Ground cover</b>	0.1-1.8	80-100	<i>Austrostipa aristiglumis</i> , <i>Dichanthium sericeum</i> subsp. <i>sericeum</i> , <i>Panicum queenslandicum</i> var. <i>queenslandicum</i> , <i>Sclerolaena muricata</i> , <i>Austrodanthonia</i> spp, <i>Aristida leptopoda</i> , <i>Leiocarpa panaetioides</i> , <i>Vittadinia cuneata</i> , <i>Daucus glochidiatus</i> and <i>Carex inversa</i>



## Exotic grassland with scattered trees

The exotic grassland with scattered trees is a highly disturbed vegetation community occurring throughout the majority of the proposed modification study area. The community is associated with areas impacted by a history of agricultural activities and no longer resembles any local native remnant vegetation communities (refer to Figure 3.1). The majority of this vegetation community was dominated by a variety of exotic and cultivated native pasture grasses and exotic herbs.

**Table 3.7 Vegetation Characteristics of Exotic grassland with scattered trees**

Exotic grassland with scattered trees			
Description			
<b>Conservation significance</b>	Not consistent with any native vegetation communities or endangered ecological communities.		
<b>Condition</b>	<p><b>Low.</b> Subject to high disturbance from previous and current land use including vegetation clearing, infrastructure, edge effects and weed invasion.</p> <p>This community generally did not contain a canopy or shrub layer aside from the occasional planted or remnant plant species such as <i>Eucalyptus pilligaensis</i> and <i>Eucalyptus populnea</i> subsp. <i>bimbil</i>. The ground layer was dominated by exotic groundcover species including numerous perennial grasses (including crops) and herbs.</p>		
Strata	Height range (m)	Foliage cover (%)	Dominant species
<b>Canopy</b>	4-18	0-20	Occasional remnant <i>Eucalyptus populnea</i> and <i>Eucalyptus pilligaensis</i> .
<b>Shrub layer</b>	0.4-1	0-20	Occasional <i>Sclerolaena birchii</i> *
<b>Ground cover</b>	0.1-1.2	0-100	<i>Dichanthium sericeum</i> , <i>Panicum spp.</i> , <i>Hypochaeris radicata</i> *, <i>Datura ferox</i> *, <i>Xanthium occidentale</i> *, <i>Cirsium vulgare</i> *, <i>Brassica spp.</i> *, <i>Silybum marianum</i> *, <i>Lolium perenne</i> *, <i>Echium plantagineum</i> *, <i>Avena fatua</i> *, <i>Trifolium arvensis</i> *, <i>Vulpia myuros</i> *, <i>Rumex crispus</i> *, <i>Anagallis arvensis</i> *, <i>Trifolium sativa</i> *, <i>Chloris gayana</i> *, <i>Plantago lanceolata</i> *, <i>Centaurea calcitrapa</i> *, <i>Medicago polymorpha</i> *, <i>Triticum aestivum</i> * and <i>Bidens pilosa</i> *.

### Exotic grassland with scattered trees



### 3.2.6 Species of plant

A total of 129 species of plant was recorded within the proposed modification study area (Appendix A). Of these species, 79 (61%) were native. The most diverse plant families were the Poaceae (grasses), Asteraceae and Fabaceae.

**No threatened species were recorded within the modification study area during the field surveys.**

Five (5) weed species (African Boxthorn, African Turnip Weed, Fireweed, Galvanised Burr and Prickly Pear) recorded within the modification study area are declared as noxious under the *Noxious Weeds Act 1993* for the Narrabri Shire Council weed control area (refer to Table 3.8)

These weeds are classified as Class 4 and Class 5 weeds under the *Noxious Weeds Act 1993* and must be managed in accordance with the control class measures specified as outlined under the Act. Fireweed and African Boxthorn are also listed as Weeds of National Significance and should be appropriately managed as it has high potential to invade and spread.



**Table 3.8 Noxious weeds and weeds of national significance identified on the site**

Scientific Name	Common Name	Noxious Weeds Act 1993 <sup>1</sup>	Weed of National Significance
<i>Opuntia stricta</i> *	Prickly Pear	4	-
<i>Senecio madagascariensis</i> *	Fireweed	4	Yes
<i>Sclerolaena birchii</i> *	Galvanised Burr	4	-
<i>Lycium ferocissimum</i> *	African Boxthorn	4	Yes
<i>Sisymbrium thellungii</i> *	African Turnip Weed	5	-

Note:

- (1) Control Categories under the *Noxious Weeds Act 1993* for the Narrabri Shire Council: Class 4: The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority, Class 5 The requirements in the *Noxious Weeds Act 1993* for a notifiable weed must be complied with (Department of Trade and Investment Regional Infrastructure and Services 2014).

### 3.3 Fauna habitat

The quality of vertebrate fauna habitats is typically correlated with the patch size, configuration, structure, species composition and connectivity of the vegetation communities present at a given site and the presence of non-biological features such as rock outcrops and water bodies. Therefore, the fauna habitats present in the modification study area varied from low condition in highly modified areas (exotic grassland with scattered trees) and moderate condition in the highly disturbed open woodland.

The modification study area consisted of two (2) fauna habitat types outlined in Table 3.9.

**Table 3.9 Fauna habitat with corresponding vegetation description**

Fauna Habitat Description	Corresponding Vegetation community
Grassy Woodland on fertile soils	Weeping Myall Woodland Pilliga Box – Poplar Box – White Cypress Pine grassy Woodland River Red Gum riparian woodlands and forest (Moderate condition)
Grasslands	River Red Gum riparian woodlands and forest (Low condition) Derived Native Grassland Plains Grassland Exotic Grassland

#### 3.3.1 Grasslands

This habitat type consisted of all exotic grassland with scattered trees, plains grassland and all derived native grassland vegetation communities recorded throughout the proposed modification study area.

The grassland areas have been subject to heavy disturbance (vegetation clearing, edge effects and weed invasion) as a result of agricultural and mining activities. This habitat is almost entirely devoid of trees and shrubs, consisting primarily of exotic and native grasses and herbaceous weeds with the occasional tree. The grassland habitat generally lacked a range of habitat features, such as tree hollows, fallen timber, rock outcrops, diverse native groundcover or deep leaf litter providing limited foraging resources and refuge sites for native animals. As this habitat lacked structural complexity it provided limited habitat suitable only for transient ground dwelling native species or highly mobile disturbance tolerant species (such as birds and bats) and is unlikely to be used on a permanent basis by most threatened fauna. This habitat does provide

foraging for a number of threatened birds of prey including the Little Eagle, Black Falcon, Square-tailed Kite and Spotted Harrier.

### 3.3.1.1 Grassy woodland on fertile soils

This habitat type included the Pilliga Box – Poplar Box – White Cypress Pine grassy woodland, River Red Gum riparian woodlands and forests and Weeping Myall Woodland vegetation communities. This habitat type occurred as moderately disturbed isolated patches of native remnant vegetation scattered throughout the proposed modification study area.

This area contained an intact native canopy cover, generally lacked a native shrub layer with a combined native and exotic groundcover (often dominated by exotic pasture grasses and herbaceous weeds). This habitat contained numerous hollows suitable for bird species however lacked other general habitat features such as fallen timber, rock outcrops and leaf litter. This habitat does provide foraging and roosting habitat for a number of disturbance tolerant species of animal including threatened bat and bird species.

### 3.3.2 Species of animal

19 animal species recorded in the proposed modification study area (Appendix B), of which, 16 (84%) were native. Birds accounted for 17 species (89%) while reptiles accounted for two (2) (11%) species.

No threatened animal species were recorded during the opportunistic fauna survey. Most of the species recorded are associated commonly with disturbed environments within a modified landscape.

# 4. Biodiversity of conservation concern

## 4.1 Endangered ecological communities

Results of the desktop assessment indicated that 12 threatened ecological communities listed under the TSC Act, FM Act, EPBC Act (Table 4.1) have potential to occur within the modification study area.

Two threatened ecological communities were recorded within the modification study area:

- Weeping Myall Woodland listed as endangered under both the EPBC Act and TSC Act
- River Red Gum riparian woodlands and forests listed as endangered under the FM Act.

None of the remaining communities identified within the modification study area correspond with any of the threatened ecological communities predicted to occur within the modification study area.

**Table 4.1 Threatened ecological communities with potential to occur within the proposed modification study area**

Ecological community name TSC Act (EPBC Act)	Conservational status			Recorded within the proposed modification study area
	TSC Act <sup>1</sup>	EPBC Act <sup>2</sup>	FM Act <sup>3</sup>	
Coolibah – Black Box Woodlands of the Northern Riverine Plains in the Darling Riverine Plains and the Brigalow Belt South Bioregions (Coolibah – Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions)	E	E	-	No. Not identified within the proposed modification study area.
Inland Grey Box Woodland in the Riverina: NSW South Western Slopes: Cobar Penepplain: Nandewar and Brigalow Belt South Bioregions (Grey Box ( <i>Eucalyptus microcarpa</i> ) Grassy Woodlands and Derived Native Grassland of South-eastern Australia)	E	E	-	No. Not identified within the proposed modification study area.
Native Vegetation on cracking Clay Soils of the Liverpool Plains (Natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland)	E	CE	-	No. The Plains Grassland identified with the modification study area did not meet the criteria for this community.
New England Peppermint ( <i>Eucalyptus nova-anglica</i> ) Grassy Woodlands		CE	-	No. Not identified within the proposed modification study area.
<b>Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Penepplain, Murray-Darling Depression, Riverina and NSW South Western Slopes Bioregion (Weeping Myall Woodlands)<sup>4</sup></b>	<b>E</b>	<b>E</b>	<b>-</b>	<b>Yes. Recorded within the modification study area along Therribri Road to the west of the study area.</b>

Ecological community name TSC Act (EPBC Act)	Conservational status			Recorded within the proposed modification study area
	TSC Act <sup>1</sup>	EPBC Act <sup>2</sup>	FM Act <sup>3</sup>	
White Box Yellow Box Blakely's Red Gum Woodland (White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland)	E	CE	-	No. Not identified within the proposed modification study area.
Semi-evergreen Vine thicket in the Brigalow Belt South and Nandewar Bioregions (Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions)	E	E	-	No. Not identified within the proposed modification study area.
Brigalow within the Brigalow Belt South, Nandewar and Darling Riverine Plains Bioregions (Brigalow ( <i>Acacia harpophylla</i> dominant and co-dominant)	E	E	-	No. Not identified within the proposed modification study area.
Carabeen Open Forest Community in the Darling Riverine Plains and Brigalow Belt South Bioregions	E	-	-	No. Not identified within the proposed modification study area.
Fuzzy Box Woodland on alluvial soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions	E	-	-	No. Not identified within the proposed modification study area.
Inland Grey box Woodland in the Riverina, NSW South Western Slopes, Cobar Penepplain, Nandewar and Brigalow Belt South Bioregions (Grey Box ( <i>Eucalyptus microcarpa</i> ) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia)	E	E	-	No. Not identified within the proposed modification study area.
<i>Cadellia pentastylis</i> (Ooline) community in the Nandewar and Brigalow Belt South Bioregions	E	-	-	No. Not identified within the proposed modification study area.
<b>Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Darling River</b>	-	-	<b>E</b>	<b>Yes. Recorded within the modification study area by (Niche Environment and Heritage 2015).</b>

Note:

(1) TSC Act – *Threatened Species Conservation act 1995*, V=Vulnerable, E= Endangered

(2) EPBC Act – *Environment Protection and Biodiversity Conservation Act1999*, E= Endangered, CE = Critically Endangered

(3) FM Act – *Fisheries Management Act 1994*, E = Endangered

(4) Community is characteristic and meets the condition criteria of both the EPBC Act and TSC Act listed community.

## 4.1.1 Commonwealth listed ecological communities

### 4.1.1.1 Weeping Myall Woodland

Weeping Myall Woodlands is listed as an Endangered Ecological Community under the EPBC Act. This community occurs as a low open to sparse woodland to a height of 10 m with a canopy dominated by *Acacia pendula* (Weeping Myall).

To be considered part of the EPBC Act listed ecological community remnant areas must meet the NSW Scientific committee’s criteria. A comparison of the EPBC Act ecological community’s condition criteria against the remnant vegetation recorded on site provided below Table 4.2.

**Table 4.2 Condition criteria for meeting EPBC Act listed Weeping Myall Woodlands**

	<b>Condition criteria</b>	<b>Weeping Myall Woodland within the modification study area</b>
<b>1</b>	Tree canopy is dominated (at least 50% of trees present) by living, dead or defoliated Weeping Myall trees.	Yes. The Weeping Myall Woodland contained a canopy cover dominated by Weeping Myall.
<b>2</b>	Overstorey must have at least 5% tree canopy cover or at least 25 dead or defoliated mature Weeping Myall trees/ha	Yes. The Weeping Myall Woodland contained a tree canopy cover with over 5% mature and semi-mature Weeping Myall trees.
<b>3</b>	Area is at least 0.5 ha in size.	Yes. The patch of Weeping Myall Woodland is greater than 0.5 ha in size.
<b>4</b>	The patch has either: <ul style="list-style-type: none"> <li>■ more than two layers of regeneration of Weeping Myall present; or</li> <li>■ tallest layer of living, dead or defoliated Weeping Myall trees is at least 4 m tall and of the vegetative cover present, 50% is comprised of native species.</li> </ul>	<ul style="list-style-type: none"> <li>■ Yes. The Weeping Myall Woodland contained two layers of regeneration of Weeping Myall present and the canopy is greater than 4 m high and contains greater than 50% native species.</li> </ul>
<b>END</b>	<b>Does the patch meet final determination of the listed community (Department of Environment Water Heritage and the Arts 2008)?</b>	<b>Yes. The patch meets all condition criteria for the federal listing of Weeping Myall Woodland.</b>

#### 4.1.1.2 Natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland

Natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland are listed as a critically endangered ecological community under the EPBC Act.

The process for identifying the presence of Natural grasslands on basalt and fine-textured alluvial plains of northern NSW and southern Qld community needs to consider the diagnostic features outlined in the Threatened Species Scientific Committee listing advice (Department of Environment Water Heritage and Arts 2008). The process for identifying the presence of Natural grasslands on basalt and fine-textured alluvial soils of northern New South Wales and southern Queensland is outlined in Table 4.3.

The Plains Grassland vegetation community identified in the recent Boggabri Coal Mine – Biodiversity Offsets Audit (Niche Environment and Heritage 2015) is not considered to be consistent with the final determination listing under the EPBC Act as the community did not meet the diagnostic characteristics outlined in Table 4.3.

**Table 4.3 Summary table of EPBC diagnostic characteristics of Natural grasslands on basalt and fine-textured alluvial soils of northern NSW and southern Queensland**

EPBC diagnostic characteristics	General comment for the modification study area
<p>Distribution mainly in the Darling Downs of southern Queensland and the Liverpool Plains and Moree Plains of northern NSW. Occurrence is mainly associated with fine textured, often cracking clay soils derived from either basalt or alluvium.</p>	<p>Although the modification study area does occur within the Liverpool Plains catchment in the Brigalow Belt South Bioregion it is not associated with black cracking fine textured clays soils derived from alluvium and basalt. Soil mapping of the area identifies the soil type as Namoi River Meander Plains which is composed of recently deposited Quaternary alluvial soil which has not been derived from Tertiary Basalt.(Duggin &amp; Allison 1984). In additional mapping of the EPBC-listed “Natural Grasslands on the basalt and fine textured alluvial plains of northern New South Wales and southern Queensland” in the Namoi Catchment (Eco Logical Australia 2010) has not identified the community as being present within the modification study area.</p>
<p>Occurrence on landforms that are typically flat to very low slopes (less than 5%/1 degree).</p>	<p>The area of Plains Grassland vegetation is located on a very flat landform with &lt;5% slope.</p>
<p>Tree canopy usually absent to sparse, comprising less than 10% Projective crown cover.</p>	<p>Tree canopy cover is estimated at &lt;5% Projective crown cover. Therefore identified as grassland.</p>
<p>The ground layer is typically dominated by perennial native grasses and contains 3 or more of the indicator native species listed below.</p> <ul style="list-style-type: none"> <li>▪ <i>Aristida leptopoda</i></li> <li>▪ <i>Astrebla elymoides</i></li> <li>▪ <i>Astrebla lappacea</i></li> <li>▪ <i>Austrodanthonia bipartita</i></li> <li>▪ <i>Austrostipa aristiglumis</i></li> <li>▪ <i>Bothriochloa biloba</i></li> <li>▪ <i>Bothriochloa erianthoides</i></li> <li>▪ <i>Dichanthium sericeum</i></li> <li>▪ <i>Digitaria divaricatissima</i></li> <li>▪ <i>Elymus plurinervis</i></li> <li>▪ <i>Eriochloa crebra</i></li> <li>▪ <i>Eulalia aurea</i></li> <li>▪ <i>Panicum decompositum</i></li> <li>▪ <i>Panicum queenslandicum</i></li> <li>▪ <i>Thellungia advena</i></li> <li>▪ <i>Themeda avenacea</i></li> <li>▪ <i>Themeda triandra</i> (synonym. <i>T. australis</i>)</li> </ul> <p><i>Walwhalleya proluta</i></p>	<p>It is assumed based on the Boggabri Coal Mine – Biodiversity Offsets Audit (Niche Environment and Heritage 2015) that the floristic diversity is dominated by the perennial native grasses outlined in the determination.</p>
<p><b>Does the patch meet the criteria for the classification of the vegetation as the listed community?</b></p>	<p><b>No</b></p>

## 4.1.2 State listed ecological communities (TSC Act, FM Act)

### 4.1.2.1 Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Penepplain, Murray-Darling Depression, Riverina and NSW South Western Slopes Bioregion

Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Penepplain, Murray-Darling Depression, Riverina and NSW South Western Slopes Bioregion is listed as an Endangered Ecological Community under the TSC Act.

The final determination for this community under the TSC Act is broad however the Weeping Myall Woodland recorded within the modification study area is characteristic with the determination as it:

- Occurs as a low sparse woodland with a canopy dominated by *Acacia pendula* to 10 m in height
- Occurs within the Narrabri LGA and
- Contains characteristic species assemblage such as *Acacia pendula*, *Austrostipa aristiglumis*, *Boehavia dominii*, *Dichanthium sericeum*, *Sclerolaena muricata* and *Chloris truncata*.

Therefore the Weeping Myall Woodland recorded within the modification study area is characteristic of the Endangered Ecological Community.

### 4.1.2.2 Native Vegetation on cracking Clay Soils of the Liverpool Plains

Native Vegetation on Cracking Clay Soils of the Liverpool Plains is listed as an Endangered Ecological Community under the TSC Act.

The final determination for this community under the TSC Act encompasses four main features defining whether a patch is consistent with the community determination:

- Whether the site occurs on cracking clay soils (referred to as Black Soils) of the Liverpool Plains Catchment.
- Whether the floristic structure is that of grassland (can have sparse occurrences of trees and shrubs).
- Whether the community is generally dominated by one or more of the grasses including *Austrostipa aristiglumis*, *Dichanthium sericeum* or *Panicum queenslandicum*.
- Whether any of the listed characteristic species occur (including as part of the seedbank in the soil).

The process for identifying the presence of the Natural vegetation on Cracking Clay Soils of the Liverpool Plains community needs to consider the diagnostic features outlined in the Final Determination of this community and is summarised in Table 4.4

The Plains Grassland vegetation community identified in the recent Boggabri Coal Mine – Biodiversity Offsets Audit (Niche Environment and Heritage 2015) is not considered to be consistent with the final determination listing under the EPBC Act as the community did not meet the diagnostic characteristics outlined in Table 4.4.

**Table 4.4 Summary table of TSC Act condition criteria for determination of native vegetation on cracking clay soils of the Liverpool Plains**

TSC diagnostic characteristics	General comment for the modification study area
Distribution mainly occurs on cracking clay soils (vertosols – including soils referred to as Black Earth) and is within the Liverpool Plains Catchment. The Mooki River, Cocks Creek and their tributaries drain this catchment into the Namoi River. This catchment occurs in the Brigalow Belt south and Nandewar Bioregions.	Although the modification study area does occur within the Liverpool Plains catchment in the Brigalow Belt South Bioregion it is not associated with black cracking fine textured clays soils derived from alluvium and basalt. Soil mapping of the area identifies the soil type as Namoi River Meander Plains which is composed of recently deposited Quaternary alluvial soil which has not been derived from Tertiary Basalt. (Duggin & Allison 1984). In additional mapping of the EPBC-listed “Natural Grasslands on the basalt and fine textured alluvial plains of northern New South Wales and southern Queensland” in the Namoi Catchment (Eco Logical Australia 2010) has not identified the community as being present within the modification study area.
Floristic structure that of grassland, only sparse occurrences of trees or shrubs.	The area of Plains Grassland vegetation is located on a very flat landform with <5% slope.
Tree canopy usually absent to sparse, comprising less than 10% Projective crown cover.	Tree canopy cover is estimated at <5% Projective crown cover. Therefore identified as grassland.
The ground layer is typically dominated by one or more of the perennial native grasses <i>Austrostipa aristiglumis</i> , <i>Panicum queenslandicum</i> or <i>Dichanthium sericeum</i> .	It is assumed based on the Boggabri Coal Mine – Biodiversity Offsets Audit (Niche Environment and Heritage 2015) that the floristic diversity is dominated by the perennial native grasses outlined in the determination.
Whether any of the listed characteristic species occur (including as part of the seedbank in the soil).	It is assumed based on the Boggabri Coal Mine – Biodiversity Offsets Audit (Niche Environment and Heritage 2015) that the floristic diversity and therefore the soil seed bank would contain the listed characteristic species outlined in the determination.
<b>Does patch meet the criteria for classification of the vegetation as the listed community?</b>	<b>No</b>

#### 4.1.2.3 Aquatic ecological community in the natural drainage system of the lowland catchment of the Darling River

Aquatic ecological community in the natural drainage system of the lowland catchment of the Darling River is listed as endangered under the FM Act.

The final determination for this community lists the following features defining this community:

- The Darling River endangered ecological community includes all native fish and aquatic invertebrates within all natural creeks, rivers, streams and associated lagoons, billabongs, lakes, flow diversions to anabranches, the anabranches, and the floodplains of the Darling River within the State of New South Wales, and including Menindee Lakes and the Barwon River. This area includes:
- The main channels and tributaries of the lower Darling and Barwon-Darling Rivers from Mungindi (28°59'S; 149°30'E) on the Queensland border to the convergence with the Murray River at Wentworth (34°07'S; 141°55'E), and including the Menindee Lakes.
- The arid-zone intermittent rivers including the Warrego (29°00'S; 145°42'E), Culgoa (29°00'S; 147°22'E) and Narran Rivers (29°00'S; 148°05'E) and their tributaries south of the Queensland border.
- The border rivers including the MacIntyre River below Graman Weir (29°25'S; 150°58.8'E), Severn River downstream of Pindari Dam (29°23'S; 151°14'E) and the Dumaresq River below the junction with the Mole River (28°59.7'S; 151°31'E).



- The north-western slope rivers including the following: the Gwydir River from Copeton Dam (29°55'S; 150°55'E) downstream; the Namoi River from the junction of the Manilla River at Manilla (including Mehi River channel west of Moree) (30°46'S; 150°44'E) downstream; the Manilla River from Split Rock Dam (30°35'S; 150°42'E) downstream; the Peel River from Chaffey Dam (31°31'S; 151°08'E) downstream; the Macquarie River from Burrendong Dam (32°40'S; 149°10'E) downstream; the Cudgegong River from Windamere Dam (32°44'S; 149°46'E) downstream; the Castlereagh River from below Binnaway (31°30'S; 149°20'E) downstream; and the Bogan River from below Peak Hill (32°50'S; 148°00'E) downstream.

As the proposed modification study area occurs on the floodplains of the Namoi River and the community of River Red Gum Woodlands and Forests is riparian vegetation along this river, it is consistent with this EEC.

## 4.2 Endangered populations

Results of the desktop assessment indicated that three endangered populations listed under the EPBC Act and FM Act have been previously recorded, or have the potential to occur within the locality (10 km buffer) of the proposal. None of these endangered populations are considered likely to occur within the proposed modification study area. These included:

- *Tandanus tandanus* – Eel tailed catfish in the Murray/Darling Basin - This species was not recorded within the modification study area, no suitable habitat was recorded during the recent field survey and the modification study area is not within the Murray/Darling Basin, therefore it is considered unlikely that the species or population would occur within the modification study area.
- Australian brush-turkey population, Nandewar and Brigalow Belt South bioregions – This species was **not** recorded within the modification study area and no suitable habitat was recorded during the recent field survey, therefore it is considered unlikely that the species or population would occur within the modification study area.
- White-fronted Chat population in the Sydney Metropolitan Catchment Management Area – This species was **not** recorded within the modification study area, no suitable habitat was recorded during the recent field survey and the modification study area is not within the Sydney Metropolitan Bioregion, therefore it is considered unlikely that the species or population would occur within the modification study area.

## 4.3 Threatened plants

Results of the desktop assessment indicated that 21 species of plant listed under the TSC Act and/or EPBC Act have been previously recorded, or could potentially occur within the locality (10 km buffer) of the proposed modification study area. Of these 21 species, the modification study area contained potential habitat for four (4) threatened flora species (refer to Table 4.5). No threatened plant species were recorded within the modification study area during current surveys.

