Appendix C

Ecological Assessment

BENGALLA MINE - SECTION 96(2) MODIFICATION TO SSD-5170

Ecological Assessment

For:

Hansen Bailey

June 2015

Final

PO Box 2474

Carlingford Court 2118

Report No. 14081RP1

The preparation of this report has been in accordance with the brief provided by the Client and has relied upon the data and results collected at or under the times and conditions specified in the report. All findings, conclusions or recommendations contained within the report are based only on the aforementioned circumstances. The report has been prepared for use by the Client and no responsibility for its use by other parties is accepted by Cumberland Ecology.

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001	12/06/2015	LH	Draft
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Approved by: David Robertson

Position: Director

Signed:

Date: *24 June, 2015*

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Glossary of Terms

Disturbance Boundary	The extent of Bengalla Mine that has been approved for development through various applications for development consent (see **Figure 1.1**)
BMC	Bengalla Mining Company Pty Limited
Buffer	Buffer area in the Modification used for construction services (see **Figure 3.1**)
CEEC	Critically Endangered Ecological Community
CW1	Clean Water Dam 1
DA	Development Application
DoE	Commonwealth Department of the Environment
EEC	Endangered Ecological Community
EP&A Act	NSW *Environmental Planning and Assessment Act 1979*
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
GDE	Groundwater Dependent Ecosystem
KTP	Key Threatening Process
LGA	Local Government Area
Levee	Vegetation to be permanently removed to facilitate levee installation (see **Figure 3.1**)
Locality	Defined as a 20km radius of the Modification to Disturbance Boundary
MNES	Matters of National Environmental Significance
the Modification	Proposed modification to SSD-5170 under Section 96(2) the EP&A Act
Modification to Disturbance Boundary	The portion of the Modification occurring outside the previously delineated Disturbance Boundary (see **Figure 1.1** and **Figure 1.2**). This area will be directly impacted by the Project and includes the diversion drains associated with CW1.
NSW	New South Wales
OEH	NSW Office of Environment and Heritage
the Project	The portion of the Modification that occurs within the Modification to Disturbance Boundary.
SEE	Statement of Environmental Effects
SSD	State Significant Development
TEC	'Threatened Ecological Community' as listed under the TSC Act and/or EPBC Act
TSC Act	NSW *Threatened Species Conservation Act 1995*

Chapter 1

Introduction

Cumberland Ecology was commissioned by Hansen Bailey on behalf of Bengalla Mining Company Pty Limited (BMC) to prepare an Ecological Assessment for a modification to the Bengalla Continuation of Mining Project (the 'Modification'). This report will form part of the Statement of Environmental Effects (SEE) being prepared by Hansen Bailey to support an application for modification to SSD-5170 under Section 96(2) the New South Wales (NSW) *Environmental Planning and Assessment Act 1979* (EP&A Act).

The Modification includes on-ground components both within and outside of the previously delineated Project and Disturbance Boundaries for Bengalla Mine (see **Figure 1.1**). The subject of this Ecological Assessment includes the portion of the Modification occurring outside the previously delineated Disturbance Boundary (the 'Modification to Disturbance Boundary') (see **Figure 1.2**). The portion of the Modification that occurs within the Modification to Disturbance Boundary is hereafter referred to as the 'Project'.

1.1 Purpose

This report will consider all of the impacts of the Modification; however the main focus of the assessment is to assess the additional impacts of the Project on biodiversity values outside the previously delineated Disturbance Boundary. Biodiversity values include threatened species, populations and ecological communities protected under State and Commonwealth legislation. The main objective of this report is to determine whether the Project is likely to significantly affect threatened biodiversity values within the Modification to Disturbance Boundary and how the Modification plans to mitigate those impacts.

Specifically, the objectives of this Ecological Assessment are to:

- Describe and map vegetation communities of the Modification to Disturbance Boundary, identifying threatened ecological communities (TECs) listed under the NSW *Threatened Species Conservation Act 1995* (TSC Act) and/or the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act);
- Assess the likelihood as to whether threatened flora and fauna species could occur within the Modification to Disturbance Boundary;
- Describe the types and extent of potential impacts arising from the Project; and

- Describe any avoidance and mitigation measures proposed to manage impacts on threatened species and areas of high conservation value.