**Table 4.5 Threatened species of plant**

Species name	Common name	TSC Act <sup>1</sup>	EPBC Act <sup>2</sup>	Recorded?
<i>Digitaria porrecta</i>	Finger Panic Grass	E	-	<b>No</b>
<i>Diuris tricolor</i>	Pine Donkey Orchid	V	-	<b>No</b>
<i>Prasophyllum</i> sp. Wybong (C. Phelps ORG 5269)	A leek orchid	-	CE	<b>No</b>
<i>Tylophora linearis</i>	-	V	E	<b>No</b>

(1) TSC Act – *Threatened Species Conservation act 1995*, V=Vulnerable, E= Endangered

(2) EPBC Act – *Environment Protection and Biodiversity Conservation Act*1999, E= Endangered, CE = Critically Endangered

*Diuris tricolor* is a cryptic orchid and field surveys were undertaken outside the flowering period (spring) of this species. Therefore a significance assessment was undertaken for this species in Appendix E as a precautionary measure due to the presence of potential habitat within the proposed modification study area.

The remaining 16 threatened flora species known or predicted to occur are considered to have a low likelihood of occurrence based on the availability of habitat in the modification study area (i.e. cleared land and remnant vegetation with a shrub and ground layer completely dominated by exotic species). Full details of the species requirements and reasons for not further considering impacts of the proposal for these threatened plants are provided in Appendix C.

## 4.4 Threatened fauna

Results of the desktop assessment indicated that 71 fauna species listed under the TSC Act, EPBC Act and/or FM Act have been previously recorded, or could potentially occur within the locality (10 km buffer) of the proposed modification study area. Of these 71 species, the modification study area contained potential habitat for 28 threatened fauna species (refer to Table 4.6).

One threatened bird species (Grey-crowned Babbler) was identified immediately adjacent to the modification study area during the field survey (refer Figure 4.1). The species was recorded within White Box – White Cypress Pine grassy woodland adjacent the site however may use the modification study area as foraging habitat.

The remaining 43 threatened fauna species known or predicted to occur are considered to have low likelihood of occurrence based on the availability of habitat within the modification study area. Full details of the species requirements and reasons for not further considering impacts of the proposed modification for these threatened fauna species are provided in Appendix D.

**Table 4.6 Threatened species of animal with suitable habitat in the modification study area**

Scientific name	Common name	TSC Act <sup>1</sup>	EPBC Act <sup>2</sup>
<b>Birds of prey</b>			
<i>Circus assimilis</i>	Spotted Harrier	V	–
<i>Hieraaetus morphnoides</i>	Little Eagle	V	–
<i>Falco subniger</i>	Black Flacon	V	–
<i>Lophoictinia isura</i>	Square-tailed Kite	V	–
<b>Hollow dependent microchiropteran bats</b>			
<i>Nyctophilus corbeni</i>	Greater Long-eared Bat – south eastern form	V	V
<i>Chalinolobus dwyeri</i>	Large-eared Pied-bat	V	V
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	V	–
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheathtail Bat	V	–
<i>Chalinolobus picatus</i>	Little Pied Bat	V	–
<i>Vespadelus troughtoni</i>	Eastern Cave Bat	V	–

Woodland birds			
<i>Climacteris picumnus</i>	Brown Treecreeper	V	–
<i>Melanodryas cucullata</i>	Hooded Robin	V	–
<i>Melithreptus gularis</i>	Black-chinned Honeyeater	V	–
<i>Grantiella picta</i>	Painted Honeyeater	V	–
<i>Pomatostomus temporalis temporalis</i>	Grey-crowned Babbler	V	–
<i>Pyrrholaemus sagittatus</i>	Speckled Warbler	V	–
<i>Stagonopleura guttata</i>	Diamond Firetail	V	–
<i>Daphoenositta chrysoptera</i>	Varied Sittella	V	–
Birds – opportunistic blossom nomads			
<i>Glossopsitta pusilla</i>	Little Lorikeet	V	–
<i>Neophema pulchella</i>	Turquoise Parrot	V	–
<i>Lathamus discolor</i>	Swift Parrot	E	E
<i>Polytelis swainsonii</i>	Superb Parrot	V	V
<i>Tyto novaehollandiae</i>	Masked Owl	V	–
<i>Ninox connivens</i>	Barking Owl	V	–
<i>Xanthomyza phrygia</i>	Regent Honeyeater	CE	E, M
Arboreal Mammals			
<i>Phascolarctos cinereus</i>	Koala	V	V
<i>Petaurus norfolcensis</i>	Squirrel glider	V	–
Reptiles			
<i>Hoplocephalus bitorquatus</i>	Pale-headed Snake	V	–

(1) TSC Act – *Threatened Species Conservation act 1995*, V=Vulnerable, E= Endangered, CE= Critically Endangered.

(2) EPBC Act – *Environment Protection and Biodiversity Conservation Act1999*, E= Endangered; M= Migratory

## 4.5 Migratory species

Migratory species are protected under international agreements to which Australia are a signatory, including the Japan Australia Migratory Bird Agreement (JAMBA), the China Australia Migratory Bird Agreement (CAMBA), the Republic of Korea Australia Migratory Bird Agreement (RoKAMBA) and the Bonn Convention on the Conservation of Migratory Species of Wild Animals. Migratory species are considered to comprise ‘Matters of National Environmental Significance’ and are protected under the EPBC Act.

Based on the findings of the desktop assessment, 13 Migratory species have been recorded or have the potential to occur in the Proposal locality. No Migratory species were recorded during field surveys. However, potential habitat was observed for the Eastern Great Egret, Cattle Egret, Regent Honeyeater and Rainbow Bee-eater.

While terrestrial Migratory species of bird may potentially use the area, the site would not be classed as 'important habitat' as defined *Matters of National Environmental Significance, Significant Impact Guidelines 1.1 EPBC Act* (Department of Environment 2013) as the site does not contain:

- habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species
- habitat utilised by a migratory species which is at the limit of the species range
- habitat within an area where the species is declining.

As such, it is unlikely that the proposed activity would significantly affect Migratory species and this group is not considered further.

## 4.6 State environmental planning policy 44 – Koala habitat protection

The proposed modification study area is located in the Narrabri Shire Local Government Area, which is listed as an area under which SEPP 44 applies, and is further positioned in the Western Slopes and Plains Koala Management Area (Department of Environment and Climate Change 2008b). The proposed modification study area contained three koala feed trees, as listed under Schedule 2 of SEPP 44 (NSW Government 2000) and the Western Slopes and Plains Koala Management Area 6 (Department of Environment and Climate Change 2008b). The suite of koala feed trees available is the most important factor influencing koala habitat and occurrence (NSW National Parks and Wildlife Service 2002). Primary feed trees are those tree species that exhibit a level of use that is significantly higher than that of other *Eucalyptus* species, independent of tree density, and make up the bulk of a koala's diet (NSW National Parks and Wildlife Service 2002). Secondary or supplementary feed trees are species that provide a seasonal or supplementary dietary resource (NSW National Parks and Wildlife Service 2002).

One primary feed tree *Eucalyptus camaldulensis* and two secondary feed trees, *Eucalyptus populnea* subsp. *bimbil* and the occasional *E. albens*, were recorded therein (Table 4.7) The koala feed trees occurred as scattered trees throughout the proposed modification study area in the Pilliga Box – Poplar Box White Cypress Pine grassy open forest, River Red Gum riparian woodland and forests as well as occasional isolated trees in the exotic grasslands.

Impacts of the proposed modification on koala have also been assessed under the TSC Act and EPBC Act threatened species significance assessment, refer to Section 5.10. The significance assessment determined that the proposed modification would not significantly impact on the koala (refer Table 8.1).

**Table 4.7 Koala feed tree species recorded in the proposed modification study area**

Scientific name	PB verified vegetation community <sup>1</sup>	>15% of the total number of trees	SEPP 44 <sup>2</sup>	Approved koala recovery plan <sup>3</sup>
<i>Eucalyptus camaldulensis</i>	Yes. River Red Gum riparian woodlands and forests	Yes	Yes	Yes (P)
<i>Eucalyptus populnea</i> subsp. <i>bimbil</i>	Yes. Occurred in Pilliga Box – Poplar Box – White Cypress Pine grassy Woodland as well as scattered in exotic grassland.	Yes	Yes	Yes (S)
<i>Eucalyptus albens</i>	Yes. As occasional isolated tree within exotic grassland community or adjacent study area.	No	Yes	Yes (S)

- (1) Vegetation type based on surveys in the proposed modification study area.
- (2) SEPP 44 – State Environmental Planning Policy No. 44 – Koala Habitat Protection.
- (3) Approved Koala Recovery Plan (Department of Environment and Climate Change 2008b). P – Primary, S – Secondary food tree species

Areas of habitat within the proposed modification study area are considered ‘core habitat’ due to:

- koala observations within the locality, and specifically along the Kamilaroi Highway
- feed tree species occurring at a density greater than 15% of the total number of trees in a vegetation community (Poplar Box Woodland).

Furthermore, the habitat within the proposed modification study area represents remnant trees within an otherwise largely cleared landscape. This habitat is potentially a corridor allowing koalas to move throughout the landscape.

## 4.7 Commonwealth Koala habitat assessment

Database searches conducted for the proposal (refer to Section 2.4) did not locate any records of koala for the study area and koalas were not recorded during the ecological surveys. The most recent koala record within 3 km to the south of the proposed modification was within riparian vegetation along the Namoi River in 2014 (Office of Environment and Heritage 2015). The Department of Environment koala habitat assessment tool (Department of Environment 2014) was used to determine the quality of koala habitat in the proposal area and if it contained habitat critical to the survival of the koala (refer Figure 4.1).

Attribute	Score	Inland	Coastal
Koala occurrence	+2 (high)	Evidence of one or more koalas within the last 5 years.	Evidence of one or more koalas within the last 2 years.
	+1 (medium)	Evidence of one or more koalas within 2 km of the edge of the impact area within the last 10 years.	Evidence of one or more koalas within 2 km of the edge of the impact area within the last 5 years.
	0 (low)	None of the above.	None of the above.
Vegetation composition	+2 (high)	Has forest, woodland or shrubland with emerging trees with 2 or more known koala food tree species. <b>OR</b> 1 food tree species that alone accounts for >50% of the vegetation in the relevant strata.	Has forest or woodland with 2 or more known koala food tree species. <b>OR</b> 1 food tree species that alone accounts for >50% of the vegetation in the relevant strata.
	+1 (medium)	Has forest, woodland or shrubland with emerging trees with only 1 species of known koala food tree present.	Has forest or woodland with only 1 species of known koala food tree present.
	0 (low)	None of the above.	None of the above.
Habitat connectivity	+2 (high)	Area is part of a contiguous landscape ≥ 1000 ha.	Area is part of a contiguous landscape ≥ 500 ha.
	+1 (medium)	Area is part of a <b>contiguous landscape</b> < 1000 ha, but ≥ 500 ha.	Area is part of a contiguous landscape < 500 ha, but ≥ 300 ha.
	0 (low)	None of the above.	None of the above.
Key existing threats	+2 (high)	Little or no evidence of koala mortality from vehicle strike or dog attack at present in areas that score 1 or 2 for koala occurrence. Areas which score 0 for koala occurrence and have no dog or vehicle threat present	
	+1 (medium)	Evidence of infrequent or irregular koala mortality from vehicle strike or dog attack at present in areas that score 1 or 2 for koala occurrence, <b>OR</b> Areas which score 0 for koala occurrence and are likely to have some degree dog or vehicle threat present.	
	0 (low)	Evidence of frequent or regular koala mortality from vehicle strike or dog attack in the study area at present, <b>OR</b> Areas which score 0 for koala occurrence and have a significant dog or vehicle threat present.	
Recovery value	+2 (high)	Habitat is likely to be important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1.	
	+1 (medium)	Uncertain whether the habitat is important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1.	
	0 (low)	Habitat is unlikely to be important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1.	

**Figure 4.1 Koala habitat assessment tool**

A score of 4 out of 10 was determined for the koala habitat in the study area based on the koala habitat assessment tool (refer Figure 4.1 and Table 4.8). Impact areas that score four or less using the habitat assessment tool for the koala do not contain habitat critical to the survival of the koala. Based on this value, the study area does not contain habitat critical to the survival of the koala.

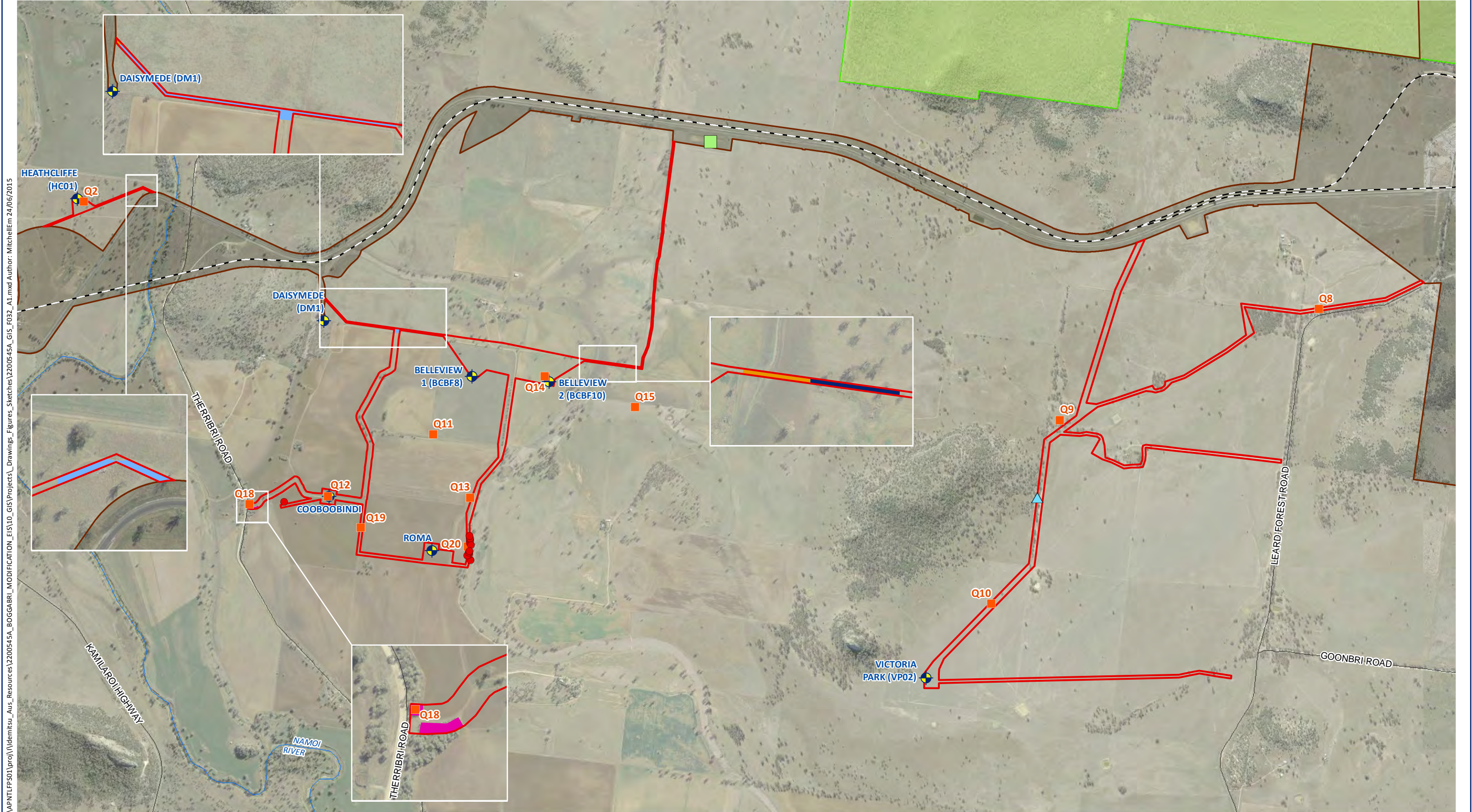
**Table 4.8 Completed Koala habitat assessment tool for the study area**

Attribute	Score	Habitat Appraisal	
Koala Occurrence	2	Desktop	<ul style="list-style-type: none"> <li>Database searches conducted for the proposal did locate two recent records (within 5 years) of koala within 5 km of the study area (Office of Environment and Heritage 2015).</li> </ul>
		On-site	<ul style="list-style-type: none"> <li>No koalas or traces of koalas were recorded during the ecological surveys</li> </ul>
Vegetation structure and composition	2	Desktop	<ul style="list-style-type: none"> <li>LGA vegetation mapping and database searches indicate that numerous Koala feed trees are present and likely to be present in the study area.</li> </ul>
		On-site	<ul style="list-style-type: none"> <li>Habitat ground-truthing was carried out during field surveys identified three feed tree species listed under SEPP 44 Schedule 2 and the National Koala Recovery Plan: <i>Eucalyptus camaldulensis</i>, <i>Eucalyptus populnea subsp. bimbil</i> and <i>Eucalyptus pilligaensis</i>.</li> </ul>
Habitat connectivity	0	<ul style="list-style-type: none"> <li>The habitat that will be impacted by the proposal is located within a highly fragmented landscape which has been heavily disturbed by agriculture and vegetation clearing within the broader locality. The vegetation on site exists predominantly as isolated trees within the highly fragmented landscape.</li> <li>Large contiguous habitat is located north and north east of the modification study area.</li> </ul>	
Key existing threats	0	Desktop	<ul style="list-style-type: none"> <li>Desktop assessment did not show any koala road kill or koala death records within 2km of the study area.</li> </ul>
		On-site	<ul style="list-style-type: none"> <li>The status of dog populations and level of predation is not known within the study area. The study area exists as fragmented agricultural land and no traces of dogs were recorded during field surveys.</li> </ul>
Recovery value	0	<ul style="list-style-type: none"> <li>Due to the size and fragmented nature of the landscape, vegetation composition and level of threats present the habitat is considered unlikely to be an important for the recovery of the koala.</li> <li>The larger habitat areas that currently occur to the north and north-east of the study area will remain and provide a corridor to remnant bushland. (Leard State Forest).</li> </ul>	
Decision	4	Habitat not critical to the survival of the koala – assessment of significance not required.	

## 4.8 Critical habitat

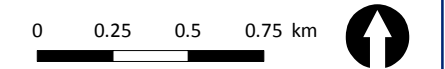
Critical habitat is listed under both the TSC Act and the EPBC Act. Critical habitat is the whole or any part or parts of an area or areas of land comprising habitat critical to the survival of an endangered species, population or community.

No listed critical habitat was found in the proposed modification. The area to be impacted by the proposed modification is not considered likely to constitute critical habitat listed under either the TSC Act or the EPBC Act, or be critical to the survival of an endangered species, population or community.



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- Hollow-bearing tree
- Quadrat
- ⊕ Groundwater bores
- Tank farm
- Road
- Drainage
- Proposed rail
- MOD 5 study area
- Boggabri Project Approval Area
- Leard State Forest
- Natural grasslands on basalt and fine-textured alluvial plains on northern New South Wales and southern Queensland (TSC Act & EPBC Act)
- Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Darling River (Low Condition) (FM Act)
- Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Darling River (Moderate Condition) (FM Act)
- Weeping Myall Woodland (TSC Act & EPBC Act)
- ▲ Grey-crowned Babbler



**Figure 4.2**  
Threatened biodiversity within the proposed Modification study area



# 5. Potential impacts

The potential impacts on biodiversity due to construction and operation of the proposed modification are summarised in Table 5.1 and described in detail below.

The potential impacts from the proposed modification are likely to be minor as a small area of disturbance for minor works are required and native understorey vegetation will be impacted upon by the proposed modification. Furthermore, the modification study area is composed of largely cleared agricultural lands with little native vegetation recorded.

Mitigation measures to ameliorate these impacts are discussed in Section 6 and assessments of significance for threatened biodiversity that occur or have potential habitat within the proposed modification study area (discussed in Sections 2.6, 4 and 8) are provided in Appendix E and summarised in Section 5.10.

**Table 5.1 Potential impacts associated with the proposed modification**

Potential impact	Potential phase of impact	
	Construction	Operation
Loss of vegetation	•	
Loss of vegetation within a secured offset area	•	
Direct loss of animals and plants	•	
Weed invasion and dispersal	•	•
Erosion and sedimentation	•	•

## 5.1 Loss of vegetation

Clearing of native vegetation is listed as a Key Threatening Process under both the NSW TSC Act and the Commonwealth EPBC Act.

The area of native vegetation to be impacted (18.8 ha) will not require removal of any trees and will be limited to ground and shrub layers disturbance. In addition to this the impacts associated with the above ground water pipeline (18.6 ha) does not require ground disturbance for installation, rather these impacts will be restricted to relatively minor disturbances to the understory vegetation associated with the placement of the pipeline on the ground.

The construction phase of the proposed modification will require impacts to 18.6 ha of native vegetation and of which approximately 1.4 ha of vegetation listed under the FM Act, TSC Act and EPBC Act as a threatened ecological community (refer to Table 5.2). Approximately 0.2 ha of these impacts will be ground disturbance due to the installation of the powerlines and below ground water pipeline. Approximately 18.6 ha will be limited to impacts associated with the above ground water pipeline.

An area of 8.6 ha of predominately disturbed and exotic vegetation will be impacted within the biodiversity offsets as described in the Boggabri Coal Mine Biodiversity Offsets Strategy. Measures to minimise impacts to threatened biodiversity affected by the loss of vegetation and associated habitat are described in Section 6.

**Table 5.2 Potential loss of native vegetation within the modification study area**

Vegetation community	TSC Act <sup>1</sup>	EPBC Act <sup>2</sup>	FM Act <sup>3</sup>	Total modification study area (ha) <sup>4</sup>		Area within offsets (ha) <sup>7</sup>	
				Ground Disturbance (ha) <sup>5</sup>	Above Ground Water pipeline (ha) <sup>6</sup>	Ground Disturbance (ha) <sup>5</sup>	Above Ground Water pipeline (ha) <sup>6</sup>
Exotic grassland with scattered trees	-	-	-	3.8	46.6	-	1.0
Derived native grassland <sup>8</sup>	-	-	-	-	11.2	-	2.9
Plains Grassland	-	-	-	-	0.1	-	0.1
Pilliga Box – Poplar Box White Cypress Pine grassy open forest	-	-	-	0.2	5.9	-	3.4
Weeping Myall Woodland <sup>9</sup>	E	E	-	-	0.1	-	-
River Red Gum riparian woodlands and forests	-	-	E	-	1.3	-	1.3
<b>Total clearing for modification</b>				<b>4.0</b>	<b>65.2</b>	<b>-</b>	<b>8.6</b>
<b>Total Native Vegetation clearing for modification</b>				<b>0.2</b>	<b>18.6</b>	<b>-</b>	<b>7.7</b>
<b>Total FM Act EEC clearing for modification</b>				<b>-</b>	<b>1.3</b>	<b>-</b>	<b>1.3</b>
<b>Total TSC Act EEC clearing for modification</b>				<b>-</b>	<b>0.1</b>	<b>-</b>	<b>-</b>
<b>Total EPBC Act EEC clearing for modification</b>				<b>-</b>	<b>0.1</b>	<b>-</b>	<b>-</b>

(1) TSC Act, E = Endangered.

(2) EPBC Act, E = Endangered, CE = Critically Endangered.

(3) FM Act, E = Endangered.

(4) For the purpose of this report, Total modification study area (ha) = all sites assessed within this report that have not previously been assessed.

(5) Disturbance from underground pipeline and installation of power lines and associated infrastructure

(6) Area includes where the pipeline will be placed above ground and no ground disturbance will take place.

(7) For the purpose of this report, Area within offsets = Area (ha) within Namoi River Offsets associated with the proposed modification.

(8) This community generally occurred as native grassland derived from the Pilliga Box – Poplar Box White Cyperus Pine grassy open forest.

(9) This community meets both the EPBC Act criteria and the TSC Act criteria for Weeping Myall Woodlands.

Vegetation clearing associated with the modification would be limited to the disturbance and clearing of groundcover vegetation only. Disturbance and clearing of hollow bearing trees and/or canopy is not required as part of the modification. The native groundcover vegetation to be disturbed and/or removed currently occurs within highly disturbed agricultural land surrounded by exotic vegetation.

The proposed modification will have a minimal impact on fauna habitats that will involve the disturbance and/or removal of groundcover vegetation only. The impact assessments confirm that the disturbance and/or removal of 18.6 ha of native understorey vegetation, which is predominantly comprised of derived native grassland, is unlikely to have a significant impact upon any threatened species, populations or communities.

## 5.2 Modification areas within offsets

The proposed modification impacts includes 7.7 ha of native understorey vegetation within previously identified offsets, as described in the Continuation of Boggabri Coal Mine - Biodiversity Offset Strategy and as such these areas, will require an alternative replacement. The extent of the proposed adjustments to the offsets is presented in Table 5.3.

**Table 5.3 Vegetation impacts within existing offsets**

Vegetation community	TSC Act listing <sup>1</sup>	EPBC Act listing <sup>2</sup>	FM Act listing <sup>3</sup>	Area within offsets (ha) <sup>4</sup>
Exotic grassland with scattered trees	–	–	–	1.0
Plains Grassland	C	CE	-	0.1
Derived Native Grassland <sup>5</sup>	–	–	–	2.9
Pilliga Box – Poplar Box White Cypress Pine grassy open forest	–	–	–	3.4
Weeping Myall Woodland <sup>1,2</sup>	E	E	–	–
River Red Gum riparian woodlands and forests <sup>3</sup>	–	–	E	1.3
<b>Total area of modification within offsets</b>				<b>8.7</b>
<b>Total Native Vegetation within offsets</b>				<b>7.7</b>
<b>Total area of FM Act CEEC within modification offsets</b>				<b>1.3</b>
<b>Total area of TSC Act CEEC within modification offsets</b>				<b>-</b>
<b>Total area of EPBC Act CEEC within modification offsets</b>				<b>-</b>

(1) TSC Act, E = Endangered.

(2) EPBC Act, E = Endangered, CE = Endangered.

(3) FM Act, E = Endangered.

(4) For the purpose of this report, Area within offsets = Total modification study area (ha) within Namoi River Offsets associated with the proposed modification.

(5) Represents Pilliga Box – Poplar box White Cypress Pine grassy open forest derived native grassland.

## 5.3 Direct loss of animals and plants

Fauna injury or death could occur, but is unlikely, as a result of the proposed modification. Specifically, the excavation and earthworks, during the construction phase of the modification, would involve ground disturbance and the removal of understorey vegetation.

While some mobile species, such as birds, have the potential to move away from the path of clearing, other species that are less mobile may have difficulty moving. Species of animal that may be affected by the removal of understorey vegetation include small terrestrial mammals, reptiles and frogs. Vehicle strike during construction, operation and maintenance works is considered unlikely to significantly increase as a result of the proposed modification.

## 5.4 Weed invasion and dispersal

The modification study area currently occurs within agricultural land which is already subjected to high levels of weed invasion. As weeds have already established within the proposed modification study area it is unlikely that the proposed modification will significantly increase the invasion of introduced weeds.

The invasion of exotic perennial grasses, such as *Chloris gayana*\*, *Avena fatua*\*, *Pennisetum clandestinum*\* and *Lolium perenne*\* which was recorded abundantly within the modification study area, is recognised as a Key Threatening Process under the TSC Act. The proposed modification has some potential to result in further spread of these species. The most likely causes of weed dispersal associated with the proposed modification would include earthworks, movement of soil and attachment of seed (and other propagules) to vehicles and machinery. Dispersal of weeds during the operation phase would relate generally to maintenance activities.

Given the high level of weed invasion, and the presence of five noxious weeds, construction and to a lesser extent, operation phase, has the potential to spread weeds from the proposed modification study area to other sites. Therefore mitigation measures relating to weed control have been outlined in Section 6 of this report.

## 5.5 Erosion and sedimentation

Excavation and earthworks undertaken during the construction phase would expose soils with the potential to enter surrounding areas of vegetation. Erosion during the operation stage relates to maintenance activities and is likely to be minor. Section 6 of this report provides a number of mitigation measures, and if properly adhered to, the impacts associated with the proposed modification are not considered significant.

## 5.6 Key threatening processes

Key Threatening Processes (KTPs) are listed under Schedule 3 of the NSW TSC Act, FM Act, Commonwealth EPBC Act. A process is defined as a KTP if it threatens or may threaten the survival, abundance, or evolutionary development of a native species or ecological community. A process can be listed as a KTP if it could cause a native species or ecological community to become eligible for adding to a threatened list (other than conservation dependant), or cause an already listed threatened species or community to become more endangered, or if it adversely affects two or more listed threatened species or ecological communities.

The proposed modification has the potential to contribute to the following threatening processes:

- TSC Act Key Threatening Processes:
  - ▶ clearing of native vegetation (refer Section 5.1)
  - ▶ invasion of native plant communities by exotic perennial grasses (refer to Section 5.4).
  - ▶ loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants (refer to Section 5.4)
- EPBC Act Key Threatening Processes:
  - ▶ land clearance (refer to Section 5.1)
  - ▶ loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants (refer to Section 5.4).

The proposed modification will result in the loss of native understorey vegetation (removal of any canopy vegetation or hollow bearing trees is not required) and thus contribute to one key threatening processes, clearing of native vegetation and land clearance. The proposed modification is not likely to significantly

increase the introduction or spread of exotic weed species, if undertaken in accordance with mitigation measures provided in Section 6. The proposed modification is unlikely to significantly impact upon the degradation of native riparian vegetation as the vegetation to be removed is in low to moderate condition and does not require removal of any native trees in riparian environments.

## 6. Mitigation measures

This section identifies appropriate management and mitigation measures that build upon the strategies currently employed as part of the Boggabri Coal Biodiversity Management Plan. The relevant management and mitigation measures previously identified in Section 6 of the Continuation of Boggabri Coal Mine – Biodiversity Impact Assessment should also be followed for works associated with the proposed modification.

The general principle to minimise impacts to biodiversity should, in order of consideration, endeavour to:

- avoid impacts on habitat, through the planning process
- minimise impacts on habitat, through the planning process
- mitigate impacts on habitat, though the use of a range of mitigation measures including securing offset areas.

### 6.1 Detailed mitigation measures

Detailed measures to mitigate ecological impacts that are adopted at the Boggabri Coal Mine are shown in Table 6.1. The mitigation measures are presented for both the construction and operational phases of the proposed modification.

**Table 6.1 Detailed mitigation measures**

Impact	Mitigation
<b>Pre-construction</b>	
Targeted <i>Tylophora linearis</i> surveys	<ul style="list-style-type: none"> <li>■ pre-clearing surveys to be undertaken along with other ecological pre-clearance surveys during the May – November flowering period for <i>Tylophora linearis</i> before any understorey vegetation clearing is to begin.</li> </ul>
<b>Construction</b>	
Vegetation and habitat loss	<ul style="list-style-type: none"> <li>■ limit disturbance of understorey vegetation to the minimum necessary for each stage of the clearing</li> <li>■ restrict equipment and stockpiling of resources to designated areas in cleared land to minimise the overall impact of the construction</li> <li>■ progressively revegetate disturbed areas</li> </ul>
Weeds	<ul style="list-style-type: none"> <li>■ a weed management plan should be developed to manage weeds during the construction phase</li> <li>■ undertake ongoing management and monitoring of weed invasion through the weed management plan</li> </ul>
Success of mitigation	<ul style="list-style-type: none"> <li>■ undertake monitoring in line with current monitoring programs</li> </ul>
Cumulative loss of habitat	<ul style="list-style-type: none"> <li>■ offset any residual biodiversity impacts</li> </ul>
<b>Operation</b>	
Weeds	<ul style="list-style-type: none"> <li>■ undertake ongoing management and monitoring of weed invasion within the Project Boundary during the life of the Projects operation</li> </ul>

Impact	Mitigation
Vehicle strike or direct mortality	■ Notify injured wildlife service if injured fauna is identified during construction.

# 7. Biodiversity offsets

## 7.1 Background

While the majority of impacts associated with the proposed modification can be mitigated, the loss of understorey native vegetation will be adequately ameliorated under the Biodiversity Offset Strategy. Impacts associated with the proposed modification, will be considered in the revision of the Biodiversity Offset Strategy.

Boggabri Coal is committed to providing offsets for the modification in accordance with the quantum (ratio) and principles of the existing BOS.

## 7.2 Changes to existing offset areas in BOS

The proposed modification includes areas within previously identified offsets, as described in the Continuation of Boggabri Coal Mine - Biodiversity Offset Strategy and are associated with the production of bores to accommodate water requirements for the Project. The extent of the modification's impact on the Namoi River Offset Area is presented in Table 7.1.

The BOS will be amended to ensure the lands previously identified within the Namoi River Offset Area and subsequently excised for the proposed Project Boundary adjustments of the modification will be replaced by an alternative offset. The quantum of this transfer will comprise up to 7.7 ha of understorey native vegetation and threatened species habitat.

## 7.3 Proposed modification biodiversity offsets

The relatively minor changes to the Namoi River Offset Area resulting from this modification and associated refined vegetation mapping will be incorporated into the final amended BOS and BMP.

Boggabri Coal considers the relatively minor impacts described in the modification EA to be adequately offset by the substantial BOS approved as part of PA 09\_0182. The minor modifications are considered part of the Boggabri Coal Project's detailed design and Project refinement and are to be expected for a Project of this scale and significance.

Boggabri Coal will provide an additional offset for the impacts of the modification. This offset will be consistent with the final ratio of 5.6:1 specified in the approved BOS, which has been developed in accordance with the *OEH Principles for Biodiversity Offsets* and consideration of the NSW Biodiversity Offsets Policy for Major Projects (2014).

A summary of the total offset requirements for the new impacts associated with the modification are provided below in Table 7.1.



**Table 7.1 Offset requirements for impacts associated within the modification**

Vegetation community	TSC Act listing <sup>1</sup>	EPBC Act listing <sup>2</sup>	FM Act <sup>3</sup>	Area not previously assessed (ha) <sup>4</sup>	Offsets requirement (ha) <sup>5</sup>
Derived native grassland <sup>6</sup>	-	-	-	11.2	62.7
Plains Grassland	E	CE	-	0.1	0.6
Pilliga Box – Poplar Box White Cypress Pine grassy open forest	-	-	-	6.1	34.2
Weeping Myall Woodland	E	E	-	0.1	0.6
River Red Gum riparian woodlands and forests	-	-	E	1.3	7.3
<b>Total Native Vegetation clearing for modification</b>				<b>18.8</b>	<b>105.4</b>
<b>Total FM Act EEC clearing for modification</b>				<b>1.3</b>	<b>7.3</b>
<b>Total TSC Act EEC clearing for modification</b>				<b>0.1</b>	<b>0.6</b>
<b>Total EPBC Act EEC clearing for modification</b>				<b>0.1</b>	<b>0.6</b>

(1) TSC Act, E = Endangered.

(2) EPBC Act, CE = Critically Endangered.

(3) FM Act, E = Endangered.

(4) For the purpose of this report, Area not previously assessed (ha) = all sites for which new impacts to biodiversity has not yet been assessed within the existing EA (PA 09\_0182) (impact assessments in Appendix E).

(5) For the purpose of this report, Offset requirements = Application of the final ratio of 5.6:1 specified in the approved BOS to all Area not previously assessed.

(6) The derived grassland generally occurred as native grassland derived from the Pilliga Box – Poplar Box White Cyperus Pine grassy open forest.

The proposed additional offset for the modification impacts will therefore incorporate a minimum of 105.4 ha of native understorey vegetation and threatened species habitat.

## 8. Significance assessments

Previous assessments of the Project area do not include the proposed modification study area assessed in this report. Therefore, additional significance assessments have been completed to consider cumulative impacts of works associated with the proposed modification. In addition, a small area of three threatened ecological communities (Weeping Myall Woodland, Plains Grassland and River Red Gum Riveriana woodlands and forest) and potential habitat for a further four threatened species of plant and 28 species of animal, including nine listed under the EPBC Act were identified therein.

The threatened ecological communities and threatened species listed in Table 8.1 have had assessments of significance completed for this report. These assessments consider cumulative impacts from the incremental addition of native understorey vegetation and habitat loss associated with the construction and operation of the proposed modification.

The findings of the significance assessments completed for this proposed modification are that while the additional impacts will add incrementally to the loss of native understorey vegetation and habitat loss for threatened biodiversity, it is unlikely to be a significant impact such that any of the assessment threatened biodiversity will be placed at risk of extinction. The significance assessments are included as Appendix E.

**Table 8.1 Significant impact assessments completed for the proposed modification**

Threatened biodiversity	Potential habitat in the proposed modification area	Recorded in the proposed modification area	Recorded in Approved Project Boundary	TSC Act <sup>1</sup>	EPBC Act <sup>2</sup>	Likely significant impact
<b>Ecological Communities</b>						
Weeping Myall	Yes	Yes	Yes	E	E	No
Plains Grassland	Yes	No	Yes	E	CE	No
River Red Gum Riparian Forest	Yes	Yes	Yes	E (FM Act)	-	No
<b>Plants</b>						
<i>Digitaria porrecta</i> <sup>3</sup>	Yes	No	No	E	-	No
<i>Diuris tricolor</i> <sup>4</sup>	Yes	No	No	V	-	No
<i>Prasophyllum</i> sp. Wybong (C. Phelps ORG 5269)	Yes	No	No	-	CE	No
<i>Tylophora linearis</i> <sup>5</sup>	Yes	No	Yes	V	E	No
<b>Birds of Prey</b>						
Spotted Harrier	Yes	No	Yes	V	-	No
Little Eagle	Yes	No	Yes	V	-	No
Black Falcon	Yes	Yes – previous observation.	No	V	-	No
Square-tailed Kite	Yes	No	No	V	-	No
<b>Bats</b>						
Greater Long-eared Bat – south eastern form	Yes	No	Yes	V	V	No
Large-eared Pied Bat	Yes	No	Potentially	V	V	No
Yellow-bellied Sheath-tail -Bat	Yes	No	Yes	V	-	No
Eastern False Pipistrelle	Yes	No	Yes	V	-	No
Little Pied Bat	Yes	No	Yes	V	-	No
Eastern Cave Bat	Yes	No	Yes	V	-	No
<b>Woodland Birds</b>						
Brown Treecreeper	Yes	No	Yes	V	-	No
Grey-crowned Babbler	Yes	No	Yes	V	-	No
Hooded Robin	Yes	Yes	Yes	V	-	No
Speckled Warbler	Yes	No	Yes	V	-	No
Diamond Firetail	Yes	No	Yes	V	-	No
Painted Honeyeater	Yes	No	Yes	V	-	No

Threatened biodiversity	Potential habitat in the proposed modification area	Recorded in the proposed modification area	Recorded in Approved Project Boundary	TSC Act <sup>1</sup>	EPBC Act <sup>2</sup>	Likely significant impact
Black-chinned Honeyeater	Yes	No	No	V	-	No
Varied Sittella	Yes	No	Yes	V	-	No
<b>Threatened blossom nomads</b>						
Little Lorikeet	Yes	No	Yes	V	-	No
Turquoise Parrot	Yes	No	Yes	V	-	No
Swift Parrot	Yes	No	Yes	E	E	No
Masked Owl	Yes	No	Yes	V	-	No
Barking Owl	Yes	No	Yes	V	-	No
Superb Parrot	Yes	No	No	V	V	No
Regent Honeyeater	Yes	No	Yes	CE	E,M	No
<b>Mammals</b>						
Koala	Yes	No	Yes	V	V	No
Squirrel Glider	Yes	No	Yes	V	-	No
<b>Reptiles</b>						
Pale-headed Snake	Yes	No	Yes	V	-	No

Notes:

- (1) TSC Act V = vulnerable, E = endangered. CE = critically endangered,
- (2) EPBC Act, V = vulnerable, E = endangered, CE = critically endangered, M = migratory
- (3) *Digitaria porrecta* delisted from the EPBC Act on 14 December 2013.
- (4) *Diuris tricolor* delisted from the EPBC Act on 19 August 2011
- (5) *Tylophora linearis* was listed from Endangered to vulnerable under the TSC Act

## 8.1 Matters of national environmental significance

The likely broad potential impacts of the proposed modification on Matters of National Environmental Significance listed under the EPBC Act include:

- Impacts on 18.8 ha of known and/or potential habitat for Threatened and/or Migratory species listed under the *Environment Protection and Biodiversity Conservation Act 1999*. This impact is considered to be minor due to retention of all native trees within the modification study area and vegetation removal will be limited small area of native ground layer. Furthermore, the placement of the water pipeline aboveground where land is not flood prone further decreases the impact to threatened biodiversity.

The impacts associated with the proposed modification will be minor in terms of loss of vegetation and habitat for Matters of National Environmental Significance. This clearing will result in a total of 18.8 ha of native vegetation and habitat for Matters of National Environmental Significance being affected, and will be limited to understorey vegetation.

### 8.1.1 The significance of the impacts

Impacts on Threatened and/or Migratory species and communities listed under the *Environment Protection and Biodiversity Conservation Act 1999* are required to be assessed following the *Significant Impact Guidelines* (Department of Environment 2013). Significance Assessments for species listed under the *Environment Protection and Biodiversity Conservation Act 1999* that have a moderate or high likelihood of occurrence within the modification are presented in full in Appendix E.

The findings of the significance assessments completed for the this modification are that the additional impacts will add incrementally to the loss of native understorey vegetation and habitat loss for threatened biodiversity, however it is unlikely to be a significant impact such that any of the assessment threatened biodiversity will be placed at risk of extinction.

## 9. Conclusions

This report assessed the ecological impacts associated with a proposed modification to the Boggabri Coal Project Approval (09\_0182). Specifically the proposed modification includes construction and operation of production bores and associated electricity infrastructure, as outlined in Section 1.3 of this report.

The proposed modification includes impacts to areas outside of the existing Project Approval (09\_0182) and will result in new impacts to 18.8 ha of native understorey vegetation and habitat, of which 1.4 ha is listed as a threatened ecological community under the FM Act, TSC Act and EPBC Act.

The native understorey vegetation proposed to be removed as part of the proposed modification is considered potential habitat for four threatened plants and 28 threatened animals, including nine species listed under the EPBC Act and would add to the cumulative removal of native understorey vegetation for the expansion of Boggabri Coal Mine.

Significance assessments have been completed in accordance with TSC Act and EPBC guidelines for the threatened biodiversity with potential to occur within, or use the proposed modification study area. The significance assessments concluded that the removal of understorey vegetation and habitat loss associated with the proposed modification is unlikely to impact significantly upon threatened biodiversity within the modification study area.

Whilst the majority of impacts associated with the proposal are able to be ameliorated, amendment of the existing BOS will be required. The BOS will be amended to ensure the lands previously identified within the Namoi River Offset Area and subsequently removed as part of the proposed Project Boundary adjustments of the modification, will be replaced by an alternative offset. The quantum of this transfer will comprise up to 105.4 ha of native understorey vegetation and threatened species habitat. In addition, the proposed modification impacts not previously assessed will also be offset in accordance with the final ratio of 5.6:1 specified in the approved BOS and therefore incorporate a minimum of 105.4 ha of native understorey vegetation and threatened species habitat.

The ecological and significance assessments concluded that, if the relevant management and mitigation measures identified in Section 6 of the Continuation of Boggabri Coal Mine – Biodiversity Impact Assessment and the additional measures outlined in Section 6 of this report are adhered to, significant impact upon any threatened community, population or species as a result of the proposed modification is unlikely.

# 10. References

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# Appendix A

Plant species recorded



**Appendix A – Plant species recorded**

Family Name	Scientific Name	Common Name	EPBC Act Status <sup>1</sup>	TSC Act Status <sup>2</sup>	Native
Adiantaceae	<i>Cheilanthes distans</i>	Bristly Cloak Fern			Y
Adiantaceae	<i>Cheilanthes sieberi</i>	Mulga Fern			Y
Anthericaceae	<i>Arthropodium minus</i>	Small Vanilla Lily			Y
Apiaceae	<i>Cyclospermum leptophyllum</i>	Slender Celery			N
Apiaceae	<i>Daucus glochidiatus</i>	Native Carrot			Y
Apocynaceae	<i>Parsonsia eucalyptophylla</i>	Gargaloo			Y
Asteraceae	<i>Bidens pilosa</i>	Cobblers Pegs			N
Asteraceae	<i>Calotis cuneifolia</i>	Purple Burr-Daisy			Y
Asteraceae	<i>Calotis lappulacea</i>	Yellow Burr-daisy			Y
Asteraceae	<i>Carduus pycnocephalus</i>	Slender Thistle			N
Asteraceae	<i>Carthamus lanatus</i>	Saffron Thistle			N
Asteraceae	<i>Centaurea calcitrapa</i>	Star Thistle			N
Asteraceae	<i>Chrysocephalum apiculatum</i>	Common Everlasting			Y
Asteraceae	<i>Cirsium vulgare</i>	Spear Thistle			N
Asteraceae	<i>Conyza sp.</i>				N
Asteraceae	<i>Euchiton sphaericus</i>				Y
Asteraceae	<i>Hypochaeris radicata</i>	Catsear			N
Asteraceae	<i>Rhodanthe diffusa subsp. leucactina</i>				Y
Asteraceae	<i>Senecio madagascariensis</i>	Fireweed			N
Asteraceae	<i>Senecio quadridentatus</i>	Cotton Fireweed			Y
Asteraceae	<i>Silybum marianum</i>	Variegated Thistle			N
Asteraceae	<i>Sonchus oleraceus</i>	Common Sowthistle			N
Asteraceae	<i>Vittadinia cuneata</i>	Fuzzweed			Y
Asteraceae	<i>Vittadinia pustulata</i>				Y
Asteraceae	<i>Vittadinia sp.</i>				Y
Asteraceae	<i>Vittadinia sulcata</i>				Y
Asteraceae	<i>Xanthium occidentale</i>	Noogoora Burr			N
Asteraceae	<i>Xerochrysum bracteatum</i>	Golden Everlasting			Y
Boraginaceae	<i>Echium plantagineum</i>	Pattersons Curse			N
Boraginaceae	<i>Echium vulgare</i>	Vipers Bugloss			N
Brassicaceae	<i>Brassica rapa</i>	White Turnip			N
Brassicaceae	<i>Brassica sp.</i>				N
Brassicaceae	<i>Lepidium africanum</i>	Common Peppergrass			N
Brassicaceae	<i>Sisymbrium irio</i>	London Rocket			Y
Brassicaceae	<i>Sisymbrium thellungii</i>	African Turnip Weed			N
Cactaceae	<i>Opuntia stricta</i>	Prickly Pear			N

Family Name	Scientific Name	Common Name	EPBC Act Status <sup>1</sup>	TSC Act Status <sup>2</sup>	Native
Campanulaceae	<i>Wahlenbergia sp.</i>	Bluebell			Y
Caryophyllaceae	<i>Petrorhagia dubia</i>	Velvety Pink			
Casuarinaceae	<i>Casuarina cristata</i>	Belah			Y
Chenopodiaceae	<i>Einadia nutans</i> subsp. <i>nutans</i>	Climbing Saltbush			Y
Chenopodiaceae	<i>Einadia polygonoides</i>				Y
Chenopodiaceae	<i>Enchylaena tomentosa</i>	Ruby Saltbush			Y
Chenopodiaceae	<i>Maireana microphylla</i>	Small-leaf Bluebush			Y
Chenopodiaceae	<i>Sclerolaena birchii</i>	Galvanized Burr			Y
Chenopodiaceae	<i>Sclerolaena muricata</i>	Black Rolypoly			Y
Clusiaceae	<i>Hypericum gramineum</i>	Small St Johns Wort			Y
Convolvulaceae	<i>Convolvulus erubescens</i>				Y
Convolvulaceae	<i>Dichondra repens</i>	Kidney Weed			Y
Crassulaceae	<i>Crassula colorata</i>	Dense Crassula			Y
Cupressaceae	<i>Callitris glaucophylla</i>	White Cypress Pine			Y
Cyperaceae	<i>Cyperus gracilis</i>	Slender Flat-sedge			Y
Cyperaceae	<i>Eleocharis pusilla</i>	Small Spike-sedge			Y
Euphorbiaceae	<i>Chamaesyce drummondii</i>	Caustic Weed			Y
Fabaceae (Faboideae)	<i>Glycine tabacina</i>				Y
Fabaceae (Faboideae)	<i>Medicago polymorpha</i>	Burr Medic			N
Fabaceae (Faboideae)	<i>Medicago sativa</i>	Lucerne			N
Fabaceae (Faboideae)	<i>Trifolium arvense</i>	Haresfoot Clover			N
Fabaceae (Faboideae)	<i>Trifolium repens</i>	White Clover			N
Fabaceae (Mimosoideae)	<i>Acacia dealbata</i>	Silver Wattle			Y
Fabaceae (Mimosoideae)	<i>Acacia decora</i>	Western Golden Wattle			Y
Fabaceae (Mimosoideae)	<i>Acacia pendula</i>	Weeping Myall			Y
Fabaceae (Mimosoideae)	<i>Vachellia farnesiana</i>	Mimosa Bush			Y
Geraniaceae	<i>Erodium crinitum</i>	Blue Storksbill			Y
Juncaceae	<i>Juncus usitatus</i>	Billabong Rush			Y
Lomandraceae	<i>Lomandra longifolia</i>	Spiny-headed Mat-rush			Y
Lomandraceae	<i>Lomandra multiflora</i> subsp. <i>multiflora</i>	Many-flowered Mat-rush			Y