1.2 Modification Description

BMC are seeking modification to SSD-5170 under Section 96(2) the EP&A Act. The Modification includes the following:

- Alterations to various water management infrastructure components including:
  - Utilisation of the Satellite Pit as a catchment dam;
  - Construction of clean water diversion levees;
  - Relocation of the Staged Discharge Dam release point; and
  - Revised location for the future relocated Hunter River and Washery Dam.
- Relocation of the existing Explosives Storage Facility; and
- Placement of fill from the excavation of the Clean Water Dam 1 (CW1) immediately east of CW1.

The conceptual layout of the Modification is shown in **Figure 1.1**. A detailed description of each component of the Modification is provided within the SEE.

1.3 Modification to Disturbance Boundary

1.3.1 Existing Mine

BMC operates the Bengalla Mine in the Upper Hunter Valley of NSW. Bengalla Mine is an open cut operation where mining advances generally to the west. BMC was granted Development Consent (Development Application (DA) 211/93) in August 1995 for the development and operation of Bengalla Mine. Bengalla Mine was approved to operate for a 21 year period from 1996 (i.e. until 2017).

In 2013, BMC lodged an application for State Significant Development (SSD) Consent (SSD-5170) under Division 4.1 of Part 4 of the EP&A Act for the continuation of mining operations at Bengalla Mine. The development includes the extension of existing operations for a further 24 years in a westerly direction. BMC was granted Development Consent in March 2015 for SSD-5170.

1.3.2 Location

The existing Bengalla Mine is located approximately 4 km west of Muswellbrook in the Upper Hunter Valley, NSW. Bengalla Mine is generally bounded by Wybong Road to the north, Roxburgh Road to the west, Overton Road to the east, and the Muswellbrook-Ulan Rail Line

to the south. Bengalla mine is wholly contained within the Muswellbrook Local Government Area (LGA).

1.3.3 Description of the Environment

i. Bioregional Context

The Project is located in the Hunter subregion of the Sydney Basin Bioregion, a large and complex area that extends from Batemans Bay in the south to Nelson Bay in the north and includes parts of the Blue Mountains. The Hunter subregion is principally located in the Hunter Valley and incorporates all of the Hunter River Catchment.

ii. Topography, Geology and Soils

The Hunter subregion is characterised by rolling hills and wide valleys, with a meandering river system (the Hunter River) on a wide floodplain. River terraces are evident, the highest with silicified gravels. Streams can be brackish or saline at low flow, and numerous small swamps are present in the upper catchment, and extensive estuarine swamps occur near the coast behind the coastal barrier of beach and dunes (Morgan, 2001).

The Project is located to the north west of the Hunter Coalfields. The stratigraphical sequence across the site is comprised of overburden and interburden layers of lithic sandstone, interbedded with siltstone, tuffaceous claystone and mudstone (Hansen Bailey, 2007b).

The soils in the Hunter subregion comprise a variety of harsh texture contrast soils on slopes and deep sandy loam alluvium on the valley floors. There are a small number of source bordering dunes on southern tributaries of the Hunter River. Deep sands with podsol profiles occur in dunes on the coastal barrier, and saline, organic muds are present in the Hunter River estuary. Soil salinity is common on some bedrocks in the upper catchment (Morgan, 2001).

iii. Water Catchments, Drainage and Aquifers

a. Hunter River

The Project lies within the catchment of the Hunter River, which is a sizable watercourse that flows in a south westerly direction approximately one kilometre south of Bengalla Mine. The Hunter River is regulated, meaning its flow regime is modified by upstream dams. Glenbawn Dam is located upstream of the Project and has the largest water storage capacity in the catchment. Regulation and water extraction from the Hunter River has resulted in alteration of natural geomorphology characterised by old alluvial or floodplain terraces and disrupted flow regimes (Brierley *et al.*, 2005; Fryirs *et al.*, 2009).

b. Dry Creek

Within the previously delineated Disturbance Boundary, surface water is naturally directed southwards to the Hunter River. The main ephemeral waterway within the previously delineated Disturbance Boundary is Dry Creek, which flows from north east to south west

and enters the Hunter River south of Bengalla Mine (**Figure 1.2**). The banks are highly eroded and the channel varies in width across the distribution in the previously delineated Disturbance Boundary. Current onsite environmental monitoring indicates that the water course is reported to flow only following heavy rain events for short periods of time. The shallow floodplain of Dry Creek is mostly bare of vegetation, or contains scattered large mature trees with exotic understorey.

A number of small tributaries in the previously delineated Disturbance Boundary drain into Dry Creek from west to east. These drainage lines are intersected with farm dams at intervals and remain dry for most of the year except in times of high rainfall. Vegetation is slightly more intact than that associated with Dry Creek and a more substantial canopy of *Angophora floribunda* (Rough-barked Apple) is commonly present, and a grassy understorey exists in parts. However, this drainage line is also highly eroded, exposing large areas of bare earth.

c. Hunter Valley Alluvium

The major aquifer system in the subregion is known as the Hunter Valley Alluvium, which extends in a continuous strip from the mouth of the Hunter River at Newcastle to just upstream of Scone (Australian Government, 2009b). The aquifer consists of sand and gravel lenses in unconsolidated alluvial deposits and is restricted to long, sinuous and relatively narrow strips along the Hunter River and its major tributaries (Australian Government, 2009a).

iv. Land Use

The main non-residential land uses in the Muswellbrook LGA include various agricultural enterprises, industry and mining. Other land uses include thoroughbred breeding and training. Approximately 42% of the LGA is represented by National Parks and Nature Reserves and includes Wollemi National Park, Goulburn River National Park and Manobalai Nature Reserve (MSC Environmental Services Department, 2011). The nearest conservation area to the Modification to Disturbance Boundary is Manobalai Nature Reserve, located more than 30 km to the north-west.

Coordinate System: MGA Zone 56 (GDA 94)

Legend

- Modification to Disturbance Boundary
- Disturbance Boundary
- Modification Area
- Roads
- Watercourse