Family Name	Scientific Name	Common Name	EPBC Act Status <sup>1</sup>	TSC Act Status <sup>2</sup>	Native
Loranthaceae	<i>Amyema pendulum</i>				Y
Malvaceae	<i>Modiola caroliniana</i>	Red-flowered Mallow			N
Malvaceae	<i>Sida corrugata</i>	Corrugated Sida, Variable Sida			Y
Malvaceae	<i>Sida rhombifolia</i>	Paddys Lucerne			N
Malvaceae	<i>Sida sp.</i>				Y
Myoporaceae	<i>Eremophila debilis</i>	Amulla			Y
Myrtaceae	<i>Eucalyptus albens</i>	White Box			Y
Myrtaceae	<i>Eucalyptus pilligaensis</i>	Narrow-leaved Grey Box			Y
Myrtaceae	<i>Eucalyptus populnea</i>	Bimble Box			Y
Nyctaginaceae	<i>Boerhavia dominii</i>	Tarvine			Y
Oxalidaceae	<i>Oxalis corniculata</i>	Creeping Oxalis			N
Plantaginaceae	<i>Plantago debilis</i>	Shade Plantain			Y
Plantaginaceae	<i>Plantago lanceolata</i>	Lambs Tongues			N
Poaceae	<i>Aristida ramosa</i>	Cane Wire-grass			Y
Poaceae	<i>Aristida sp.</i>				Y
Poaceae	<i>Aristida vagans</i>	Threeawn Speargrass			Y
Poaceae	<i>Austrostipa aristiglumis</i>	Plains Grass			Y
Poaceae	<i>Austrostipa bigeniculata</i>				Y
Poaceae	<i>Austrostipa scabra</i>	Speargrass			Y
Poaceae	<i>Austrostipa verticillata</i>				Y
Poaceae	<i>Avena fatua</i>	Wild Oats			N
Poaceae	<i>Bothriochloa decipiens</i>	Red Grass			Y
Poaceae	<i>Bromus arenarius</i>	Sand Brome			Y
Poaceae	<i>Bromus molliformis</i>				N
Poaceae	<i>Chloris divaricata</i>				Y
Poaceae	<i>Chloris gayana</i>	Rhodes Grass			N
Poaceae	<i>Chloris truncata</i>	Windmill Grass			Y
Poaceae	<i>Chloris ventricosa</i>	Tall Chloris			Y
Poaceae	<i>Cymbopogon refractus</i>	Barbed Wire Grass			Y
Poaceae	<i>Cynodon dactylon</i>	Common Couch			Y
Poaceae	<i>Dichanthium sericeum</i>	Queensland Bluegrass			Y
Poaceae	<i>Digitaria breviglumis</i>				Y
Poaceae	<i>Elymus scaber</i>				Y
Poaceae	<i>Enteropogon acicularis</i>	Spider Grass			Y
Poaceae	<i>Eragrostis leptostachya</i>	Paddock Lovegrass			Y
Poaceae	<i>Lolium perenne</i>	Perennial Ryegrass			N

Family Name	Scientific Name	Common Name	EPBC Act Status <sup>1</sup>	TSC Act Status <sup>2</sup>	Native
Poaceae	<i>Panicum queenslandicum</i>	Yadbil Grass			Y
Poaceae	<i>Panicum decompositum</i>	Native Millet			Y
Poaceae	<i>Panicum sp.</i>				Y
Poaceae	<i>Paspalum dilatatum</i>	Paspalum			N
Poaceae	<i>Pennisetum clandestinum</i>	Kikuyu Grass			N
Poaceae	<i>Rytidosperma bipartitum</i>				Y
Poaceae	<i>Setaria gracilis</i>	Slender Pigeon Grass			N
Poaceae	<i>Sporobolus creber</i>	Slender Rats Tail Grass			Y
Poaceae	<i>Triticum aestivum</i>	Wheat			N
Poaceae	<i>Vulpia myuros</i>	Rats Tail Fescue			N
Polygonaceae	<i>Rumex crispus</i>	Curled Dock			N
Primulaceae	<i>Anagallis arvensis</i>	Scarlet/Blue Pimpernel			N
Rubiaceae	<i>Richardia stellaris</i>				N
Rutaceae	<i>Geijera parviflora</i>	Wilga			Y
Sapindaceae	<i>Dodonaea viscosa</i>	Sticky Hop-bush			Y
Sapindaceae	<i>Dodonaea viscosa subsp. angustifolia</i>				Y
Solanaceae	<i>Datura ferox</i>	Fierce Thornapple			N
Solanaceae	<i>Lycium ferocissimum</i>	African Boxthorn			N
Solanaceae	<i>Solanum nigrum</i>	Black-berry Nightshade			N
Solanaceae	<i>Solanum parvifolium</i>				Y
Verbenaceae	<i>Verbena officinalis</i>	Common Verbena			N

## Appendix B

Animal species recorded



**Appendix B – Animal species recorded**

Family Name	Scientific Name	Common Name	Observation type	Native
<b>Birds</b>				
Artamidae	<i>Gymnorhina tibicen</i>	Australian Magpie	O	Yes
Cacatuidae	<i>Cacatua galerita</i>	Sulphur-crested Cockatoo	O	Yes
Cacatuidae	<i>Cacatua roseicapilla</i>	Galah	O	Yes
Cacatuidae	<i>Cacatua sanguinea</i>	Little Corella	O	Yes
Charadriidae	<i>Vanellus miles</i>	Masked Lapwing	O	Yes
Columbidae	<i>Ocyphaps lophotes</i>	Crested Pigeon	O	Yes
Corcoracidae	<i>Corcorax melanorhamphos</i>	White-winged Chough	O	Yes
Corcoracidae	<i>Struthidea cinerea</i>	Apostlebird	O	Yes
Corvidae	<i>Corvus coronoides</i>	Australian Raven	O	Yes
Dicruridae	<i>Grallina cyanoleuca</i>	Magpie-lark	O	Yes
Falconidae	<i>Falco berigora</i>	Brown Falcon	O	Yes
Falconidae	<i>Falco cenchroides</i>	Nankeen Kestrel	O	Yes
Meliphagidae	<i>Manorina melanocephala</i>	Noisy Miner	O	Yes
Muscicapidae	<i>Turdus merula</i>	Common Blackbird	O	Yes
Petroicidae	<i>Microeca fascinans</i>	Jacky Winter	O	Yes
Psittacidae	<i>Platycercus eximius</i>	Eastern Rosella	O	Yes
Sturnidae	<i>Acridotheres tristis</i>	Common Myna	O	No
<b>Mammals</b>				
Bovidae	<i>Bos taurus</i>	Cattle (feral)	O	No
Suidae	<i>Sus scrofa</i>	Pig (feral)	O	No

Notes: O = Observed

# Appendix C

Threatened species of plant





**Appendix C - Threatened species of plant known or predicted to occur within the Study Area**

Family Name	Species Name	Common Name	EPBC Act Status <sup>1</sup>	TSC Act Status <sup>2</sup>	Habitat	Data Source <sup>3</sup>	Likelihood of occurrence <sup>4</sup>	Impact assessment required?
Asclepiadaceae	<i>Tylophora linearis</i>		E	E1	Grows in dry scrub in the Barraba, Mendooran, Temora and West Wyalong districts, in the NWS, CWS botanical subdivisions (Royal Botanic Gardens 2005). Grows in dry scrub and open forest. Recorded from low-altitude sedimentary flats in dry woodlands of <i>Eucalyptus fibrosa</i> , <i>E. sideroxylon</i> , <i>E. albens</i> , <i>Callitris endlicheri</i> , <i>C. glaucophylla</i> and <i>Allocasuarina luehmannii</i> . Also grows in association with <i>Acacia hakeoides</i> , <i>A. lineata</i> , <i>Myoporum</i> species and <i>Casuarina</i> species (Department of Environment and Conservation 2005). This species has recently been recorded within Leard State Forest near Boggabri NSW (Pers. Obs.).	EPBC, PlantNet, Atlas of NSW, Namoi – Liverpool Plains (B) CMA	<b>Moderate -</b> Marginal habitat recorded within the study area and has been recorded within the broader locality.	<b>Yes</b> – this species was recorded and will be impacted upon by the proposed modification an impact assessment has been undertaken in Appendix E.
Brassicaceae	<i>Lepidium aschersonii</i>	Spiny Peppercross	V	V	Not widespread, occurring in the marginal central-western slopes and north-western plains regions of NSW (and potentially the south western plains). A recent survey has located several populations at Narrabri, from where the species had last been recorded in 1899. Also known from the West Wyalong, Barmedman and Temora areas, although most records are old. Approximately 50% of the total <i>Lepidium aschersonii</i> recorded for Australia occurs in NSW. Found on ridges of gilgai clays dominated by Brigalow ( <i>Acacia harpophylla</i> ), with <i>Austrodanthonia</i> and/or <i>Austrostipa</i> species in the understorey. The species grows as a component of the ground flora, in grey loamy clays. Vegetation structure varies from open to dense Brigalow, with sparse grassy understorey and occasional heavy litter. Flowers from spring to autumn. Recorded population sizes vary from 10 to 2000+ plants. Plant numbers decrease with increasing overstorey density, and plants were not found where the Brigalow canopy cover exceeded about 60%. The species is often described as a “weed” where it dominates paddocks (Royal Botanic Gardens 2007).	PlantNet, Namoi – Liverpool Plains (B) CMA	Low - No suitable habitat was recorded within the study area.	No.

Family Name	Species Name	Common Name	EPBC Act Status <sup>1</sup>	TSC Act Status <sup>2</sup>	Habitat	Data Source <sup>3</sup>	Likelihood of occurrence <sup>4</sup>	Impact assessment required?
Brassicaceae	<i>Lepidium monoplocoides</i>	Winged Peppergrass	E	E1	Widespread in the semi-arid western plains regions of NSW. Occurs on seasonally moist to waterlogged sites, on heavy fertile soils, with a mean annual rainfall of around 300-500 mm. Predominant vegetation is usually an open woodland dominated by <i>Allocasuarina luehmannii</i> (Bulloak) and/or eucalypts, particularly <i>E. largiflorens</i> (Black Box) or <i>E. populnea</i> (Poplar Box). The field layer of the surrounding woodland is dominated by tussock grasses. Recorded in a wetland-grassland community comprising <i>Eragrostis australasicus</i> , <i>Agrostis avenacea</i> , <i>Austrodanthonia duttoniana</i> , <i>Homopholis proluta</i> , <i>Myriophyllum crispatum</i> , <i>Utricularia dichotoma</i> and <i>Pycnosorus globosus</i> , on waterlogged grey-brown clay. Also recorded from a <i>Maireana pyramidata</i> shrubland. The species is highly dependent on seasonal conditions. Occurs in periodically flooded and waterlogged habitats and does not tolerate grazing disturbance. The number of plants at each site varies greatly with seasonal conditions, but sites tend to be small in area with local concentrations of the plant. Has been recorded as uncommon to locally common with hundreds of plants at sites (Department of Environment and Conservation 2005).	PlantNet	Low - No suitable habitat was recorded within the study area.	No.

Family Name	Species Name	Common Name	EPBC Act Status <sup>1</sup>	TSC Act Status <sup>2</sup>	Habitat	Data Source <sup>3</sup>	Likelihood of occurrence <sup>4</sup>	Impact assessment required?
Cyperaceae	<i>Cyperus conicus</i>	-		E1	Occurs rarely in the Pilliga area of NSW and is also found in Victoria, Qld, the NT and WA. It grows in open woodland on sandy soil. In central Australia, the species grows near waterholes and on the banks of streams in sandy soils. In Qld the species usually found on heavy soils. Recorded from Callitris forest in the Pilliga area, growing in sandy soil with <i>Cyperus gracilis</i> , <i>C. squarrosus</i> and <i>C. fulvus</i> . Often associated with other sedge species including <i>C. victoriensis</i> , <i>C. difformis</i> , <i>C. iria</i> , <i>C. compressus</i> , <i>C. nervulosus</i> , <i>C. dactylotes</i> , <i>Fimbristylis</i> and <i>Eleocharis</i> species. <i>Cyperus conicus</i> has been recorded as very rare and occasional, to common and abundant in populations. Interstate habitats include floodplains, creek beds and banks, swamps, run-on areas and various watercourses, near or in dams and bores, and in vegetation communities such as Melaleuca swamps, open Box woodland and sedgeland. Soils are usually sandy or silty and damp to wet (Department of Environment and Conservation 2005).	PlantNet, Namoi – Liverpool Plains (B) CMA	Low - No suitable habitat was recorded within the study area.	No.
Eriocaulaceae	<i>Eriocaulon australasicum</i>		E	E1	Occurs within habitat typically described as 'wet places along the Murray towards the junction of Murrumbidgee' such as within swamps and sedgeland (Department of Environment and Conservation 2006).	PlantNet	Low - No suitable habitat was recorded within the study area.	No.
Euphorbiaceae	<i>Bertya opponens</i> (syn. <i>Bertya</i> sp. A Cobar-Coolabah)		V	V	It occurs in a range of habitats which makes the identification of critical habitat difficult. The species grows predominantly in shallow soil on stony mallee ridges and cypress pine forest on the red soils in the west, to coastal cliff edges in open eucalypt forests in the east (Briggs & Leigh 1996).(Harden 2000).	PlantNet, Namoi – Liverpool Plains (B) CMA	Low –suitable habitat was recorded within the study area.	No.

Family Name	Species Name	Common Name	EPBC Act Status <sup>1</sup>	TSC Act Status <sup>2</sup>	Habitat	Data Source <sup>3</sup>	Likelihood of occurrence <sup>4</sup>	Impact assessment required?
Fabaceae (Faboideae)	<i>Swainsona murrayana</i>	Slender Darling Pea	V	V	Often grows with <i>Maireana</i> species on heavy soils, especially in depression (Royal Botanic Gardens 2005). Found throughout NSW, it has been recorded in the Jerilderie and Deniliquin areas of the southern riverine plain, the Hay plain as far north as Willandra National Park, near Broken Hill and in various localities between Dubbo and Moree. It grows in a variety of vegetation types including bladder saltbush, black box and grassland communities on level plains, floodplains and depressions and is often found with <i>Maireana</i> species. Plants have been found in remnant native grasslands or grassy woodlands that have been intermittently grazed or cultivated. The species has been collected from clay-based soils, ranging from grey, red and brown cracking clays to red-brown earths and loams. The species may require some disturbance and has been known to occur in paddocks that have been moderately grazed or occasionally cultivated (Department of Environment and Conservation 2005).	EPBC, Namoi – Liverpool Plains (B) CMA	Low - No suitable habitat was recorded within the study area.	No.
Haloragaceae	<i>Myriophyllum implicatum</i>			CE	It occurs in moist microhabitats adjacent to fresh water (Callaghan <i>et al.</i> 2002; Orchard 1985; Thompson, D. & Sharp 2003a; Thompson, E. & Sharp 2003b). Previously presumed extinct in NSW it was rediscovered in 2008 in open inundated gilgai depression on cracking clays in an area dominated by open forest/woodland. In QLD it is located in the Moreton Bay area, sporadically along the east coast to Townsville and inland to the Desert Uplands.	PlantNet	Low - No suitable habitat was recorded within the study area.	No.
Malvaceae	<i>Commersonia procumbens</i>	V	V		This species is known to occur on sandy sites mainly confined to the Dubbo – Mendooran and Gilgandra region. It is also known in the Pilliga and Nymagee areas (Royal Botanic Gardens, 2015).	PlantNet	Low - No suitable habitat was recorded within the study area.	No

Family Name	Species Name	Common Name	EPBC Act Status <sup>1</sup>	TSC Act Status <sup>2</sup>	Habitat	Data Source <sup>3</sup>	Likelihood of occurrence <sup>4</sup>	Impact assessment required?
Orchidaceae	<i>Diuris tricolor</i>	Donkey Orchid		V	Grows in sclerophyll forest among grass, often with Callitris (Royal Botanic Gardens 2005). It is found in sandy soils, either on flats or small rises. Also recorded from a red earth soil in a Bimble Box community in western NSW. Soils include gritty orange-brown loam on granite, shallow red loamy sand on stony porphyry, skeletal lateritic soil and alluvial grey silty loam. Disturbance regimes are not known, although the species is usually recorded from disturbed habitats (Department of Environment and Conservation 2005). Within the Upper Hunter it is known to occur in <i>Eucalyptus albens</i> / <i>Eucalyptus crebra</i> / <i>Eucalyptus blakelyi</i> / <i>Corymbia maculata</i> woodland complexes and grasslands (Parsons Brinckerhoff 2004).	Atlas of NSW	<b>Moderate</b> - Suitable habitat was recorded in within the derived native grassland within the study area.	<b>Yes</b> – as potential habitat was recorded an impact assessment has been undertaken in Appendix E.
Orchidaceae	<i>Prasophyllum</i> sp. Wybong (C. Phelps ORG 5269)	a leek orchid	CE		<i>Prasophyllum</i> sp. Wybong (C. Phelps ORG 5269) is known from seven populations in open eucalypt woodland and grassland in NSW. The species' area of occupancy is estimated to be 1.5 km <sup>2</sup> with an estimated population size based on surveys in 2006 of 460 mature individuals. This species occurs within the Sydney Basin, New England Tablelands, Brigalow Belt South and NSW South Western Slopes IBRA Bioregions and the Border Rivers-Gwydir, Namoi, Hunter-Central Rivers and Central West Natural Resource Management Regions. The distribution of this species overlaps with the White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland EPBC Act-listed threatened ecological community (Department of Sustainability Environment Water Population and Communities 2011)	EPBC	<b>Moderate</b> - Suitable habitat was recorded in within the derived native grassland within the study area.	<b>Yes</b> – as potential habitat was recorded an impact assessment has been undertaken in Appendix E.

Family Name	Species Name	Common Name	EPBC Act Status <sup>1</sup>	TSC Act Status <sup>2</sup>	Habitat	Data Source <sup>3</sup>	Likelihood of occurrence <sup>4</sup>	Impact assessment required?
Orchidaceae	<i>Pterostylis cobarensis</i>		V	V	Grows among rocks on low hills and on slopes above streams; chiefly from Nyngan to Bourke district (Royal Botanic Gardens 2005). Western plains of NSW, chiefly in Nyngan - Cobar - Bourke region; favours stony ridges, often growing under <i>Eucalyptus morisii</i> (Grey Mallee) (Bishop 2000). Habitats are eucalypt woodlands, open mallee or <i>Callitris</i> shrublands on low stony ridges and slopes in skeletal sandy-loam soils. It has been recorded from ridge tops as well as steep exposed slopes and sheltered east slopes. Soils include shallow red clay-loam, skeletal red loam on metaquartzite, shallow sandy-loam on conglomerate and sandstone, and skeletal gritty organic loam on microgranite. Associated species include <i>Eucalyptus morisii</i> , <i>E. viridis</i> , <i>E. intertexta</i> , <i>E. vicina</i> , <i>Callitris glaucophylla</i> , <i>Geijera parviflora</i> , <i>Casuarina cristata</i> , <i>Acacia doratoxylon</i> , <i>Senna</i> spp. and <i>Eremophila</i> spp. (Department of Environment and Conservation 2005).	PlantNet	Low - No suitable habitat was recorded within the study area.	No.
Poaceae	<i>Dichanthium setosum</i>	Bluegrass	V	V	Grows in woodland and grassland (Harden 1993). On the New England Tablelands and North West Slopes it grows on stony red-brown hard-setting soils over basalt, or on black soil (Department of Environment and Conservation 2007).	Namoi – Liverpool Plains (B) CMA	Low - No suitable habitat was recorded within the study area.	No.
Poaceae	<i>Digitaria porrecta</i>	Finger Panic Grass	E	E1	In NSW it occurs in north western slopes and north western plains subdivisions (Royal Botanic Gardens 2004) where it grows in native grassland, woodlands or open forest with a grassy understorey, on richer soils. It is often found along roadsides and travelling stock routes where there is light grazing and occasional fire (Department of Environment and Conservation 2006).	PlantNet, Namoi – Liverpool Plains (B) CMA	<b>Moderate -</b> Suitable habitat was recorded in within the derived native grassland within the study area.	<b>Yes</b> – as potential habitat was recorded and impact assessment has been undertaken in Appendix E.
Poaceae	<i>Homopholis belsonii</i>		V		Occurs north from the Warialda district. It grows in dry woodland on poor soils such as <i>belah</i> (Department of Environment and Conservation 2006; Royal Botanic Gardens 2005)	EPBC, Namoi – Liverpool Plains (B) CMA	Low - No suitable habitat was recorded within the study area.	No.

Family Name	Species Name	Common Name	EPBC Act Status <sup>1</sup>	TSC Act Status <sup>2</sup>	Habitat	Data Source <sup>3</sup>	Likelihood of occurrence <sup>4</sup>	Impact assessment required?
Polygalaceae	<i>Polygala linariifolia</i>			E1	Grows in dry sclerophyll communities from Warialda area to Weebah gate on the Qld border (Royal Botanic Gardens 2005).	Namoi – Liverpool Plains (B) CMA	Low - No suitable habitat was recorded within the study area.	No.
Rhamnaceae	<i>Pomaderris queenslandica</i>	Scant Pomaderris		E1	Widely scattered but not common in north-east NSW and in Queensland. It is only known from a few locations on the New England Tablelands and North West Slopes, including near Torrington and Coolatai, and also from several locations on the NSW north coast (Department of Environment and Conservation 2005). It grows in moist eucalypt forest or sheltered woodlands with a shrubby understorey, and occasionally along creeks (Department of Environment and Conservation 2005).	PlantNet, Namoi – Liverpool Plains (B) CMA	Low - No suitable habitat was recorded within the study area.	No.
Rutaceae	<i>Philothea ericifolia</i>	-	V		Grows chiefly in dry sclerophyll forest and heath on damp sandy flats and gullies, in the upper Hunter Valley and Pilliga to Peak Hill district (Royal Botanic Gardens 2004). It has been collected from a variety of habitats including heath, open woodland, dry sandy creek beds, and rocky ridge and cliff tops. Associated species include <i>Melaleuca uncinata</i> , <i>Eucalyptus crebra</i> , <i>E. rossii</i> , <i>E. punctata</i> , <i>Corymbia trachyphloia</i> , <i>Acacia triptera</i> , <i>A. burrowii</i> , <i>Beyeria viscosa</i> , <i>Philothea australis</i> , <i>Leucopogon muticus</i> and <i>Calytrix tetragona</i> . Noted as being a moisture-loving plant, with plants common on the sides of a particular spur of the Hervey Ranges where soakage from the high background provides sufficient moisture for the plants (Department of Environment and Conservation 2005).	Namoi CMA	Low - No suitable habitat was recorded within the study area.	No.
Santalaceae	<i>Thesium australe</i>	Austral Toadflax	V	V	Grows in grassland or woodland often in damp sites. It is a semi-parasitic herb and hosts are likely to be <i>Themeda australis</i> and <i>Poa</i> spp. (Department of Environment and Climate Change 2008; Harden 1992).	Namoi – Liverpool Plains (B) CMA	Low - No suitable habitat was recorded within the study area.	No.

Family Name	Species Name	Common Name	EPBC Act Status <sup>1</sup>	TSC Act Status <sup>2</sup>	Habitat	Data Source <sup>3</sup>	Likelihood of occurrence <sup>4</sup>	Impact assessment required?
Scrophulariaceae	<i>Euphrasia orthocheila</i> subsp. <i>orthocheila</i>			E1	Grows in moist open situations such as swamps north from Walcha districts and west to Mt Kaputar N.P., also at Orange and possibly in Sydney area.	PlantNet	Low – No suitable habitat was recorded within the study area.	No.
Surianaceae	<i>Cadellia pentastylis</i>	Ooline	V	V	Occurs west from near Tenterfield and north from Terry Hie Hie (Royal Botanic Gardens 2005). Grows mainly in vine thickets or dry rainforest, and more rarely occurs in woodlands. It is a relict rainforest species and tends to favour upper and mid slope positions, often with a northerly aspect. It commonly occurs on sandy-loam to clay soils of low to medium fertility. It can occur in pure stands or in a mixed community on the slopes of residual sandstone ranges and scarps (Department of Environment and Conservation 2006).	EPBC, PlantNet, Namoi – Liverpool Plains (B) CMA	Low - No suitable habitat was recorded within the study area.	No.

Notes:

1. Listed as Vulnerable (V), Endangered (E) or Critically Endangered (CE) under the EPBC Act.
2. Listed as an Endangered Population (EP), Vulnerable (V), Endangered (E1), Critically Endangered (CE) or Extinct (E4) under the TSC Act.
3. EPBC = EPBC Act Protected Matters Search Tool Report  
Atlas of NSW Wildlife = Office of Environment and Heritage Bionet Atlas – 10 km buffer of study area  
PlantNet = The Royal Botanic Gardens PlantNet database – 25 km buffer of study area  
Namoi CMA = OEH Namoi CMA Liverpool Range (Part B) regional search
4. Refer to Section 4 of the main report



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- Thompson, D & Sharp, D 2003a, *Regional ecosystems of the Desert Uplands: 10.3.15 Grasslands, sedgeland, ephemeral herblands and open-woodlands in depressions on sand plains*, Queensland Environmental Protection Agency.

Thompson, E & Sharp, D 2003b, *Regional ecosystems of the Desert Uplands: 10.3.14 River red gum and/or coolabah open-woodland along channels and on floodplains*, Queensland Environmental Protection Agency.

## Appendix D

Threatened species of animal



**Appendix D - Threatened species of animal known or predicted to occur within the Study Area**

Scientific name	Common Name	EPBC Act Status <sup>1</sup>	TSC Act Status <sup>2</sup>	Habitat	Data source <sup>3</sup>	Likelihood of occurrence <sup>4</sup>	Impact assessment required?
<b>Amphibians</b>							
<i>Litoria booroolongensis</i>	Booroolong Frog	E	E1	Confined to mountain streams of the Great Dividing Range (Cogger 2000). Usually found on or under boulders and debris in and beside the rocky beds of mountain streams; breeds in summer (Anstis 2002).	EPBC	Low – No preferred habitat recorded.	No.
<b>Birds</b>							
<i>Botaurus poiciloptilus</i>	Australasian Bittern	E	E1	Occurs in shallow, vegetated freshwater or brackish swamps. Requires permanent wetlands with tall dense vegetation, particularly bulrushes and spikerushes. When breeding, pairs are found in areas with a mixture of tall and short sedges but will also feed in more open territory. (Garnett & Crowley 2000; NSW National Parks and Wildlife Service 2002a).	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.
<i>Alectura lathami</i>	Australian Brush-turkey		E2	Has a largely coastal distribution from Cape York south as far as the Illawarra in NSW (Barrett, G.W. <i>et al.</i> 2003; Marchant & Higgins 1993). It occurs in forested and wooded areas of tropical and warm-temperate districts, particularly above 300 m to at least 1200 m altitude. The species is commonly associated with closed forest, including rainforest and vine thickets, as well as dense woodland habitats. More open dry woodland habitats are also used including open woodland dominated by Spotted Gum, <i>Corymbia maculata</i> , <i>Brigalow</i> , <i>Acacia harpophylla</i> , and <i>Belah</i> , <i>Casuarina cristata</i> (Marchant & Higgins 1993). In NSW the inland vegetation type preferred by the Australian Brush-turkey is a dry rainforest community that is found within the Semi-evergreen Vine Thicket in the Brigalow Belt South and Nandewar Bioregions Endangered Ecological Community (NSW Scientific Committee 2005). The population in the Nandewar and Brigalow Belt South bioregions of NSW is listed as an Endangered population.	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.

Scientific name	Common Name	EPBC Act Status <sup>1</sup>	TSC Act Status <sup>2</sup>	Habitat	Data source <sup>3</sup>	Likelihood of occurrence <sup>4</sup>	Impact assessment required?
<i>Ardeotis australis</i>	Australian Bustard		E1	The ground-dwelling bird mainly inhabits tussock and hummock grasslands, though prefers tussock grasses to hummock grasses; also occurs in low shrublands and low open grassy woodlands; occasionally seen in pastoral and cropping country, golf courses and near dams. Breeds on bare ground on low sandy ridges or stony rises in ecotones between grassland and protective shrubland cover; roosts on ground among shrubs and long grasses or under trees. Forages on insects, young birds, lizards, mice, leaves, seeds and fruit. Dispersive, with irregular widespread movements over long distances; movements are thought to be in response to habitat and climatic conditions; known to converge on areas with high mice numbers and in recently burnt areas (Marchant & Higgins 1993).	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.
<i>Rostratula australis</i> (syn. <i>R. benghalensis</i> )	Australian Painted Snipe (Painted Snipe)	VM	E1	Inhabits shallow, vegetated, temporary or infrequently filled wetlands, including where there are trees such as <i>Eucalyptus camaldulensis</i> (River Red Gum), <i>E. populnea</i> (Poplar Box) or shrubs such as <i>Muehlenbeckia florulenta</i> (Lignum) or <i>Sarcocornia quinqueflora</i> (Samphire). Feeds at the water's edge and on mudflats on seeds and invertebrates, including insects, worms, molluscs and crustaceans. Males incubate eggs in a shallow scrape nest (Garnett & Crowley 2000).	EPBC, Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.
<i>Ninox connivens</i>	Barking Owl		V	Occurs in dry sclerophyll woodland. In the south west it is often associated with riparian vegetation while in the south east it generally occurs on forest edges. It nests in large hollows in live eucalypts, often near open country. It feeds on insects in the non-breeding season and on birds and mammals in the breeding season (Garnett & Crowley 2000).	Atlas of NSW, Namoi – Liverpool Plains (B) CMA	<b>Moderate</b> – preferred habitat recorded.	<b>Yes</b> – as potential habitat was recorded an impact assessment has been undertaken in Appendix E.
<i>Hamirostra melanosternon</i>	Black-breasted Buzzard		V	Distributed throughout most of inland Australia and prefers arid scrubland, and open woodlands. Feeds on small mammals and birds (Garnett & Crowley 2000).	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.

Scientific name	Common Name	EPBC Act Status <sup>1</sup>	TSC Act Status <sup>2</sup>	Habitat	Data source <sup>3</sup>	Likelihood of occurrence <sup>4</sup>	Impact assessment required?
<i>Melithreptus gularis gularis</i>	Black-chinned Honeyeater (eastern subspecies)		V	Occurs within areas of annual rainfall between 400-700 mm. Feed on insects, nectar and lerps (Garnett & Crowley 2000). It occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, Blakely's Red Gum and Forest Red Gum. Also inhabits open forests of smooth-barked gums, stringybarks, river sheoaks (nesting habitat) and tea-trees. Feeding territories are large making the species locally nomadic. It tends to occur in the largest woodland patches in the landscape as birds forage over large home ranges of at least 5 hectares (Office of Environment and Heritage 2012b).	Namoi – Liverpool Plains (B) CMA	<b>Moderate</b> – preferred habitat recorded.	<b>Yes</b> – as potential habitat was recorded an impact assessment has been undertaken in Appendix E.
<i>Falco subniger</i>	Black Falcon		V	Widely, but sparsely, distributed in New South Wales, mostly occurring woodland, shrubland and grassland in the arid and semi-arid zones, especially wooded watercourses and agricultural land with scattered remnant trees. It is usually associated with streams or wetlands, visiting them in search of prey and often using standing dead trees as lookout posts. Habitat selection is generally influenced more by prey densities than by specific aspects of habitat floristics or condition, although in agricultural landscapes it tends to nest in healthy, riparian woodland remnants with a diverse avi-fauna {NSW Scientific Committee, 2013 #4096}.	Namoi – Liverpool Plains (B) CMA	<b>Moderate</b> – preferred habitat recorded.	<b>Yes</b> – as potential habitat was recorded an impact assessment has been undertaken in Appendix E.
<i>Ephippiorhynchus asiaticus</i>	Black-necked Stork		E1	Feed in shallow water up to 0.5 m deep on fish, reptiles and frogs. Build nests in trees close to feeding sites (Garnett & Crowley 2000).	Atlas of NSW, Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.
<i>Limosa limosa</i>	Black-tailed Godwit	M	V	A coastal species found on tidal mudflats, swamps, shallow river margins and sewage farms. Also found inland on larger shallow fresh or brackish waters. A migratory species visiting Australia between September and May (Pizzey & Knight 2007).	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.

Scientific name	Common Name	EPBC Act Status <sup>1</sup>	TSC Act Status <sup>2</sup>	Habitat	Data source <sup>3</sup>	Likelihood of occurrence <sup>4</sup>	Impact assessment required?
<i>Oxyura australis</i>	Blue-billed Duck		V	Relatively sparse throughout species range. Regularly found breeding in south-east Queensland, north-east South Australia and throughout New South Wales. Found on temperate, fresh to saline, terrestrial wetlands, and occupies artificial wetlands. Prefers deep permanent open water, within or near dense vegetation. Nest in rushes, sedge, <i>Lignum Muehlenbeckia cunninghamii</i> and paperbark <i>Melaleuca</i> (Garnett & Crowley 2000).	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.
<i>Grus rubicunda</i>	Brolga		V	Occurs in well vegetated shallow freshwater wetlands, small isolated swamps in eucalypt forests, floodplains, grasslands, paddocks, ploughed fields, irrigated pastures, stubbles, crops, desert claypans, bore drains, tidal areas, mangroves, beach wastes. Roosts in shallow, bare swamps and nests on small islands in wetland or standing in shallow water, eggs are occasionally laid on bare ground {Pizzey, 1997 #24}.	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.
<i>Climacteris picumnus victoriae</i>	Brown Treecreeper (eastern subspecies)		V	Found in eucalypt woodlands and dry open forest of the inland slopes and plains inland of the Great Dividing Range; mainly in habits woodlands dominated by stringybarks or other rough-barked eucalypts. Nesting occurs in tree hollows (Department of Environment and Conservation 2005a).	Atlas of NSW, Namoi – Liverpool Plains (B) CMA	<b>Moderate</b> – preferred habitat recorded.	<b>Yes</b> – as potential habitat was recorded an impact assessment has been undertaken in Appendix E.
<i>Burhinus grallarius</i>	Bush Stone-curlew		E1	Inland habitat consists of open forest and woodlands with few, if any, shrubs, and short, sparse grasses of less than 15cm in height, with scattered fallen timber, leaf litter and bare ground present (Department of Environment and Conservation 2006a). In coastal areas, structurally similar elements of tidal and estuarine communities ( <i>Casuarina</i> woodlands, saltmarsh and mangroves) provide suitable habitat (Price 2004). Nesting sites are frequently located in relatively open areas, where ground cover is extremely low and/or sparse including native vegetation and mown lawns, ploughed paddocks and paddocks cut for hay, dirt and gravel roads, seaweed on sand beach, playing fields, vacant lots (Department of Environment and Conservation 2006b).	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.

Scientific name	Common Name	EPBC Act Status <sup>1</sup>	TSC Act Status <sup>2</sup>	Habitat	Data source <sup>3</sup>	Likelihood of occurrence <sup>4</sup>	Impact assessment required?
<i>Ardea ibis</i>	Cattle Egret	M		Occurs in tropical and temperate grasslands, wooded lands and terrestrial wetlands and very rarely in arid and semi-arid regions. High numbers may occur in moist, poorly drained pastures with high grass; it avoids low grass pastures but has been recorded on earthen dam walls and ploughed fields. It is commonly associated with the habitats of farm animals, particularly cattle, but also pigs, sheep, horses and deer. It is known to follow earth-moving machinery and has been located at rubbish tips. It uses predominately shallow, open and fresh wetlands including meadows and swamps with low emergent vegetation and abundant aquatic flora (Marchant & Higgins 1990; Morton <i>et al.</i> 1989).	EPBC	<b>Moderate</b> – preferred habitat recorded.	<b>Yes</b> – impact assessment conducted in Section 4.5 of the main report.
<i>Stagonopleura guttata</i>	Diamond Firetail		V	Distributed through central and eastern NSW, extending north into southern and central Queensland and south through Victoria to the Eyre Peninsula, South Australia. In NSW, the species occurs predominantly west of the Great Dividing Range, although populations are known from drier coastal areas (Blakers <i>et al.</i> 1984; Schodde & Mason 1999). Occurs in a range of eucalypt dominated communities with a grassy understorey including woodland, forest and mallee. Most populations occur on the inland slopes of the dividing range (Garnett & Crowley 2000). Firetails nest in trees and bushes, and forage on the ground, largely for grass seeds and other plant material, but also for insects (Blakers <i>et al.</i> 1984; Read 1994).	Atlas of NSW, Namoi – Liverpool Plains (B) CMA	<b>Moderate</b> – preferred habitat recorded.	<b>Yes</b> – as potential habitat was recorded an impact assessment has been undertaken in Appendix E.
<i>Tyto longimembris</i>	Eastern Grass Owl		V	Typically found in tussock-grasslands but also occur in heathland, swamps, coastal dunes, tree-lined creeks, treeless plains, grassy gaps between trees and crops. Nest on the ground generally under tussocks. They generally feed on rodents but will also eat insects {Pizzey, 1997 #24}.	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.



Scientific name	Common Name	EPBC Act Status <sup>1</sup>	TSC Act Status <sup>2</sup>	Habitat	Data source <sup>3</sup>	Likelihood of occurrence <sup>4</sup>	Impact assessment required?
<i>Pandion cristatus</i>	Eastern Osprey	M	V	Generally a coastal species, occurring in estuaries, bays, inlets, islands and surrounding waters, coral atolls, reefs, lagoons, rock cliffs and stacks. Sometimes ascends larger rivers to far inland. Builds nests high in tree, on pylon or on ground on islands. Feeds on fish {Pizzey, 2007 #24}.	EPBC	Low – No preferred habitat recorded.	No.
<i>Ardea modesta</i>	Eastern Great Egret	M		Great Egrets occur throughout most of the world. They are common throughout Australia, with the exception of the most arid areas. Great Egrets prefer shallow water, particularly when flowing, but may be seen on any watered area, including damp grasslands. Great Egrets can be seen alone or in small flocks, often with other egret species, and roost at night in groups. In Australia, the breeding season of the Great Egret is normally October to December in the south and March to May in the north. This species breeds in colonies, and often in association with cormorants, ibises and other egrets. (Australian Museum 2003).	EPBC	<b>Moderate</b> – preferred habitat recorded.	<b>Yes</b> – as potential habitat was recorded an impact assessment has been undertaken in Appendix E.
<i>Petroica phoenicea</i>	Flame Robin		V	In NSW the Flame Robin breeds in upland moist eucalypt forests and woodlands, often on ridges and slopes, in areas of open understorey. It migrates in winter to more open lowland habitats (Higgins & Peter 2002). The Flame Robin forages from low perches, feeding on invertebrates taken from the ground, tree trunks, logs and other woody debris. The robin builds an open cup nest of plant fibres and cobweb, which is often near the ground in a sheltered niche, ledge or shallow cavity in a tree, stump or bank (Department of Environment Climate Change and Water 2010a).	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.

Scientific name	Common Name	EPBC Act Status <sup>1</sup>	TSC Act Status <sup>2</sup>	Habitat	Data source <sup>3</sup>	Likelihood of occurrence <sup>4</sup>	Impact assessment required?
<i>Apus pacificus</i>	Fork-tailed Swift	M		Breeds in the northern hemisphere, wintering south to Australia. It is almost exclusively aerial, flying from less than 1 m to at least 300 m above ground. It mostly occurs over inland plains but sometimes above foothills or in coastal areas over cliffs, beaches, islands and well out to sea. It also occurs over towns and cities. It mostly occurs over dry and/or open habitats, including riparian woodland and tea-tree swamps, low scrub, heathland or saltmarsh, grassland, spinifex sandplains, farmland and sand-dunes. It sometimes occurs above forests. It probably roosts aerially, but has occasionally been observed to land (Higgins 1999).	EPBC	Low – Likely to occur over study area on intermittent basis but no terrestrial habitat.	No.
<i>Stictonetta naevosa</i>	Freckled Duck		V	In most years this species appear to be nomadic between ephemeral inland wetlands. In dry years they congregate on permanent wetlands while in wet years they breed prolifically and disperse widely, generally towards the coast. In inland eastern Australia, they generally occur in brackish to hyposaline wetlands that are densely vegetated with Lignum ( <i>Muehlenbeckia cunninghamii</i> ) within which they build their nests (Garnett & Crowley 2000).	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.
<i>Calyptorhynchus lathamii</i>	Glossy Black-Cockatoo		V	Occurs in eucalypt woodland and forest with Casuarina/Allocasuarina spp. Characteristically inhabits forests on sites with low soil nutrient status, reflecting the distribution of key Allocasuarina species. The drier forest types with intact and less rugged landscapes are preferred by the species. Nests in tree hollows (Garnett & Crowley 2000; NSW National Parks and Wildlife Service 1999a).	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.
<i>Falco hypoleucos</i>	Grey Falcon		E1	Generally centred on inland drainage systems where the average rainfall is less than 500 millimetres. It is found in timbered lowland plains that are crossed by tree-lined water courses. Nests in the old nests of other birds, particularly raptors (Garnett & Crowley 2000).	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.

Scientific name	Common Name	EPBC Act Status <sup>1</sup>	TSC Act Status <sup>2</sup>	Habitat	Data source <sup>3</sup>	Likelihood of occurrence <sup>4</sup>	Impact assessment required?
<i>Melanodryas cucullata cucullata</i>	Hooded Robin (south-eastern)		V	Found in south-eastern Australia, generally east of the Great Dividing Range. Found in eucalypt woodland and mallee and acacia shrubland. This is one of a suite of species that has declined in woodland areas in south-eastern Australia (Garnett & Crowley 2000; Traill & Duncan 2000). The species appears unable to survive in remnants smaller than 100-200ha (NSW Scientific Committee 2001).	Atlas of NSW, Namoi – Liverpool Plains (B) CMA	<b>Moderate</b> – preferred habitat was recorded.	<b>Yes</b> – as potential habitat was recorded an impact assessment has been undertaken in Appendix E.
<i>Pomatostomus temporalis temporalis</i>	Grey-Crowned Babbler (Eastern subspecies)		V	The eastern form of the species formerly ranged throughout eastern Australia from South Australia, through Victoria and broadly through NSW and central Queensland but is now extinct in South Australia, coastal Victoria and the ACT. In NSW, it occurs on the western slopes and plains but is less common at the higher altitudes of the tablelands. Isolated populations are known from coastal woodlands on the North Coast, in the Hunter Valley and from the South Coast near Nowra (Blakers <i>et al.</i> 1984; Schodde & Mason 1999). Grey-crowned Babblers occupy open woodlands dominated by mature eucalypts, with regenerating trees, tall shrubs, and an intact ground cover of grass and forbs. The species builds conspicuous dome-shaped nests and breeds co-operatively in sedentary family groups of 2-13 birds (Davidson & Robinson 1992). Grey-crowned Babblers are insectivorous and forage in leaf litter and on bark of trees (NSW Scientific Committee 2001a).	Atlas of NSW, Namoi – Liverpool Plains (B) CMA	<b>Recorded.</b>	<b>Yes</b> – as this species was recorded in the vicinity of the modification study area and potential habitat was recorded an impact assessment has been undertaken in Appendix E.
<i>Gallinago hardwickii</i>	Latham's Snipe	M		Occurs in freshwater or brackish wetlands generally near protective vegetation cover. This species feeds on small invertebrates, seeds and vegetation. It migrates to the northern hemisphere to breed (Garnett & Crowley 2000).	EPBC	Low – No preferred habitat recorded.	No.

Scientific name	Common Name	EPBC Act Status <sup>1</sup>	TSC Act Status <sup>2</sup>	Habitat	Data source <sup>3</sup>	Likelihood of occurrence <sup>4</sup>	Impact assessment required?
<i>Hieraetus morphnoides</i>	Little Eagle		V	The Little Eagle is distributed throughout the Australian mainland occupying habitats rich in prey within open eucalypt forest, woodland or open woodland. Sheoak or acacia woodlands and riparian woodlands of interior NSW are also used. For nest sites it requires a tall living tree within a remnant patch, where pairs build a large stick nest in winter and lay in early spring. Prey includes birds, reptiles and mammals, with the occasional large insect and carrion. Most of its former native mammalian prey species in inland NSW are extinct and rabbits now form a major part of the diet (Marchant & Higgins 1993).	Namoi – Liverpool Plains (B) CMA	<b>Moderate</b> – preferred habitat recorded.	<b>Yes</b> – as potential habitat was recorded an impact assessment has been undertaken in Appendix E.
<i>Glossopsitta pusilla</i>	Little Lorikeet		V	The Little Lorikeet is a small green lorikeet with black bill and red patch on forehead and throat. The underside is yellow-green. Immatures are duller with less red on face and brown bill. Found in forests, woodland, treed areas along watercourses and roads. Forages mainly on flowers, nectar and fruit. Found along coastal east Australia from Cape York in Queensland down east coast and round to South Australia. Uncommon in southern Victoria (Higgins 1999).	Atlas of NSW, Namoi – Liverpool Plains (B) CMA	<b>Moderate</b> – preferred habitat recorded.	<b>Yes</b> – as potential habitat was recorded an impact assessment has been undertaken in Appendix E.
<i>Anseranas semipalmata</i>	Magpie Goose		V	Occurs in shallow wetlands such as large swamps and dams, especially with dense growth of rushes or sedges, and with permanent lagoons and grassland nearby. Feeds on seeds, tubers and green grass. Form large nesting colonies during the wet season. During the dry season this species migrates hundreds of kilometres to perennial swamps (Garnett & Crowley 2000; NSW National Parks and Wildlife Service 2002a).	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.

Scientific name	Common Name	EPBC Act Status <sup>1</sup>	TSC Act Status <sup>2</sup>	Habitat	Data source <sup>3</sup>	Likelihood of occurrence <sup>4</sup>	Impact assessment required?
<i>Leipoa ocellata</i>	Malleefowl	VM	E1	Ground-dwelling bird found in mallee woodland and other dry scrub in the semi-arid zone of inland Australia. Restricted to semi-arid rangelands and small habitat remnants in the dryland cropping zone of the southwest and centre of NSW. Prefers well drained, light sandy or loamy soils. Habitat usually contains dense but discontinuous canopy which provides abundant leaf litter and dense, varied shrub and herb layers containing food plants, particularly Acacia, Cassia, Bossiaea, Beyeria and some open ground for ease of movement (NSW National Parks and Wildlife Service 1999c).	EPBC, Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.
<i>Tyto novaehollandiae novaehollandiae</i>	Masked Owl (southern mainland)		V	Occurs within a diverse range of wooded habitats including forests, remnants and almost treeless inland plains. This species requires large-hollow bearing trees for roosting and nesting and nearby open areas for foraging. They typically prey on terrestrial mammals including rodents and marsupials but will also take other species opportunistically. Also known to occasionally roost and nest in caves (Garnett & Crowley 2000).	Atlas of NSW, Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.
<i>Grantiella picta</i>	Painted Honeyeater		V	Lives in dry forests and woodlands. Primary food is the mistletoes in the genus Amyema, though it will take some nectar and insects. Its breeding distribution is dictated by presence of mistletoes which are largely restricted to older trees. Less likely to be found in in strips of remnant box-ironbark woodlands, such as occur along roadsides and in windbreaks, than in wider blocks (Garnett & Crowley 2000).	Atlas of NSW, Namoi – Liverpool Plains (B) CMA	<b>Moderate</b> – preferred habitat recorded.	<b>Yes</b> – as potential habitat was recorded an impact assessment has been undertaken in Appendix E.

Scientific name	Common Name	EPBC Act Status <sup>1</sup>	TSC Act Status <sup>2</sup>	Habitat	Data source <sup>3</sup>	Likelihood of occurrence <sup>4</sup>	Impact assessment required?
<i>Certhionyx variegatus</i>	Pied Honeyeater		V	Inhabits wattle shrub (primarily Mulga, <i>Acacia aneura</i> ), mallee, spinifex and eucalypt woodlands, usually when shrubs are flowering; feeds on nectar, predominantly from various species of emu-bushes ( <i>Eremophila</i> spp.); also from mistletoes and various other shrubs (e.g. <i>Brachysema</i> spp. and <i>Grevillea</i> spp.); also eats saltbush fruit, berries, seed, flowers and insects. Highly nomadic, following the erratic flowering of shrubs; can be locally common at times. Constructs a relatively large cup-shaped nest, usually robust, although occasionally loose, constructed of grasses and fine twigs, bound with spider webs, in the fork of a shrub or tree up to 5 m above the ground (Higgins and Marchant 2001).	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.
<i>Ninox strenua</i>	Powerful Owl		V	A sedentary species with a home range of approximately 1000 hectares it occurs within open eucalypt, Casuarina or Callitris pine forest and woodland. It often roosts in denser vegetation including rainforest of exotic pine plantations. Generally feeds on medium-sized mammals such as possums and gliders but will also eat birds, flying-foxes, rats and insects. Prey are generally hollow dwelling and require a shrub layer and owls are more often found in areas with more old trees and hollows than average stands (Garnett & Crowley 2000).	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.
<i>Merops ornatus</i>	Rainbow Bee-eater	M		Usually occur in open or lightly timbered areas, often near water. Breed in open areas with friable, often sandy soil, good visibility, convenient perches and often near wetlands. Nests in embankments including creeks, rivers and sand dunes. Insectivorous, most foraging is aerial, in clearings (Higgins 1999).	EPBC	<b>Moderate</b> – preferred habitat recorded.	<b>Yes</b> – impact assessment conducted in Section 4.5 of the main report.

Scientific name	Common Name	EPBC Act Status <sup>1</sup>	TSC Act Status <sup>2</sup>	Habitat	Data source <sup>3</sup>	Likelihood of occurrence <sup>4</sup>	Impact assessment required?
<i>Anthochaera phrygia</i> (syn. <i>Xanthomyza phrygia</i> )	Regent Honeyeater	EM	CE	Occurs mostly in box-ironbark forests and woodland and prefers wet, fertile sites such as along creek flats, broad river valleys and foothills. Riparian forests with <i>Casuarina cunninghamiana</i> and <i>Amyema cambagei</i> are important for feeding and breeding. Spotted Gum and Swamp Mahogany forests are also important feeding areas in coastal areas. Important food trees include <i>Eucalyptus sideroxylon</i> (Mugga Ironbark), <i>E. albens</i> (White Box), <i>E. melliodora</i> (Yellow Box) and <i>E. leucoxyton</i> (Yellow Gum) (Garnett & Crowley 2000).	EPBC, Namoi – Liverpool Plains (B) CMA	Moderate – preferred habitat recorded.	Yes – as potential habitat was recorded an impact assessment has been undertaken in Appendix E.
<i>Myiagra cyanoleuca</i>	Satin Flycatcher	M		Occurs in heavily vegetated gullies, in forests and taller woodlands. During migration it is found in coastal forests, woodlands, mangroves, trees in open country and gardens (Pizzey & Knight 2007).	EPBC	Low – No preferred habitat recorded.	No.
<i>Petroica boodang</i>	Scarlet Robin		V	In NSW, the Scarlet Robin occupies open forests and woodlands from the coast to the inland slopes. Some dispersing birds may appear in autumn or winter on the eastern fringe of the inland plains. It prefers an open understorey of shrubs and grasses and sometimes in open areas. Abundant logs and coarse woody debris are important structural components of its habitat. In autumn and winter it migrates to more open habitats such as grassy open woodland or paddocks with scattered trees. It forages from low perches, feeding on invertebrates taken from the ground, tree trunks, logs and other coarse woody debris (Department of Environment Climate Change and Water 2010b; Higgins & Peter 2002). The species has been found to be absent from remnants surrounded by cereal cropping, less common in isolated patches of 30 ha or less (where there was no tree cover within 200 m and less than 20% cover within 1 km), less common in sites surrounded by cattle grazing and more common in sites with native versus exotic grasses if ungrazed for more than 10 years (Barrett, G.W. <i>et al.</i> 2003).	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.