Grid North

Image Source:
BMC 2012

Data Source:
© Copyright Commonwealth of Australia
(Geoscience Australia) 2006

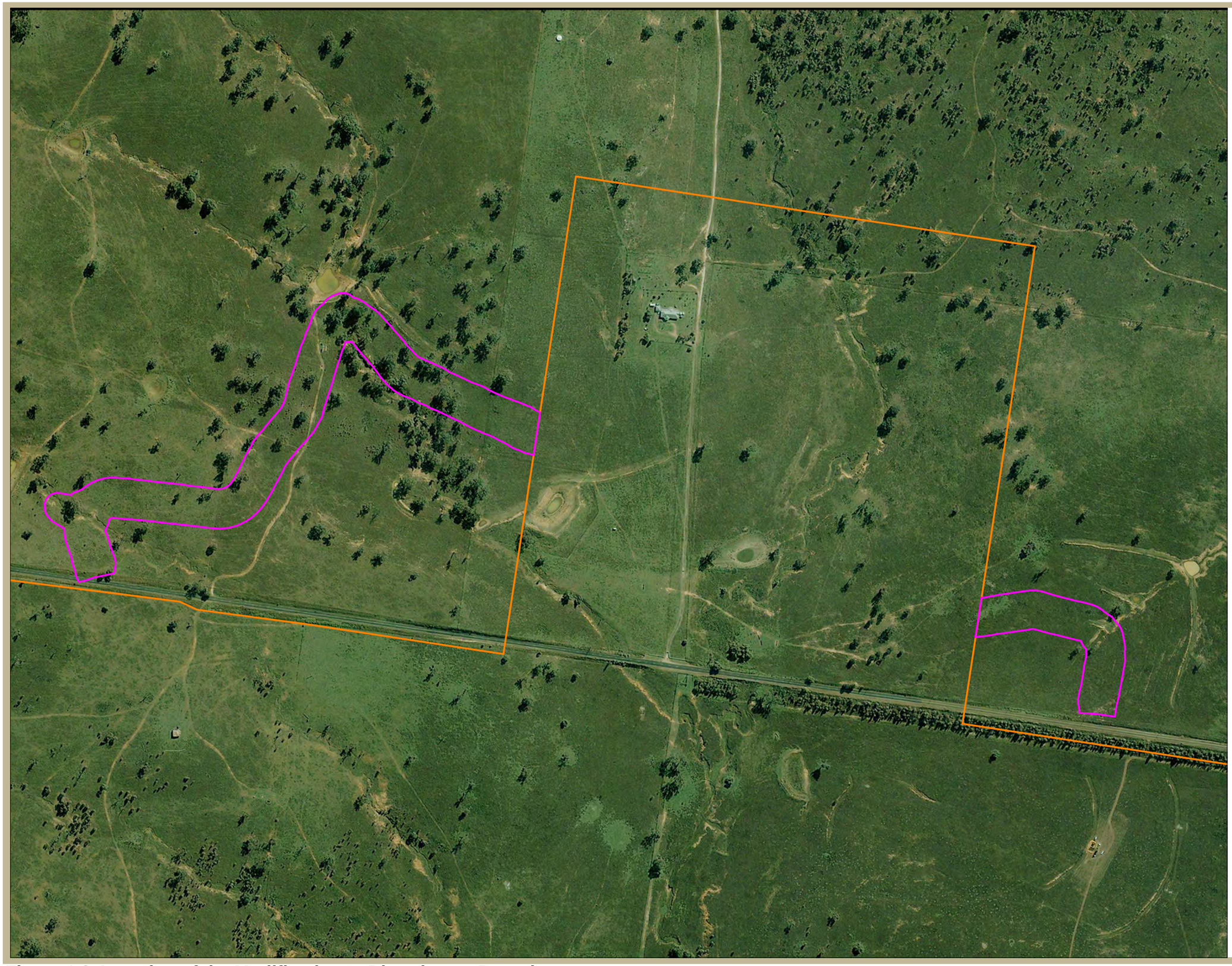
CUMBERLAND ECOLOGY

250 0 250 500 750 1000m

I:\...\14081\Figures\RP1_Mod Report\20150622\Figure 1.1. Conceptual Layout

Figure 1.1. Conceptual layout of the Modification

Coordinate System: MGA Zone 56 (GDA 94)



Legend

- Modification to Disturbance Boundary
- Disturbance Boundary

Grid North

Image Source:
BMC 2012

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I:\...\14081\Figures\RP1_Mod Report\20150622\Figure 1.2. Modification to Disturbance Boundary.mxd

Figure 1.2. Location of the Modification to Disturbance Boundary

100 0 100 200 300 400m

Chapter 2

Methodology

2.1 Database Analysis

Database analysis was conducted for the locality using both the NSW Office of Environment and Heritage (OEH) Atlas of NSW Wildlife Database (OEH, 2015) and the Commonwealth Department of the Environment (DoE) Protected Matters Search Tool (DoE, 2015a). The locality is defined as the area within a 20 km radius of the centre of the Modification to Disturbance Boundary. The Atlas of NSW Wildlife Database search facility was used to generate records of threatened flora and fauna species and populations listed under the TSC Act within the locality of the Modification to Disturbance Boundary. The abundance, distribution and age of records generated within the search areas provided supplementary information for the assessment of likelihood of occurrence of those threatened species within the Modification to Disturbance Boundary. The Protected Matters Search Tool generated a list of potentially occurring Matters of National Environmental Significance listed under the EPBC Act within the locality of the Modification to Disturbance Boundary.

2.2 Literature Review

A literature review was completed to identify the key ecological attributes and issues of the Modification to Disturbance Boundary and its surrounds. This information was used to assist in the preparation of this Ecological Assessment, in conjunction with the results of the database analysis.

The biodiversity values of the Modification to Disturbance Boundary and its surrounds is generally well known as a result of numerous ecological studies for coal projects in the locality, including the Mount Pleasant Project (ERM Mitchell McCotter, 1997; Cumberland Ecology, 2010b), Mt Arthur Coal (Dames & Moore, 2000; Umwelt (Australia) Pty Limited, 2006; Umwelt (Australia) Pty Limited, 2007; Cumberland Ecology, 2009), Muswellbrook Coal (HLA-Envirosciences, 2002), Drayton Mine (Hansen Bailey, 2007a; Hansen Bailey, 2009), Drayton South (Cumberland Ecology, 2012) and Bayswater B Power Station (Resource Planning Pty Limited, 1993; Eco Logical Australia Pty Ltd, 2009).

Bengalla Mine has been subject to a number of ecological investigations, including those prepared for the original DA 211/93 (Envirosciences Pty Ltd, 1993) and for various modifications to the original development consent (Hansen Consulting, 2006; Cumberland Ecology, 2007; Hansen Bailey, 2007b; Cumberland Ecology, 2010a). Most recently, detailed

ecological studies were conducted for the continuation of mining operations project at Bengalla Mine by Cumberland Ecology (2013).