Scientific name	Common Name	EPBC Act Status <sup>1</sup>	TSC Act Status <sup>2</sup>	Habitat	Data source <sup>3</sup>	Likelihood of occurrence <sup>4</sup>	Impact assessment required?
<i>Chthonicola sagittata</i> (syn. <i>Pyrrholaemus sagittatus</i> )	Speckled Warbler		V	Occurs in a wide range of eucalypt dominated vegetation with a grassy understorey and is often found on rocky ridges or in gullies. It feeds on seeds and insects and builds domed nests on the ground (Garnett & Crowley 2000). The species has been shown to decrease in abundance as woodland area decreased, and it appears to be extinct in districts where no fragments larger than 100ha remain (Barrett, G.W <i>et al.</i> 1994). Isolation of Speckled Warbler populations in small remnants increases their vulnerability to local extinction as a result of stochastic events and decreases their genetic viability in the long term (NSW Scientific Committee 2001b).	Atlas of NSW, Namoi – Liverpool Plains (B) CMA	<b>Moderate</b> – preferred habitat recorded.	<b>Yes</b> – as potential habitat was recorded an impact assessment has been undertaken in Appendix E.
<i>Circus assimilis</i>	Spotted Harrier		V	The Spotted Harrier occurs throughout the Australian mainland in grassy open woodland including acacia and mallee remnants, inland riparian woodland, grassland and shrub steppe (e.g. chenopods) (Marchant & Higgins 1993). It is found mostly commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands. The diet of the Spotted Harrier includes terrestrial mammals, birds and reptiles, occasionally large insects and rarely carrion (Department of Environment Climate Change and Water 2010b).	Atlas of NSW, Namoi – Liverpool Plains (B) CMA	<b>High</b> – preferred habitat recorded.	<b>Yes</b> – as potential habitat was recorded an impact assessment has been undertaken in Appendix E.
<i>Lophoictinia isura</i>	Square-tailed Kite		V	This species hunts primarily over open forest, woodland and mallee communities as well as over adjacent heaths and other low scrubby habitats in wooded towns. It feeds on small birds, their eggs and nestlings as well as insects. Seems to prefer structurally diverse landscapes (Garnett & Crowley 2000).	Atlas of NSW, Namoi – Liverpool Plains (B) CMA	<b>Moderate</b> – preferred habitat recorded.	<b>Yes</b> – as potential habitat was recorded an impact assessment has been undertaken in Appendix E.



Scientific name	Common Name	EPBC Act Status <sup>1</sup>	TSC Act Status <sup>2</sup>	Habitat	Data source <sup>3</sup>	Likelihood of occurrence <sup>4</sup>	Impact assessment required?
<i>Polytelis swainsonii</i>	Superb Parrot	V	V	Mainly found in the Riverina where they nest in loose colonies in riparian woodland on River Red Gum. On the inland slopes, Superb Parrots both forage and feed within box woodland, mostly nesting in dead trees (Garnett & Crowley 2000).	Namoi – Liverpool Plains (B) CMA	<b>Moderate</b> – preferred habitat recorded immediately adjacent.	<b>Yes</b> – as potential habitat was recorded an impact assessment has been undertaken in Appendix E.
<i>Lathamus discolor</i>	Swift Parrot	E	E1	Breeding occurs in Tasmania, majority migrates to mainland Australia in autumn, over-wintering, particularly in Victoria and central and eastern NSW, but also south-eastern Queensland as far north as Duinga. Until recently it was believed that in New South Wales, swift parrots forage mostly in the western slopes region along the inland slopes of the Great Dividing Range but are patchily distributed along the north and south coasts including the Sydney region, but new evidence indicates that the forests on the coastal plains from southern to northern NSW are also extremely important. In mainland Australia is semi-nomadic, foraging in flowering eucalypts in eucalypt associations, particularly box-ironbark forests and woodlands. Preference for sites with highly fertile soils where large trees have high nectar production, including along drainage lines and isolated rural or urban remnants, and for sites with flowering <i>Acacia pycnantha</i> , is indicated. Sites used vary from year to year. (Garnett & Crowley 2000),(Swift Parrot Recovery Team 2001).	EPBC, Namoi – Liverpool Plains (B) CMA	<b>Moderate</b> – preferred habitat recorded.	<b>Yes</b> – as potential habitat was recorded an impact assessment has been undertaken in Appendix E.

Scientific name	Common Name	EPBC Act Status <sup>1</sup>	TSC Act Status <sup>2</sup>	Habitat	Data source <sup>3</sup>	Likelihood of occurrence <sup>4</sup>	Impact assessment required?
<i>Neophema pulchella</i>	Turquoise Parrot		V	The Turquoise Parrot inhabits eucalypt and cypress-pine open forests and woodlands (commonly box or box-ironbark) with native grasses, sometimes with a low shrubby understorey, often in undulating or rugged country, or on footslopes. It also lives in open woodland or riparian gum woodland, and often near ecotones between woodland and grassland, or coastal forest and heath. The Turquoise Parrot requires live or dead trees, stumps and logs for nesting, trees and shrubs for shelter, and seeding grasses and forbs (often beneath trees) for food. The Turquoise Parrot's nest is a cavity in a live or dead tree, stump or log, or even fence post often within 1-2 m of the ground. Hollows average about 0.5 m deep, with an entrance hole of 10 x 7 cm, and a nest chamber 12 x 9 cm in diameter (Garnett & Crowley 2000; Higgins 1999).	Atlas of NSW, Namoi – Liverpool Plains (B) CMA	<b>Moderate</b> – preferred habitat recorded.	<b>Yes</b> – as potential habitat was recorded an impact assessment has been undertaken in Appendix E.
<i>Daphoenositta chrysoptera</i>	Varied Sittella		V	The Varied Sittella inhabits most of mainland Australia except the treeless deserts and open grasslands. It inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. The Varied Sittella feeds on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees, and from small branches and twigs in the tree canopy. It builds a cup-shaped nest of plant fibres and cobwebs in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years (Department of Environment Climate Change and Water 2010b).	Atlas of NSW, Namoi – Liverpool Plains (B) CMA	<b>Moderate</b> – preferred habitat recorded.	<b>Yes</b> – as potential habitat was recorded an impact assessment has been undertaken in Appendix E.
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	M		Occurs in coastal areas including islands, estuaries, inlets, large rivers, inland lakes and reservoirs. Builds a huge nest of sticks in tall trees near water, on the ground on islands or on remote coastal cliffs (Pizzey & Knight 2007).	EPBC	Low – No preferred habitat recorded.	No.

Scientific name	Common Name	EPBC Act Status <sup>1</sup>	TSC Act Status <sup>2</sup>	Habitat	Data source <sup>3</sup>	Likelihood of occurrence <sup>4</sup>	Impact assessment required?
<i>Epthianura albifrons</i>	White-fronted Chat		E2	The White-fronted Chat occupies foothills and lowlands below 1000 m above sea level (North 1904; Higgins et al. 2001; Barrett et al. 2003). In New South Wales the White-fronted Chat occurs mostly in the southern half of the state, occurring in damp open habitats along the coast, and near waterways in the western part of the state (Higgins et al. 2001). Along the coastline, White-fronted Chats are found predominantly in saltmarsh vegetation although they are also observed in open grasslands and sometimes in low shrubs bordering wetland areas. (North 1904; Higgins et al. 2001; Barrett et al. 2003). The population in the Sydney Metropolitan Catchment Management Authority region is listed as Endangered (Office of Environment and Heritage 2012).	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.
<i>Hirundapus caudacutus</i>	White-throated Needletail	M		Occurs in airspace over forests, woodlands, farmlands, plains, lakes, coasts and towns. Breeds in the northern hemisphere and migrates to Australia in October-April (Pizzey & Knight 2007).	EPBC	Low – Likely to occur over study area on intermittent basis but no terrestrial habitat.	No.
<b>Fish</b>							
<i>Tandanus tandanus</i>	Eel-tailed Catfish		E2	Occupies a wide range of habitats including rivers, creeks, lakes, billabongs and lagoons. It inhabits flowing streams but prefers slow and still waters and can be found in clear or turbid water over substrates including mud, gravel and rock (NSW Fisheries Scientific Committee 2008).	Fisheries	Low – No preferred habitat recorded.	No.
<i>Maccullochella peelii</i>	Murray Cod	V		The Murray Cod occurs in lower reaches of the Murray-Darling Basin, where the water temperature is warm. The diverse range of habitats frequented by the Murray Cod includes slow moving rivers, murky billabongs and clear, rocky rivers (Threatened Species Scientific Committee 2011).	EPBC, Fisheries	Low – No preferred habitat recorded.	No.

Scientific name	Common Name	EPBC Act Status <sup>1</sup>	TSC Act Status <sup>2</sup>	Habitat	Data source <sup>3</sup>	Likelihood of occurrence <sup>4</sup>	Impact assessment required?
<i>Craterocephalus fluviatilis</i>	Murray Hardyhead	V	CE	Murray hardyhead live along the edges of slow-flowing lowland rivers, as well as in lakes, billabongs and backwaters. They are often found amongst aquatic weeds, in both fresh and quite saline waters. They were once widespread and abundant in the Murray and Murrumbidgee river systems in southern NSW and northern Victoria; however, they have suffered a serious population decline, and now seem to be limited to a few sites, mainly in northern Victoria. Since 2000, only one individual has been collected in extensive surveys in NSW (NSW Fisheries Scientific Committee 2008).	Fisheries	Low – No preferred habitat recorded.	No.
<i>Bidyanus bidyanus</i>	Silver Perch		V	The most abundant remaining natural population occurs in the central Murray River downstream of Yarrawonga Weir as well as several of its anabranches and tributaries (including the Edward River, an anabranch of the Murray which flows through Deniliquin, and the Murrumbidgee River). The central Murray population is considered secure and self-sustaining. There have also been reports of self-sustaining populations in other rivers, including the MacIntyre and Macquarie Rivers in northern NSW and the Warrego River in Queensland, mostly from recreational anglers. Little is currently known about the status of these populations (Department of Trade and Investment Regional Infrastructure and Services 2011).	EPBC, Fisheries	Low – No preferred habitat recorded.	No.
<b>Mammals</b>							
<i>Macropus dorsalis</i>	Black-striped Wallaby		E1	The preferred habitats for the species is forested country with a dense shrub layer including rainforest margins; Brigalow scrub, particularly in a phase of regrowth; open forest with a thick acacia or other shrub understorey; and lantana thickets (Strahan 1995).	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.

Scientific name	Common Name	EPBC Act Status <sup>1</sup>	TSC Act Status <sup>2</sup>	Habitat	Data source <sup>3</sup>	Likelihood of occurrence <sup>4</sup>	Impact assessment required?
<i>Onychogalea fraenata</i>	Bridled Nailtail Wallaby	E	E4	The species is recorded in habitats west of the Great Dividing Range in a mixture of tall shrubland and grassy woodland, and on the fertile soils which support open eucalypt forest and woodland, and Brigalow scrub. The species has a preference for scrub edges and adjacent vegetation, grazing and sheltering in the shrubland and grazing the grassy woodland {Strahan, 1995 #185}.	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.
<i>Bettongia penicillata penicillata</i>	Brush-tailed Bettong (SE Mainland)	X	E4	Occurs in open forests and woodlands with clumped, low understorey of tussock grasses or clumped low woody scrub. Feeds on underground fungi, bulbs, tubers, seeds, insects and resin (probably from Hakeas). Nest is an elaborate dome of grass, shredded bark that is built over a shallow depression scraped in the ground under a bush or other cover {Strahan, 1995 #185}.	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.
<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale		V	Largely arboreal it occurs in a range of habitats which have reliable rainfall (500-2000mm), but has preference for open dry sclerophyll forest on ridges (up to 600 m alt) with little/sparse ground cover. It nests in tree hollows and feeds at dusk on arthropods and small vertebrates (Strahan 1995).	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.
<i>Petrogale penicillata</i>	Brush-tailed Rock-wallaby	V	E1	Occurs in inland and sub-coastal south eastern Australia where it inhabits rock slopes. It has a preference for rocks which receive sunlight for a considerable part of the day. Windblown caves, rock cracks or tumbled boulders are used for shelter. Occur in small groups or "colonies" each usually separated by hundreds of metres (NSW National Parks and Wildlife Service 2003a).	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.

Scientific name	Common Name	EPBC Act Status <sup>1</sup>	TSC Act Status <sup>2</sup>	Habitat	Data source <sup>3</sup>	Likelihood of occurrence <sup>4</sup>	Impact assessment required?
<i>Vespadelus troughtoni</i>	Eastern Cave Bat		V	A cave-dwelling species found in eastern Australia from Cape York to NSW. They inhabit tropical mixed woodland and wet sclerophyll forests on the coast and the dividing range, but extend into drier forests on the western slopes (Churchill 1998). Breeding habitat includes caves, rocky outcrops, cliffs, scarps and old mine workings. Roosting habitat includes breeding habitat types and very small crevices in rocky areas or boulder piles or old mine workings and Fairy martin nests. Foraging habitat includes suitable native vegetation within 5km of breeding habitat (Office of Environment and Heritage 2011b).	Atlas of NSW, Namoi – Liverpool Plains (B) CMA	<b>Moderate</b> – preferred habitat recorded.	<b>Yes</b> – as potential habitat was recorded an impact assessment has been undertaken in Appendix E.
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle		V	Usually roosts in tree hollows in higher rainfall forests. Sometimes found in caves (Jenolan area) and abandoned buildings. Forages within the canopy of dry sclerophyll forest. It prefers wet habitats where trees are more than 20 metres high (Churchill 2008)	Previous assessment	<b>Moderate</b> – preferred habitat recorded.	<b>Yes</b> – as potential habitat was recorded an impact assessment has been undertaken in Appendix E.
<i>Mormopterus norfolkensis</i>	Eastern Freetail-bat		V	The Eastern Freetail-bat is found along the east coast from south Queensland to southern NSW. Occur in dry sclerophyll forest and woodland east of the Great Dividing Range. Roost mainly in tree hollows but will also roost under bark or in man-made structures {Churchill, 2008 #2904}.	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.
<i>Cercartetus nanus</i>	Eastern Pygmy-possum		V	Found in a range of habitats from rainforest through sclerophyll forest to tree heath. It feeds largely on the nectar and pollen of banksias, eucalypts and bottlebrushes and sometimes soft fruits. It nests in very small tree holes, between the wood and bark of a tree, abandoned birds' nests and shredded bark in the fork of trees (Turner & Ward 1995).	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.

Scientific name	Common Name	EPBC Act Status <sup>1</sup>	TSC Act Status <sup>2</sup>	Habitat	Data source <sup>3</sup>	Likelihood of occurrence <sup>4</sup>	Impact assessment required?
<i>Phascolarctos cinereus</i>	Koala (NSW, ACT & QLD - excluding SE QLD)	V	V	Found in sclerophyll forest. Throughout New South Wales, Koalas have been observed to feed on the leaves of approximately 70 species of eucalypt and 30 non-eucalypt species. However, in any one area, Koalas will feed almost exclusively on a small number of preferred species. The preferred tree species vary widely on a regional and local basis. Some preferred species in NSW include Forest Red Gum <i>Eucalyptus tereticornis</i> , Grey Gum <i>E. punctata</i> , Monkey Gum <i>E. cypellocarpa</i> and Ribbon Gum <i>E. viminalis</i> . In coastal areas, Tallowwood <i>E. microcorys</i> and Swamp Mahogany <i>E. robusta</i> are important food species, while in inland areas White Box <i>E. albens</i> , Bimble Box <i>E. populnea</i> and River Red Gum <i>E. camaldulensis</i> are favoured (NSW National Parks and Wildlife Service 1999b, 2003b). Hawks Nest and Tea Gardens Population and population in the Pittwater LGA listed as Endangered under the NSW TSC Act.	Atlas of NSW, EPBC, Namoi – Liverpool Plains (B) CMA	<b>Moderate</b> – preferred habitat recorded.	<b>Yes</b> – as potential habitat was recorded an impact assessment has been undertaken in Appendix E.
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V	V	Occurs in moderately wooded habitats, mainly in areas with extensive cliffs and caves and roosts in caves, mine tunnels and the abandoned, bottle-shaped mud nests of Fairy Martins (Churchill 1998; Office of Environment and Heritage 2011b). Breeding habitat (maternity roosts) is located in roof domes in sandstone caves (Office of Environment and Heritage 2011b). Thought to forage below the forest canopy for small flying insects (Churchill 1998).	EPBC, Namoi – Liverpool Plains (B) CMA	<b>Moderate</b> – preferred habitat recorded.	<b>Yes</b> – as potential habitat was recorded an impact assessment has been undertaken in Appendix E.
<i>Rattus villosissimus</i>	Long-haired Rat	V	E4	Predominately found in mesic and densely vegetated habitats in north-western NSW, with more scattered populations throughout western NSW. With adequate rainfall or flooding, plagues of Long-haired Rat can extend from these areas southwards along river channels and inhabit most areas. After water supply ceases, the population can die off quickly (Department of Environment and Climate Change 2007).	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.

Scientific name	Common Name	EPBC Act Status <sup>1</sup>	TSC Act Status <sup>2</sup>	Habitat	Data source <sup>3</sup>	Likelihood of occurrence <sup>4</sup>	Impact assessment required?
<i>Chalinolobus picatus</i>	Little Pied Bat		V	The Little-Pied Bat is found in inland Queensland and NSW (including Western Plains and slopes) extending slightly into South Australia and Victoria and has been recorded in dry open forest, open woodland, Mulga woodlands, chenopod shrublands, Callitris forest and mallee (Churchill 1998; Office of Environment and Heritage 2011a). The species roosts and breeds in tree hollows, fissures or cracks, buildings, powerpoles, fenceposts, caves, cliff crevices, mine shafts and tunnels. Roost sites in caves are usually warm and dry but the species can tolerate roost temperatures of more than 40 degrees Celsius (Office of Environment and Heritage 2011a).	Namoi – Liverpool Plains (B) CMA	<b>Moderate</b> – preferred habitat recorded.	<b>Yes</b> – as potential habitat was recorded an impact assessment has been undertaken in Appendix E.
<i>Pseudomys australis</i>	Plains Rat		V	The species lives in complex burrow systems dug into hard rock gibber or the softer soil built up around the bases of the stunted bushes on the inland slopes of the Great Dividing Range (Strahan, 1995).	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.
<i>Pseudomys pilligaensis</i>	Pilliga Mouse	V	V	Restricted to unique habitat known as Pilliga scrub, which occurs on deep, low nutrient sand in the Pilliga region of NSW (south of Narrabri). Specifically, Pilliga mouse has been found in areas dominated by broombush, or with Acacia burrowii shrub layer and Corymbia trachyphloia overstory. Both of these habitats had relatively high species richness with moist groundcover and medium to high shrub cover. An additional habitat for the Pilliga Mouse is recently burnt moist gullies with high cover of low grasses and sedges, yet low cover of shrubs (Department of Environment and Climate Change 2007).	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.



Scientific name	Common Name	EPBC Act Status <sup>1</sup>	TSC Act Status <sup>2</sup>	Habitat	Data source <sup>3</sup>	Likelihood of occurrence <sup>4</sup>	Impact assessment required?
<i>Aepyprymnus rufescens</i>	Rufous Bettong		V	Distribution: From Cooktown in north Queensland, to north-east NSW, where it occurs east of the Dividing Range. In Queensland, it still occurs on both sides of the Great Divide. Macrohabitat: Found in a variety of forest types from wet sclerophyll to dry open woodland, where grass tussocks or fallen timber are present. Also known to occupy a mosaic of open forest and grasslands. Microhabitat: It appears to prefer a more open forest structure, with an sparse shrub layer and a diverse ground cover. Builds nests in grass tussocks and under logs. Strongly associated with dry sclerophyll forest particularly those dominated by Spotted Gum (NSW National Parks and Wildlife Service 1999f).	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.
<i>Nyctophilus corbeni</i> (syn. <i>N. timoriensis</i> )	South-eastern Long-eared Bat (Corben's Loong-eared Bat & Greater Long-eared Bat)	V	V	The species has a limited distribution that is restricted around the Murray-Darling Basin in south-eastern Australia (Turbill & Ellis 2006). It occurs in far eastern South Australia, in areas north of the Murray River (Turbill <i>et al.</i> 2008). It occurs in a range of inland woodland vegetation types being most abundant in vegetation with a distinct canopy and a dense cluttered shrub layer (Dominelli 2000; Ellis <i>et al.</i> 1999; Lumsden & Bennet 2003; Parnaby 1995; Turbill & Ellis 2006). Roosting and breeding habitat includes in tree hollows and under loose bark in arid and semi-arid Australia (Strahan 1995) and forages in the understorey of woodlands and open savannah and swamps (Churchill 1998).	Atlas of NSW, EPBC, Namoi – Liverpool Plains (B) CMA	<b>Moderate</b> – preferred habitat recorded.	<b>Yes</b> – as potential habitat was recorded an impact assessment has been undertaken in Appendix E.

Scientific name	Common Name	EPBC Act Status <sup>1</sup>	TSC Act Status <sup>2</sup>	Habitat	Data source <sup>3</sup>	Likelihood of occurrence <sup>4</sup>	Impact assessment required?
<i>Dasyurus maculatus maculatus</i>	Spotted-Tailed Quoll (Southern Subspecies)	E	V	Occurs from the Bundaberg area in south-east Queensland, south through NSW to western Victoria and Tasmania. In NSW, it occurs on both sides of the Great Dividing Range and north-east NSW represents a national stronghold (NSW National Parks and Wildlife Service 1999f). Occurs in wide range of forest types, although appears to prefer moist sclerophyll and rainforest forest types, and riparian habitat. Most common in large unfragmented patches of forest. It has also been recorded from dry sclerophyll forest, open woodland and coastal heathland, and despite its occurrence in riparian areas, it also ranges over dry ridges. Nests in rock caves and hollow logs or trees. Feeds on a variety of prey including birds, terrestrial and arboreal mammals, small macropods, reptiles and arthropods (NSW National Parks and Wildlife Service 1999d, 1999f).	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.
<i>Petaurus norfolcensis</i>	Squirrel Glider		V	The Squirrel Glider is sparsely distributed along the east coast and immediate inland districts from western Victoria to north Queensland. In NSW it is found in dry sclerophyll forest and woodland but not found in dense coastal ranges, inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. It is associated with mixed tree species stands with a shrub or Acacia midstorey. It requires abundant tree hollows for refuge and nest sites and feeds on gum of acacias, eucalypt sap and invertebrates (NSW National Parks and Wildlife Service 1999e).	Namoi – Liverpool Plains (B) CMA	<b>Moderate</b> – preferred habitat recorded.	<b>Yes</b> – as potential habitat was recorded an impact assessment has been undertaken in Appendix E.
<i>Sminthopsis macroura</i>	Stripe-faced Dunnart		V	The species are found in many habitats in the arid and semi-arid parts of Australia; they occur in low shrublands of saltbush and bluebush, in tussock grasslands on clay, sandy or stony soils, among sparse shrublands and on low, shrubby, rocky ridges. Dense populations occur in tussock grasslands. The species shelters in cracks in the soil or under rocks and logs, probably in nests (Strahan 1995).	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.

Scientific name	Common Name	EPBC Act Status <sup>1</sup>	TSC Act Status <sup>2</sup>	Habitat	Data source <sup>3</sup>	Likelihood of occurrence <sup>4</sup>	Impact assessment required?
<i>Petaurus australis</i>	Yellow-bellied Glider		V	Restricted to tall, mature eucalypt forest in high rainfall areas of temperate to sub-tropical eastern Australia. Feeds on nectar, pollen, the sap of eucalypts and sometimes insects. Preferred habitats are productive, tall open sclerophyll forests where mature trees provide shelter and nesting hollows and year round food resources are available from a mixture of eucalypt species (NSW National Parks and Wildlife Service 1999g, 2003c).	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat		V	This species is widespread through tropical Australia and migrates to southern Australia in summer. Occurs in eucalypt forest where it feeds above the canopy and in mallee or open country where it feeds closer to the ground. Generally a solitary species but sometimes found in colonies of up to 10. It roosts and breeds in tree hollows but has also been recorded roosting under exfoliating bark, in burrows of terrestrial mammals, in soil cracks and under slabs of rock and in the nests of bird and sugar gliders (Churchill 2008).	Atlas of NSW, Namoi – Liverpool Plains (B) CMA	<b>Moderate</b> – preferred habitat recorded.	<b>Yes</b> – as potential habitat was recorded an impact assessment has been undertaken in Appendix E.
<b>Reptiles</b>							
<i>Underwoodisaurus sphyrurus</i>	Border Thick-tailed Gecko	V	V	Found only on the tablelands and slopes of northern NSW and southern Queensland, reaching south to Tamworth and west to Moree. Most common in the granite country of the New England Tablelands. It is found on rocky hills with dry open eucalypt forest or woodland. It favours forest and woodland areas with boulders, rock slabs, fallen timber and deep leaf litter (Department of Environment and Conservation 2005b; NSW National Parks and Wildlife Service 2002b; Royal Botanic Gardens 2005).	EPBC, Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.
<i>Hoplocephalus bitorquatus</i>	Pale-headed Snake		V	A partly arboreal, nocturnal species found in a range of habitats from rainforest and wet sclerophyll forest to the drier eucalypt forests of the western slopes. Feeds largely on frogs and lizards (Cogger 2000).	Namoi – Liverpool Plains (B) CMA	<b>Moderate</b> – preferred habitat recorded.	<b>Yes</b> – as potential habitat was recorded an impact assessment has been undertaken in Appendix E.

Scientific name	Common Name	EPBC Act Status <sup>1</sup>	TSC Act Status <sup>2</sup>	Habitat	Data source <sup>3</sup>	Likelihood of occurrence <sup>4</sup>	Impact assessment required?
<i>Aprasia parapulchella</i>	Pink-tailed Worm Lizard (syn. Pink-tailed Legless Lizard)	V	V	This lizard is known from four sites in eastern Australia: near Canberra in the ACT, Tarcutta and Bathurst in NSW, and near Bendigo in Vic. In general, lizards occur in open grassland habitats that have a substantial cover of small rocks (Osbourne & Jones 1995). Lizards also show a preference for sunny aspects, avoiding S facing slopes. Some specimens have been collected from grassland sites that appear not to support any native grasses and several animals have been found on the edge of <i>Callitris enlicheri</i> woodland and <i>Eucalyptus macrorhyncha</i> woodland (Barrer 1992). A burrowing species, it is usually found under rocks on well-drained soil and in ant nests, occasionally with several individuals found under the same rock (Swan <i>et al.</i> 2004).	EPBC, Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.

Notes:

1. Listed as Vulnerable (V), Endangered (E) or Critically Endangered (CE) under the EPBC Act.
2. Listed as an Endangered Population (E2), Vulnerable (V), Endangered (E1), Critically Endangered (CE) or Extinct (E4) under the TSC Act.
3. EPBC = EPBC Act Protected Matters Search Tool Report  
Atlas of NSW Wildlife = Office of Environment and Heritage Bionet Atlas – 10 km buffer of study area  
Fisheries = Department of Primary Industries Fishing and Aquaculture Records Viewer  
Namoi CMA = OEH Namoi CMA Liverpool Range (Part B) regional search
4. Refer to Section 4 of the main report

Fauna species considered extinct or greatly outside of their known distribution (such as ) have been removed from the above table.

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# Appendix E

Significance assessments



## Appendix E – Significance assessments

Idemitsu Boggabri Coal Pty Limited (Boggabri Coal) is applying for a project area Modification to its current approval PA 09\_0182.

Section 5A of the *Environmental Planning & Assessment Act 1979* (EP&A Act) requires that a 7 part test is undertaken to assess the likelihood of significant impact upon threatened species, populations or ecological communities under the *Threatened Species Conservation Act 1995* (TSC Act 1995) (Department of Environment and Climate Change 2007). Under Section 5A of the EP&A Act requires that a 7 part test is undertaken to assess the likelihood of significant impact upon threatened aquatic species, populations or ecological communities listed under Schedule 4, Part 3 of the *Fisheries Management Act 1994* (FM Act) (NSW Department of Primary Industries 2008).

For threatened biodiversity under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act 1999) significance assessments have been completed in accordance with the *Matters of National Environmental Significance, Significant Impact Guidelines 1.1* (Department of Environment 2013). Species listed under both the TSC Act and the EPBC Act has been assessed using both assessment guidelines separately.

The following assessments were undertaken to consider impacts of works associated with the proposed Modification upon species, populations or communities with a moderate or greater likelihood of occurring within the proposed Modification area. A total of 18.9 ha of native vegetation will require removed as part of the proposed modification.

No threatened species or populations of plant or animal were recorded within proposed Modification Area. The proposed Modification study area did however contain three threatened ecological community listed under both the TSC Act and EPBC Act and potential habitat for four threatened species of plant and 28 species of animal. One threatened ecological community listed under the FM Act was recorded.

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## 1. Weeping Myall Woodland

### Status

Weeping Myall Woodland is an Endangered Ecological Community listed under the EPBC Act and as Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Penneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions under the TSC Act.

### Distribution, habitat and ecology

This community occurs as scattered remnants within the alluvial plains of the Murray-Darling river system within the Local Government Areas of Berrigan, Bland, Bogan, Carrathool, Conargo, Coolamon, Coonamble, Corowa, Forbes, Gilgandra, Griffith, Gwydir, Inverell, Jerilderee, Lachlan, Leeton, Lockhart, Moree Plains, Murray, Murrumbidgee, Narrabri, Narranderra, Narromine, Parkes, Urana, Wagga Wagga and Warren.

This community canopy layer is dominated by *Acacia pendula* (Weeping Myall) as low sparse woodland that reaches 10 m in height. The community typically occurs on textured red or brown alluvial soils that received approximately 375-500 mm mean annual rainfall (Office of Environment and Heritage 2015).

### Threats

Threats for this EEC include (Office of Environment and Heritage 2015):

- Clearing and fragmentation associated with cropping
- Overgrazing by feral and domestic animals
- Weed invasion
- Herbivory by the processionary caterpillar *Ochrogaster lunifer* (Bag-shelter moth).

### Specific impacts

The field surveys confirmed that 0.1 ha of Weeping Myall Woodland consistent with the endangered TSC Act and EPBC Act community will be impacted by the proposed Modification.

The proposed Modification would have indirect impacts on the Weeping Myall Woodland associated with utilisation of existing access tracks that already segment the community. Impacts may include increased exposure to exotic species and occasional disturbance of vegetation immediately adjacent the existing road.

#### 1.1 TSC Act significance assessment

**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**

Not applicable.

**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**

Not applicable.

**In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:**

- (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**

The proposed Modification will result in the indirect disturbance to 0.1 ha of Weeping Myall Woodland.

The cumulative impact will reduce this community to a smaller extent but unlikely to place the local occurrence at risk of extinction due to the small area and nature of the indirect impacts that will occur to the Weeping Myall Woodland community.

The proposed Modification is not considered significant and is unlikely to place a local occurrence at risk of extinction.

- (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**

It is unlikely that the composition will be substantially or adversely modified as a result of the proposed Modification. Management and mitigation measures outlined in the Continuation of Boggabri Coal Mine – Biodiversity Impact Assessment (Parsons Brinckerhoff 2010b), Modification 3 (Parsons Brinckerhoff 2013) and Modification 4 (Parsons Brinckerhoff 2014), if adhered to, should minimise any impacts to abiotic characteristics that affect composition.

Connectivity will remain relatively unchanged within the locality - continuing current genetic flow and dispersal mechanisms.

**In relation to the habitat of a threatened species, population or ecological community:**

- (i) the extent to which habitat is likely to be removed or modified as a result of the action proposed**

The proposed Modification will result in the indirect disturbance to 0.1 ha of Weeping Myall Woodland. This is in addition to the area being removed for the mine expansion (BCEP).

- (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**

The Weeping Myall Woodland EEC is a highly fragmented community across its former extent. The community already exists as a fragmented patch that runs immediately along Therribri Road in Boggabri which is intersected by the exiting access road into the agriculture residence. Although this remnant is already fragmented it does play an important role in maintaining linkages for both flora and fauna movement and genetic exchange across modified landscape.

The proposed Modification would have indirect impacts on 0.1 ha which may reduce the occupancy area of the EEC. This is considered unlikely to contribute significantly to the fragmentation currently experienced by the EEC.

- (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.**

The proposed Modification will result in the indirect disturbance to 0.1 ha of Weeping Myall Woodland. This remnant of Weeping Myall Woodland already exists as a fragmented remnant bounded by Therribri Road and other arterial unsealed access tracks. As a result the proposed Modification is considered unlikely to cause significant fragmentation or isolation. This habitat is not considered to be important to the long-term survival of the EEC in the locality with large areas of this community occurring in the wider region of equal or greater value.

**Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)**

The Office of Environment and Heritage maintains a register of critical habitat. The land within the subject site is not listed as a critical habitat and it is not considered to be critical to the survival of Weeping Myall Woodland.

**Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan**

A recovery plan has not been prepared for the Weeping Myall Woodland ecological community by the Office of Environment and Heritage. The Office of Environment and Heritage is developing a targeted strategy for the management of this endangered ecological community under the Saving Our Species program (SOS). In the interim the management actions outlined in Table 1.1 have been developed. The project is unlikely to significantly affect these actions.

**Table 1.1 Management actions for Weeping Myall Woodlands**

Management action	Likely to be impacted upon by the proposed modification
Identify and develop recovery actions that are necessary for the conservation of this species.	No
Survey key identified remnants on public land in order to identify remnant in high condition and protect sites as demonstration areas for EEC management.	No
Review and delineate distribution of the community from existing vegetation maps.	No

**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**

The proposed Modification constitutes the key threatening processes of clearing on native vegetation. It may also encourage the invasion of native plant communities by exotic perennial grasses. The proposed Modification has been designed to avoid existing trees and stands of native vegetation, existing trees will be retained, were possible.

**Conclusion**

The proposed Modification will result in the indirect disturbance to 0.1 ha of Weeping Myall Woodland EEC. The Weeping Myall Woodland recorded on site exists as a fragmented patch which is already being indirectly impacted upon by existing road infrastructure in the immediate area. Whilst the overall occupancy area will be reduced, it is unlikely that indirect impacts associated with the Modification on this small patch will contribute significantly to fragmentation or modify the composition so that the EEC is placed at risk of extinction. It will however, add incrementally to loss of this EEC.



## 1.2 EPBC Act significance assessment

The following assessment has been completed in accordance with the EPBC Act Policy Statement 1.1 Significant Impact Guidelines (Department of Environment 2013) and is related to those remnants of the endangered ecological community as defined by the EPBC Act Policy Statement – Weeping Myall Woodlands (Department of the Environment Water Heritage and the Arts 2009).

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

### **Reduce the extent of an ecological community**

The proposed Modification would result in indirect impacts on Weeping Myall Woodland within the Modification study area. A total of 0.1 ha of the EPBC listed community would be disturbed. As this is a relatively small amount and given the nature of works in the vicinity impacts associated with proposed Modification are unlikely to be significant.

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

The proposed Modification within the EPBC listed community may result in minor increases in fragmentation. The Weeping Myall Woodland recorded on site is highly fragmented and disturbed as a result of past land uses which include road construction, grazing and other agricultural practices. Given the highly fragmented state of the community this incremental increase is unlikely to be significant.

### **Adversely affect habitat critical to the survival of an ecological community**

No critical habitat has been listed for the Weeping Myall Woodland ecological community under the *Environment Protection and Biodiversity Conservation Act 1999* (Department of the Environment and Heritage 2006b).

Habitat critical to the survival of an ecological community may, however, also include areas that are not listed on the Register of Critical Habitat if they are necessary:

- for activities such as foraging, breeding, roosting, or dispersal
- for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators)
- to maintain genetic diversity and long term evolutionary development, or
- for the reintroduction of populations or recovery of the species or ecological community (Department of Environment 2013).

The area of woodland to be disturbed currently occurs as roadside remnant vegetation along Therribri Road. This vegetation has been heavily degraded and is subjected to weed invasion as a result of edge effects. Nevertheless given that over 89% of the original extent has already been removed all representations of the community are important (Eco Logical Australia 2008). However, it is unlikely that the area within the proposed Modification Area is critical to the survival of the community compared to larger more intact areas.

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

Given the small amount of Weeping Myall Woodland to be disturbed (0.1 ha), it is unlikely this would have a substantial alteration to groundwater levels or surface water drainage. In addition, the soil will not be significantly impacted.

**Will the action cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of to date functionally important species for example through regular burning or flora or fauna harvesting?**

The species composition of the Weeping Myall Woodland to be removed is believed to be similar to that elsewhere in the patch. It is unlikely that disturbing 0.1 ha of the vegetation would cause a substantial change in the species composition of the vegetation elsewhere within the patch.

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

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

Much of the landscape surrounding the proposed Modification study area is already weed invaded. With the implementation of appropriate weed management practices (such as those detailed in Section 6 of the main Ecological Assessment), the proposed Modification study area will not significantly increase weed levels from that which already exist in the landscape and within the Weeping Myall Woodland patch.

**Will the action interfere with the recovery of an ecological community**

The disturbance or removal of any occurrence of Weeping Myall Woodland will contribute to the continual decline of the community, and therefore will interfere with its recovery. However given the small size to be removed this is not likely to be significant.

**Conclusions**

The proposed Modification would result in a disturbance of Weeping Myall Woodland by 0.1 ha. Although the loss of 0.1 ha is not significant in itself due to the small size, this contributes incrementally into loss of this community.

Impacts to the woodland area can be minimised through design by utilising existing tracks and avoiding woodland stands where possible. The proposed Modification will utilise the existing access track and likely indirect impacts that are unlikely to have significant impacts on the Weeping Myall Woodland EEC.

## 2. Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Darling River

### Status

The Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Darling River is listed as an Endangered Ecological Community under the *Fisheries Management Act 1994* (FM Act).

### Distribution, habitat and ecology

The lowland catchment of the Darling River ecological community includes all native fish and aquatic invertebrates within all natural creeks, rivers, streams, and associated lagoons, billabongs, lakes, flow diversions to anabranches, and the floodplains of the Darling River including Menindee Lakes and the Barwon River. Specifically, these areas include the main Barwon-Darling channel from Mungindi (Qld-NSW border) to the confluence with the Murray River, the arid zone intermittent intersections streams (Warrego, Culgoa, and Narran Rivers), Border Rivers (Macintyre, Severn and Dumaresq Rivers), and regulated tributaries of the Gwydir, Namoi, Macquarie, Castlereagh, and Bogan Rivers (NSW Fisheries 2003).

### Threats

Threats identified by the NSW Department of Primary Industries for this EEC include:

- Modification of natural flows as a result of river regulation (dams, weirs etc.), leading to reduced habitat quality and complexity, loss of spawning cues, and reduced opportunities for dispersal and migration of aquatic species.
- Spawning failures and habitat loss resulting from cold water releases from dams.
- Degradation of the riparian (riverbank) zone through clearing of native vegetation and stock trampling, leading to loss of shelter and increased sedimentation.
- Clearing of floodplain vegetation for agriculture also increases sedimentation, and reduces carbon inputs to the river, which are an important food source for instream invertebrates.
- Removal of in-stream large woody debris, which is an important habitat component and territory marker for many fish and invertebrates.
- Predation, competition, diseases and habitat modification associated with introduced fish species, such as carp, goldfish, redfin perch, mosquitofish and the snail *Physa acuta*.
- Agricultural practices, such as irrigation, clearing, grazing and the use of fertilisers and pesticides, which affect water quality.
- Over-fishing has probably contributed to declines in some fish species, such as Murray cod and golden perch. Illegal fishing activities, together with hooking injuries in accidentally caught fish, still pose a threat to some species.

### Specific impacts

The Namoi River and the Namoi River Floodplain occurs within the proposed modification study area and the Namoi River is part of this EEC. The field surveys confirmed that 1.3 ha of low to moderate condition River Red Gum Riparian Woodlands and Forests are consistent with this endangered FM Act community and will be impacted by the proposed Modification.

The proposed Modification would have direct and indirect impacts on the River Red Gum Riparian Woodlands and Forests associated with utilisation of existing access tracks that already segment the community. Impacts may include increased exposure to exotic species and occasional disturbance of vegetation immediately adjacent the existing road.

## 2.1 FM Act Significance assessment

**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**

Not applicable.

**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**

Not applicable.

**In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:**

- (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**

The Namoi River and the surrounding associated floodplain fall within the broad catchment, and therefore, form part of this ecological community. The proposed modification will remove 1.3 ha of vegetation.

The project would require minor modification of riparian vegetation of the Namoi River and the associated floodplain to facilitate the proposed modification. However, the Namoi River and the associated floodplains do not contain unique or important assemblages of species and are in poor condition. As such the impacts on this community are not considered to be significant.

- (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**

It is unlikely that the composition will be substantially or adversely modified as a result of the proposed Modification. Management and mitigation measures outlined in the Continuation of Boggabri Coal Mine – Biodiversity Impact Assessment (Parsons Brinckerhoff 2010b), Modification 3 (Parsons Brinckerhoff 2013) and Modification 4 (Parsons Brinckerhoff 2014), if adhered to, should minimise any impacts to abiotic characteristics that affect composition.

The proposed modification will remove some of the riparian vegetation associated with Namoi River floodplain which is likely to add to the overall disturbance regimes within the Namoi River. However, the waterways within the modification study area are currently affected by riparian vegetation clearance, erosion and sedimentation, alteration of flow and bank instability due to stock access and riparian removal. Given that suitable habitat exists up and downstream of the watercourses, no long-term impacts from the proposed modification, and sufficient erosion and sediment controls are implemented in accordance with best practice management (Department of Environment and Climate Change 2008b). It is therefore unlikely that the proposed modification will place this community at risk of extinction.

**In relation to the habitat of a threatened species, population or ecological community:**

- (i) the extent to which habitat is likely to be removed or modified as a result of the action proposed**

The proposed modification will remove approximately 1.3 ha of River Red Gum Riparian Woodland and Forests vegetation which is commensurate with this community. This is in addition to the area being removed for the mine expansion (BCEP).

**(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**

The Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Darling River EEC is a highly fragmented and disturbed community across its former extent. The community already exists as a fragmented patch that exists as remanent riparian vegetation along the Namoi River and its floodplain. Although this remnant is already fragmented it does play an important role in maintaining linkages for both flora and fauna movement and genetic exchange across modified landscape.

The proposed Modification would have indirect impacts on 1.3 ha which may reduce the occupancy area of the EEC. This is considered unlikely to contribute significantly to the fragmentation currently experienced by the EEC.

**(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.**

The proposed Modification will result in the indirect disturbance to 1.3 ha of Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Darling River. This remnant of already exists as a fragmented patch that exists as remanent riparian vegetation along the Namoi River and its floodplain. As a result the proposed Modification is considered unlikely to cause significant fragmentation or isolation. This habitat is not considered to be important to the long-term survival of the EEC in the locality with large areas of this community occurring in the wider region of equal or greater value.

**Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)**

The Department of Primary Industries maintains a register of critical habitat. The land within the subject site is not listed as a critical habitat and it is not considered to be critical to the survival of this EEC. The Department of Primary Industries maintains a register of critical habitat. Water bodies within the subject site are generally in poor condition, are not listed as a critical habitat and are not considered critical to the survival of the ecological community.

**Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan**

A recovery plan has not been prepared for the Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Darling River ecological community by the Department of Primary Industries. The Department of Primary industries have developed Priority Action Statements and recovery strategies for this community. These are outlined in Table 2.1 below. The proposed modification is unlikely to significantly affect these actions.

**Table 2.1 Recovery strategies and Priority Action Statements**

Priority Action Statement	Recovery Strategy	Priority
Advice to consent and determining authorities	Provide local councils, government agencies and Local Land Service's (LLS's) with resource materials and training regarding habitat protection and threatened species provisions of the <i>NSW Fisheries Management Act 1994</i> to support planning, determination, impact assessment and concurrence decision making processes. This may include impact assessment guidelines, mitigating prescriptions, offsets, and generic consent conditions.	Medium
	Distribute guidelines regarding flow requirements of key characteristic species to relevant Natural Resource Management (NRM) agencies.	Medium

Priority Action Statement	Recovery Strategy	Priority
Collate and review existing information	Compile existing records of characteristic native species occupying the Endangered Ecological Community (EEC) and map their current known distribution.	Medium
Community and stakeholder liaison, awareness and education	Develop and disseminate advisory materials on priority issues relevant to the recovery of the EEC ( <b>Medium priority</b> ).	Medium
	Actively encourage community involvement in aspects of the recovery of the EEC including for example, research, reporting, monitoring and management activities ( <b>Medium priority</b> ).	Medium
	Encourage community reporting of key species through the Protected, Threatened and Pest Species Sighting Sheet Program ( <b>Low priority</b> ).	Low
Compliance / enforcement	Implement and enforce relevant fishing regulations (e.g. seasonal closures, bag and size limits, gear restrictions etc.) ( <b>High priority</b> ).	High
	Undertake and continue targeted enforcement activities by regional Fisheries Officers ( <b>High priority</b> ).	High
	Identify and implement measures to improve the reporting of illegal activities and enhance feedback to stakeholders (such as anglers) on actions taken ( <b>Medium priority</b> ).	Medium
Enhance, modify or implement NRM planning processes to minimize adverse impacts on threatened species	Ensure information on the location of characteristic native species within the EEC is considered in state and national management programs for introduced species and diseases ( <b>Medium priority</b> ).	Medium
Habitat protection	Review regulatory and voluntary incentive based mechanisms available in the EEC to enhance protection for key habitat areas and apply as required. This may include the use of critical habitat provisions, aquatic reserves, environmentally sensitive land provisions, voluntary conservation agreements etc ( <b>Medium priority</b> ).	Medium
Habitat rehabilitation	Advocate appropriate allocation and improved management of environmental flows, particularly in areas known to support remnant natural populations of threatened species and reduced diversion volumes during the spawning and larval period ( <b>High priority</b> ).	High
	Improve fish passage at major regulating structures through existing programs ( <b>High priority</b> ).	High
	Identify and prioritise the most significant barriers to fish passage within the geographic area of the EEC having regard to relevant existing programs ( <b>Medium priority</b> ).	Medium
	Work with LLS's to encourage implementation of relevant aquatic habitat rehabilitation / threatened species actions outlines in catchment action plans ( <b>Medium priority</b> ).	Medium
	Determine key threatening processes within each zone and prioritise zones for action according to management capability, ecological function and threatened species considerations ( <b>Medium priority</b> ).	Medium
	Work with local councils and relevant government agencies to mitigate the impacts of cold water pollution within the EEC ( <b>Medium priority</b> ).	Medium
	Develop a NSW Cold Water Pollution Program including a program of works and funding options ( <b>Medium priority</b> ).	Medium

Priority Action Statement	Recovery Strategy	Priority
	Support and assist community groups, NRM authorities, local councils and landholders to protect and rehabilitate riparian vegetation and instream habitats along key river reaches where populations of threatened species are known to occur <b>(Medium priority)</b> .	Medium
	Develop new projects in consultation with community groups, relevant natural resource management agencies, local councils and landholders to address key water quality issues within the EEC (e.g. sedimentation, algal blooms, salinity, and agricultural chemicals) <b>(Medium priority)</b> .	Medium
Pest eradication and control	Assess information on current management techniques for pest species and their application in the EEC <b>(Medium priority)</b> .	Medium
	Reduce the risk of disease and pest species introduction from aquaculture operations by ensuring compliance with the Hatchery Quality Assurance Program and appropriate grow-out facility permit conditions <b>(Medium priority)</b> .	Medium
	Monitor populations of introduced fish species at key sites and undertake eradication and/or control programs where appropriate <b>(Medium priority)</b> .	Medium
Research / monitoring	Develop and implement a targeted investigation program to quantify the distribution and abundance of native species in the EEC, focusing on threatened species and populations. The investigation program should form the basis for monitoring over time <b>(High priority)</b> .	High
	Develop and implement research projects investigating key areas of the biology and ecology of characteristic native species within the EEC to inform the recovery program. Projects are to include for example, investigation into flow requirements, taxonomic status, levels of genetic diversity, migration, habitat requirements, factors critical to the successful spawning and recruitment, interactions between trophic guilds, interactions with introduced species and environmental tolerances <b>(High priority)</b> .	High
	Develop guidelines and principles to help determine the ecological needs of key characteristic species within the EEC and the flow levels required to complete their lifecycle <b>(High priority)</b> .	High
	Develop and implement a research program to investigate the impacts of introduced species and diseases that affect native species occupying the EEC, and assess their potential impacts <b>(High priority)</b> .	High
	Develop reference criteria for each river management zone to allow meaningful insights into ecological condition and changes over time to be made <b>(High priority)</b> .	High
	Review the available evidence on the impacts of fishing activities on characteristic native species within the EEC, and the current fishing regulations to determine the need for changes <b>(High priority)</b> .	High
	Investigate available evidence on the impacts of commercial and recreational fishing activities on key native species in the EEC <b>(High priority)</b> .	High
	Disseminate results from investigation and research activities to inform recovery and threat abatement efforts for threatened species and populations in the EEC <b>(Medium priority)</b> .	Medium
	Investigate the contribution of smaller impoundments (e.g. weir pools) to reductions in river temperatures, and low-cost options for their management <b>(Medium priority)</b> .	Medium
	Identify the characteristic native species likely to be sensitive to cold water pollution and the extent of instream habitat affected <b>(Medium priority)</b> .	Medium

Priority Action Statement	Recovery Strategy	Priority
	Design and implement targeted monitoring programs linked to river management zones to enable the effectiveness of recovery actions to be evaluated <b>(Medium priority)</b> .	Medium
	Identify opportunities for collaboration on monitoring and evaluation activities in the EEC <b>(Medium priority)</b> .	Medium
	Investigate the impacts of water diversion on fish larvae <b>(Low priority)</b> .	Low
Stocking / translocation	Implement the NSW Hatchery Quality Assurance Program and the NSW Freshwater Fish Stocking Fishery Management Strategy to ensure that harvest and conservation stocking activities are carried out in a manner that will not adversely impact wild populations of native fish <b>(High priority)</b> .	High
	Where appropriate enhance and/or initiate conservation stocking programs for threatened species within the EEC <b>(Medium priority)</b> .	Medium
Survey / mapping	Develop mapping products for stakeholders regarding the distribution and abundance of native species in the EEC to assist in targeting habitat rehabilitation projects <b>(High priority)</b> .	High
	Establish a system of distinct river management zones for the EEC, consistent with other strategies and plans (where possible), in conjunction with stakeholders including LLS's and natural resource management agencies <b>(Medium priority)</b> .	Medium

**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**

There is currently one key threatening process listed under the FM Act which affects this EEC being, degradation of native riparian vegetation along New South Wales water courses. The proposed Modification has been designed to avoid existing trees and stands of vegetation, existing trees will be retained, were possible.

**Conclusion**

The proposed Modification will result in the disturbance of 1.3 ha of low to moderate condition Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Darling River EEC. Whilst this small area will add incrementally to the loss of this community it is small in comparison to larger areas of this community present in the wider region. Whilst the overall occupancy area will be reduced, it is unlikely that removal of this small patch will contribute significantly to fragmentation or modify the composition so that the EEC is placed at risk of extinction. It will however, add incrementally to loss of this EEC.



### 3. Plains Grassland

#### Status

The Natural grasslands on basalt and fine-textured alluvial plains of northern NSW and southern Queensland is listed as a Critically Endangered Ecological Community under the EPBC Act and the Native vegetation on cracking clay soils of the Liverpool Plains is listed as an Endangered Ecological Community under the TSC Act.

#### Distribution, habitat and ecology

This community occurs from the Darling Downs in Queensland to Dubbo in NSW and includes the Liverpool and Moree Plains. This community has a strong affiliation with the soil type and occurs on fine textured often cracking clays derived from either basalt or quaternary alluvium, on flat to very low slopes (Department of Environment Water Heritage and the Arts 2008c). In NSW these include the Mooki River, Coxs Creek and their tributaries which drain into the Namoi Catchment (NSW Scientific Committee 2001a). The floristic structure is that of native Grassland, with a canopy of less than 10% projective foliage cover. The community is dominated by *Austrostipa aristiglumis*, with other native grasses such as *Dichanthium sericeum*, *Panicum queenslandicum* and *Aristida leptopoda* are often present as co-dominants.

The original extent and floristic composition of plains grassland has been the subject of a recent study by (Lang R. D. 2008). This study found that the treeless nature of the community was attributed to a mixture of fine-textured soil, climate and topography restricting water availability. The distribution of the grasslands has been mapped to Old Warrah in the south-east, to Boggabri in the North and to Goolhi in the west. Review of historical records found that the dominance *Austrostipa aristiglumis* could possibly be a result of agricultural practices and that the original areas of grasslands before European settlement could have been dominated by grasses such as *Eulalia aurea*, *Astrebla lappacea* and *Themeda avenacea* (Lang R. D. 2008). If agriculture techniques are altered to mimic kangaroo grazing these three aforementioned native grass species become dominant over *Austrostipa aristiglumis*. This finding could have implications for further management of this community.

#### Threats

The Office of Environment and Heritage list a number of threats for this community:

- Clearing and fragmentation of habitat for cropping and grazing.
- Roadworks.
- Grazing by domestic stock.
- Salinity and soil erosion.
- Weed invasion.

#### Specific impacts

Within the proposed modification boundary the Plains Grassland vegetation type is consistent with the TSC Act listing and the EPBC Act listing of this community. This community occurred to the north-east of Belleview and is associated with areas of recent clearing for agricultural land uses and Boggabri Coal Mine. This community encompassed 0.1 ha within the proposed modification boundary. Of this approximately 0.1 ha of this community will be removed and/or disturbed as part of the proposed modification.

### 3.1 TSC Act Significance assessment

**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**

Not applicable

**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**

Not applicable

**In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:**

- (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction**

The proposed Modification will result in the disturbance to 0.1 ha of Plains Grassland.

The cumulative impact will reduce this community to a smaller extent but unlikely to place the local occurrence at risk of extinction due to the small area of removal and nature of the indirect impacts that will occur to the plains grassland.

The proposed Modification is not considered significant and is unlikely to place a local occurrence at risk of extinction.

- (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**

It is unlikely that the composition will be substantially or adversely modified as a result of the proposed Modification. Management and mitigation measures outlined in the Continuation of Boggabri Coal Mine – Biodiversity Impact Assessment (Parsons Brinckerhoff 2010b), Modification 3 (Parsons Brinckerhoff 2013) and Modification 4 (Parsons Brinckerhoff 2014), if adhered to, should minimise any impacts to abiotic characteristics that affect composition.

Connectivity will remain relatively unchanged within the locality - continuing current genetic flow and dispersal mechanisms.

**In relation to the habitat of a threatened species, population or ecological community:**

- (i) the extent to which habitat is likely to be removed or modified as a result of the action proposed**

The proposed modification will result in the removal of approximately 0.1 ha of plains grassland. This is in addition to the area being removed for the mine expansion (BCEP).

- (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**

The plains grassland EEC is a highly fragmented as a consequence of previous agricultural practices across its former extent. The community already exists as an isolated patch within an agricultural patch near Belleview groundwater bore.

The proposed Modification would have impact on xx ha which may reduce the occupancy area of the EEC. This is considered unlikely to contribute significantly to the fragmentation currently experienced by the EEC.

**(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.**

The proposed Modification will result in the disturbance to 0.1ha of Plains Grassland. This remnant of Plains Grassland already exists as a fragmented remnant as a result of past agricultural practices. As a result the proposed Modification is considered unlikely to cause significant fragmentation or isolation. This habitat is not considered to be important to the long-term survival of the EEC in the locality, as this area represents a small proportion of the total area of this community in the region (0.002%).

The area of plains grassland to be removed is unlikely to be important for the long term survival of the community in the locality.

**Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)**

The Office of Environment and Heritage maintains a register of critical habitat. The land within the subject site is not listed as a critical habitat and it is not considered to be critical to the survival of Plains Grassland.

**Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan**

No recovery plans have been developed for this community. The Office of the Environment and Heritage is currently developing a targeted approach for managing Ecological Communities as part of the Saving Our Species program. In the interim, the management actions have been identified for this community (Table 3.1). The proposed modification will not significantly affect any of these actions.

**Table 3.1 Management actions for the Natural grasslands on basalt and fine-textured alluvial plains of northern NSW and southern Queensland**

Management Actions	Likely to be impacted upon by the proposed modification
Identify, map the locations and assess the conservation values of remnant areas of the EEC, particularly where it occurs on TSRs.	No
Undertake weed control in areas where required.	No
Provide advice and support, including locale maps, to local and state govt depts to ensure appropriate environmental assessment and targeting of conservation action.	No
Erect fences if necessary to protect the EEC from stock grazing where it occurs on TSRs.	No
Provide advice, support and encouragement to local bushcare groups to restore remnant areas of degraded EEC - field days, tube stock, advice on species to re-plant, brochures.	No
Identify areas suitable for restoration and initiate restoration works.	No
Erect signage and/or fences around the EEC where it occurs along roadsides, to protect it from roadworks.	No
Encourage landholders to enter into a VCA where the EEC occurs on their property.	No

**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**

The proposed Modification constitutes the key threatening processes of clearing on native vegetation. It may also encourage the invasion of native plant communities by exotic perennial grasses.

The proposed modification would include clearing of native vegetation, however, the extent required to be removed is not considered significant in terms of the areas to be retained within the study area and the surrounding landscape.

The proposed modification also has the potential to spread weeds, including perennial grasses. The most likely causes of weed dispersal associated with the proposed modification would include earthworks, movement of soil and attachment of seed (and other propagules) to vehicles and machinery. Mitigation measures have been provided to minimise the likelihood of weed spread. Furthermore, the majority of works are within already disturbed areas and the majority of the vegetation within the study area already has considerable weed growth; therefore, the overall extent of habitat modification is not likely to increase significantly.

### **Conclusion**

The proposed Modification is likely to remove approximately 0.1 ha of Plains Grassland EEC. The Plains Grassland recorded on site exists as a fragmented patch which is already being impacted upon by existing agricultural practices in the immediate area. Whilst the overall occupancy area will be reduced, it is unlikely that the impacts associated with the Modification on this small patch will contribute significantly to fragmentation or modify the composition so that the EEC is placed at risk of extinction. It will however, add incrementally to loss of this EEC.

### **3.2 EPBC Act Significance assessment**

The following assessment has been completed in accordance with the EPBC Act Policy Statement 1.1 Significant Impact Guidelines (Department of Environment 2013) and is related to those remnants of the endangered ecological community as defined by the EPBC Act Policy Statement – Nationally Threatened Ecological Communities (Department of Sustainability Environment Water Population and Communities 2012).

Under the EPBC Act, an action is likely to have a significant impact on a CEEC if there is a real chance or possibility that it will:

#### **Reduce the extent of an ecological community?**

The proposed Modification would result in approximately 0.1 ha of Plains Grassland being affected within the Modification study area. Therefore the action will reduce the extent of this community. The area of plains grassland proposed to be removed represents a small proportion of this community in the study area and surrounding landscape. Approximately 25,000 ha of this CEEC has been mapped within the Liverpool and Moree Plains (Carter *et al.* 2003), with the removal of approximately 0.1 ha within the modification study area equating to 0.002 % of plains grassland within the region. As this is a relatively small amount and given the nature of works in the vicinity impacts associated with proposed Modification are unlikely to be significant.

#### **Will the action fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines?**

The proposed Modification within the EPBC listed community may result in minor increases in fragmentation. The plains grassland recorded on site is highly fragmented and disturbed as a result of past land uses which include road construction, grazing and other agricultural practices. Given the highly fragmented state of the community this incremental increase is unlikely to be significant.

#### **Will the action adversely affect habitat critical to the survival of an ecological community?**

No critical habitat has been listed for the plains grassland ecological community under the *Environment Protection and Biodiversity Conservation Act 1999*.

Habitat critical to the survival of an ecological community may, however, also include areas that are not listed on the Register of Critical Habitat if they are necessary:

- for activities such as foraging, breeding, roosting, or dispersal
- for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators)
- to maintain genetic diversity and long term evolutionary development, or
- for the reintroduction of populations or recovery of the species or ecological community (Department of Environment 2013).

The area of plains grassland to be disturbed currently occurs as a single patch within the study area. This vegetation has been heavily degraded and is subjected to weed invasion as a result of edge effects. Nevertheless given that over 96% of the original extent has already been removed all representations of the community are important (Eco Logical Australia 2008). However, it is unlikely that the area within the proposed Modification Area is critical to the survival of the community compared to larger more intact areas.

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

The proposed modification would not modify or adversely affect abiotic factors necessary for the survival of plains grassland within the study area. Soil would be disturbed in the construction footprint; however the extent of this area is not essential for the survival of the ecological community.

Plains grassland is located on the lower lying plains and this community is considered to be associated with shallow perched water tables over impermeable clay lenses rather than groundwater fed by subsurface aquifers. Therefore this community has been classed as having some proportional dependence upon groundwater. The proposed modification would require the excavation and shaping of the upper soil profile and minor alterations to the existing surface water drainage however is unlikely to require groundwater extraction or significant impacts on the existing subsurface aquifers and their associated groundwater dependent ecosystems. Therefore it is unlikely that the proposed modification will modify the groundwater levels such to an extent to effect this community's survival.

The proposed modification would result in some localised modification to surface water hydrology, however not to an extent that would affect the survival of the ecological community. These impacts include a potential increase in sediment and water runoff from the construction footprint and the potential for oil spills. Therefore it is considered that there is potential for the proposed modification to modify abiotic factors; however the modifications are unlikely to be of a significant impact that they would affect the survival of this community.

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

The proposed modification is not likely to cause a substantial change in the species composition of the plains grassland within the modification study area. The plains grassland within the modification study area is characterised by a dominance of native grasses but has minor pasture weed invasion as a result of past land-uses, and edge effects from the adjoining exotic grasslands. Edge effects from the existing tracks and road reserves are currently having a small impact with minor pasture weed incursions occurring. The proposed modification will not substantially change the species composition within this community.

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

- **assisting invasive species, that are harmful to the ecological community, to become established; or**
- **causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community?**

The plains grassland has been subjected to numerous past land use activities including vegetation clearing, grazing, and pasture improvement. Therefore, it is highly unlikely that the plains grassland within the modification study area is in the pre-european condition. However, in saying this it is likely that very few examples of this community remain relatively intact throughout its range. The construction and operation of the proposed modification may amplify the conditions that have resulted in the modification of the community.

**Will the action interfere with the recovery of the ecological community?**

The removal of approximately 0.1 ha of plains grassland is unlikely to interfere with the recovery of the community given the extent of clearing in relation to the broader extent within the region. However at the local scale, small patches of plains grassland vegetation do contain important species such as those that are grazing sensitive and may function as an important source of species for the wider area.

### **Conclusion**

The proposed modification would remove approximately 0.1 ha of plains grassland. However, given that over 5,980 ha has been mapped within the region, the proposed modification is not likely to have a significant impact on this community.

#### 4. *Digitaria porrecta*

##### Status

*Digitaria porrecta* (Finger Panic Grass) is listed as Endangered under the TSC Act 1995. The species was delisted from the EPBC Act on 14 December 2014.

##### Description

The species has grey leaves which are 2-3 mm wide with sharp hairs along the middle of the leaf blade. Flowers are clustered together along a stalk in a cylinder shape (Department of Environment and Climate Change 2009). Flowering occurs in summer (Jan-Feb), inflorescences are exerted with racemes stiffly spreading at maturity, the lower flowers arranged whorls of four to six (Wheeler *et al.* 2002).

##### Distribution, habitat and ecology

*Digitaria porrecta* populations occur on the North Western Slopes and Plains from near Moree south to Tambar Springs and from Tamworth to Coonabarabran in NSW (Department of Environment Water Heritage and the Arts 2008a) where it grows in native grassland, woodlands or open forest with a grassy understorey, on richer soils. It is often found along roadsides and travelling stock routes where there is light grazing and occasional fire (Office of Environment and Heritage 2011).

Most frequency recorded associated with over storey trees such as *Eucalyptus albens* and *Acacia pendula*. Common associated understorey species include *Austrostipa aristiglumis*, *Enteropogon acicularis*, *Cyperus bifax*, *Hibiscus tronum* and *Neptuna gracilis*.

##### Threats

Threats include grazing, urban expansion, clearing of native habitat for cropping and pastures, destruction and disturbance of habitat for roadside maintenance, competition from introduced grasses such as *Chloris gayana* (Rhodes Grass) and *Urochloa panicoides* (Liverseed Grass) and frequent fires (Department of Environment Water Heritage and the Arts 2008a).

##### Specific impacts

No *Digitaria porrecta* was located during surveys, however habitat within the proposed Modification study area was identified in the following vegetation communities:

- Weeping myall Woodland.
- River Red Gum riparian woodlands and forests.
- Plains Grassland.
- Pilliga Box – Poplar Box White cypress pine grassy open forest.
- Derived native grassland

A total of 18.9 ha of potential habitat will be removed as a result of the proposed Modification.

#### 4.1 TSC Act significance assessment

**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.**

The lifecycle of *Digitaria porrecta* within the proposed Modification area is unlikely to be affected by the proposed Modification. While the pollination mechanisms of *Digitaria porrecta* have not been identified, like other stoloniferous or rhizomatous grasses, it is likely to be reliant on wind pollination for cross or self-pollination and asexual (vegetative) reproduction. The species small, light seeds are also likely to be dispersed by wind or by attachment to fauna. As the proposed Modification is unlikely to affect wind conditions in the area, or greatly affect the distance between individuals, it is considered unlikely to result in the loss of pollinators or disruption of seed dispersal mechanisms.

**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.**

Not applicable.

**In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:**

- (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
- (ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction**

Not applicable.

**In relation to the habitat of a threatened species, population or ecological community:**

- (i) the extent to which habitat is likely to be removed or modified as a result of the action proposed**

*Digitaria porrecta* is a tufted grass that occurs on rich soils of basaltic geologies within grassy woodlands and grassland communities (Department of Environment and Climate Change 2009). The proposed Modification will remove 18.9 ha of potential habitat for this species. This is in addition to vegetation being removed by the BCEP. This is not considered a significant proportion of the habitat available within the region.

- (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**

Connectivity within a plant population relates to the ability of individuals to disperse and cross pollinate. Reproduction of *Digitaria porrecta*, like many other grasses, is likely to involve a combination of vegetative reproduction and cross or self-pollination. Pollination vectors are unknown for this species, but other species of *Digitaria porrecta* utilise wind pollination. The species is most likely to rely on a combination of wind dispersal and attachment to fauna for seed dispersal. As these processes are unlikely to be significantly affected by the proposed Modification it is considered that habitat connectivity for *Digitaria porrecta* in the wider region would not be significantly affected.

- (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.**

18.9 ha of native grassland and grassy woodland will be removed as a result of the proposed Modification, resulting in a small incremental loss of potential *Digitaria porrecta* habitat. This habitat is not considered to be important in terms of the long-term survival of the species due to the extent of similar or greater quality habitat in the surrounding landscape.

**Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)**



Critical habitats are areas of land that are crucial to the survival of particular threatened species, populations and ecological communities. Under the TSC Act the Director-General maintains a register of critical habitat. To date, no critical habitat has been declared for this species. The habitat within the boundaries of the proposed Modification is not considered to be critical to the survival of this species.

**Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan**

Neither a recovery nor threat abatement plan has been prepared for *Digitaria porrecta*. However, research actions and conservation actions have been developed to assist in the recovery of this species by the Office of Environment and Heritage. *Digitaria porrecta* has been designated as a data-deficient species as part of the Saving Our Species Program and therefore the following two research actions have been developed by the Office of Environment and Heritage to further knowledge in the species:

- Assess population size through survey of known locations.
- Identify threats acting on populations in order to inform management.

The following state wide conservation actions have been developed to assist in the recovery of this species:

- Conduct media publicity campaign to highlight implementation of recovery actions.
- Control rabbit grazing near high density populations (best practice: locally efficient and effective).
- Determine if and/or where an ecological burn is required.
- Develop EIA guidance for consent and determining authorities with regard to development and other activities.
- Encourage livestock management so as to maintain or improve habitat for this species.
- Clearly identify roadside populations and ensure no impact by road maintenance.
- Discourage fertilizer drift into populations.
- Ensure OEH is advised of any consents or approvals that affect the species.
- Negotiate with landholders (and neighbouring properties where relevant) to prepare and implement site management plans that address threats.
- Fence sites with high density populations to prevent grazing.
- Conduct weed control, especially of invasive exotic grasses.
- Encourage landholders to enter VCAs and other site management agreements.
- Opportunistically monitor populations after wildfire to determine fire ecology.
- Ensure awareness by managers and users of Travelling Stock Routes of the species' location and identification and requirements.
- Monitor Queensland Recovery Plan and effort for guidance.
- Conduct targeted surveys in potential habitat.

The proposed Modification will not interfere with any of the identified research or conservation actions.

**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**

The proposed Modification will directly involve one Key Threatening Process for this species: clearing of native vegetation. Invasion of habitat by exotic perennial grasses may also occur unless weed control measures are implemented during construction.

**Conclusion**

No *Digitaria porrecta* were observed during site inspections, however 18.9 ha of potential habitat was identified in the following vegetation communities:

- Weeping myall Woodland.
- River Red Gum riparian woodlands and forests.
- Plains Grassland.
- Pilliga Box – Poplar Box White cypress pine grassy open forest.
- Derived native grassland

The proposed Modification is unlikely to have an adverse effect on the lifecycle of a viable local population so that *Digitaria porrecta* is placed at risk of extinction. The proposed Modification is unlikely to affect pollination or seed dispersal mechanisms, because the areas to be removed are largely on the edge of larger stands of bushland and as such the edge effect and barrier effects will not be significantly altered from current regimes. The importance of the habitat to be removed by the proposed Modification, in terms of the long-term survival of *Digitaria porrecta* in the locality, is likely to be low. Consequently, a significant impact to *Digitaria porrecta* is considered unlikely to occur as a result of the proposed Modification.

## 5. *Diuris tricolor*

### Status

*Diuris tricolor* (Pine Donkey Orchid) is listed as Vulnerable under the TSC Act 1995. The species was delisted from the EPBC Act 1999 on 19 August 2011.

### Distribution, habitat and ecology

*Diuris tricolor* (formerly known as *Diuris sheaffiana*) is a terrestrial species (it grows from the ground rather than from rocks or vegetation).

*Diuris tricolor* grows in sclerophyll forest among grass, often with native Cypress Pine (*Callitris* spp.). It is found in sandy soils, either on flats or small rises. Disturbance regimes are not known, although the species is usually recorded from disturbed habitats. Associated species include *Callitris glaucophylla*, *Eucalyptus populnea*, *Eucalyptus intertexta*, Ironbark and *Acacia* Shrubland (Jones 2006). The understorey is often grassy with herbaceous plants such as Bulbine species. Flowers from September to November or generally spring (Jones 2006).

### Threats

Threats for this species include habitat clearing and Modification, difficulty of detection due to short flowering period, impacts by feral animals, and competition from weed species (OEH 2012).

### Specific impacts

No *Diuris tricolor* was observed during survey period, however this is outside of the flowering period, between September and November, and as such the species is unlikely to have been detected even if present.

No *Diuris tricolor* was located during surveys, however habitat for *Diuris tricolor* within the proposed Modification area was identified in the following vegetation communities:

- Weeping myall Woodland.
- River Red Gum riparian woodlands and forests.
- Plains Grassland.
- Pilliga Box – Poplar Box White cypress pine grassy open forest.
- Derived native grassland

A total of 18.9 ha of potential habitat will be removed as a result of the proposed Modification.

### 5.1 TSC Act significance assessment

**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**

*Diuris tricolor* (Pine Donkey Orchid) is likely to be pollinated through a process called pseudocopulation (Jones 1988). The glands on the perianth segments are a source of the sexual attractants for the pollinators, male thynnine wasps are drawn to the flowers by scent mimicking the female thynnine wasp pheromone. Once in sight of the flower, the male attempts to copulate with the labellum of the flower, mistaking it for a female wasp, and effects pollination. Habitat for these pollinators is vital for the continuation of the life cycle

of this cryptic orchid. Removal of 18.9 ha of potential habitat is unlikely to have a significant impact to these processes considering the areas to be removed are largely on the edge of larger stands of bushland, reducing the in areas already impacted by edge effect and weed invasion.

The lifecycle of *Diuris tricolor* within the proposed Modification area is unlikely to be significantly impacted.

**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**

Not applicable.

**In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:**

- (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
- (ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction**

Not applicable.

**In relation to the habitat of a threatened species, population or ecological community:**

- (i) the extent to which habitat is likely to be removed or modified as a result of the action proposed**

The proposed Modification will remove 18.9 ha of potential habitat. This is in addition to the vegetation being removed by the BCEP. As a large area of potential habitat remains in the locality, this is not considered a significant proportion of the habitat available within the region.

- (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**

Connectivity within a plant population relates to the ability of individuals to disperse and cross pollinate. As previously mentioned the proposed Modification is unlikely to affect the mechanisms by which this species cross-pollinates or disperses.

The removal of 18.9 ha of potential habitat is unlikely to further fragment the population significantly.

- (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.**

Due to the small size and relatively degraded nature of the habitat to be removed, it is not considered to be important to the long-term survival to either of the species in the locality.

**Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)**

Critical habitats are areas of land that are crucial to the survival of particular threatened species, populations and ecological communities. Under the TSC Act, the Director-General maintains a register of critical habitat. To date, no critical habitat has been declared for this species. Nor is the habitat present considered critical to the survival of the species.

**Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan**

Neither a recovery nor threat abatement plan has been prepared for *Diuris tricolor* by the Office of Environment and Heritage.

As part of the SOS program being developed by the Office of Environment and Heritage *Diuris tricolor* has been assigned as a keep watch species. Threatened species assigned as Keep Watch species require no immediate investment because they are either naturally rare, have few known threats, or are more abundant than previously assumed. Ten state wide conservation actions for managing the recovery of this species have been identified by Office of Environment and Heritage (2014b). These are as follows:

- conduct baseline surveys to locate new populations and extend the ranges of currently known populations. Surveys should include all State Forests where suitable habitat occurs
- following surveys, assess the current conservation status and prepare and submit a nomination for de-listing if required
- annually monitor at least five populations that represent the spatial distribution of the species
- collect seed and soil for NSW Seedbank. Develop collection program (including mycorrhizal symbiont) in collaboration with BGT - multiple provenances
- conduct experimental trials into the effects of fire, grazing and weed disturbances
- erect rabbit, goat and stock-proof fences around populations that are highly threatened from trampling and grazing by feral animals and stock
- develop a fact sheet and distribute via community newsletters, regional shows and field days and by promoting the DEC threatened species website
- conduct surveys and assessments of less known sites to confirm presence of species and develop and implement conservation management agreements with landholders for high priority sites
- develop an expression of interest (EOI) for incentives targeted towards private landowners to locate new sites for conservation
- investigate seed viability, germination, dormancy and longevity (in natural environment and in storage) (+ symbionts and soil for orchids, gentians).

The project is unlikely to affect the above conservation measures.

**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**

The proposed Modification involves the clearing of native vegetation, a known threatening process for this species. As the area proposed to be removed is small (18.9 ha) and of limited quality it is not considered to significantly contribute to this key threatening process. It will however add incrementally to the process.

**Conclusion**

Approximately 18.9 ha of potential habitat will be removed by the proposed Modification. This includes the following vegetation communities identified within the proposed Modification area:

- Weeping myall Woodland.
- River Red Gum riparian woodlands and forests.
- Plains Grassland.
- Pilliga Box – Poplar Box White cypress pine grassy open forest.