This Ecological Assessment primarily utilised the data presented in the Ecological Impact Assessment prepared by Cumberland Ecology (2013) for Bengalla Mine as well as data presented in the Ecological Assessment prepared by Cumberland Ecology (2010b) for the Mount Pleasant Project.

2.3 Aerial Photograph Interpretation

Aerial photographs of the Modification to Disturbance Boundary and surrounds were obtained and detailed analysis was undertaken, in conjunction with interpretation of background information and existing knowledge of the locality and Modification to Disturbance Boundary.

2.4 Limitations

The Modification to Disturbance Boundary, immediate surrounds and broader locality have been surveyed numerous times over many years for various projects, including Mt Arthur Coal Mine, Mount Pleasant, Drayton Mine and Drayton South. As a result, detailed baseline vegetation and fauna data (including threatened species known and expected to occur within the locality) exists and are well documented on a spatial and temporal scale.

Extensive detailed field surveys have been undertaken within both Bengalla Mine and Mount Pleasant Project areas. When combined, the data from these surveys provides a database that is sufficiently comprehensive to support this Ecological Assessment. The field surveys have produced reliable information regarding flora and fauna species occurrences within the Modification to Disturbance Boundary, and immediate surrounds, and are considered to be adequate to support the assessment of the impacts of the Modification.

Additionally, a precautionary approach was used to assess threatened species impacts. Presence of suitable habitat was considered when assessing the potential occurrence of a given threatened species; where potential habitat was present and the species was known to occur at other locations in the locality, it was assumed that the species had potential to occur and were thus assessed accordingly.

Chapter 3

Results

3.1 Overview

The original character of the land within the Modification has been greatly altered as a result of historical and current land uses. Prior to European settlement, the vegetation in the Modification and surrounds would have been dominated by open grassy forest and woodland communities. Following European settlement, the majority of the forest and woodland in the Modification and surrounds was cleared to provide grasslands for livestock. In 1999, mining associated with the approved Bengalla Mine commenced and is currently ongoing. Although approved, the Mount Pleasant Project is not currently operational.

In the current landscape, a high proportion of the Modification is now dominated by native perennial grassland of variable diversity and floristic composition, with scattered patches of modified woodland. The resultant mosaic of grassland and modified woodland patches in the Modification to Disturbance Boundary is typical of the Muswellbrook locality and has been influenced by a long history of agricultural land use.

3.2 Vegetation Communities

The vegetation within the Modification consists of a mosaic of grasslands that were derived when the woody component (i.e. canopy trees and tall shrubs) of the original woodland community were first cleared, leaving behind predominantly native understorey. These grasslands are referred to as Derived Native Grassland in this report and are distinct from naturally occurring grasslands.

Within the Modification, six vegetation communities have been recorded that are spread across the Modification to Disturbance Boundary and previously delineated Disturbance Boundary. For the purposes of this report, only the vegetation communities within the Modification to Disturbance Boundary have been assessed. Further information on the vegetation communities within the previously delineated Disturbance Boundary can be found in the Bengalla Continuation of Mining Environmental Impact Assessment (Cumberland Ecology, 2013).

Three locally defined vegetation communities have been recorded within the Modification to Disturbance Boundary. Two of these communities conform to Box Gum Woodland and Derived Native Grassland, a TEC listed under both the TSC Act and EPBC Act. **Table 3.1** lists the vegetation communities occurring within the Modification to Disturbance Boundary.

The distribution of these communities within these areas is shown in **Figure 3.1**. General descriptions of the vegetation communities known from the Modification to Disturbance Boundary are provided below.

One potential groundwater dependent ecosystem (GDE), Hunter Floodplain Red Gum Woodland, has been identified within the previously delineated Disturbance Boundary for Bengalla Mine. No area of this community occurs within the Modification to Disturbance Boundary and none of the vegetation in this area is considered to comprise a GDE.

Table 3.1 Vegetation communities within the Modification to Disturbance Boundary

Vegetation Community	TSC Act Status	EPBC Act Status	Modification to Disturbance Boundary (ha)^
Grey Box/White Box Intergrade Grassy Woodland (Box Gum Woodland)	EEC	CEEC	2.79
Derived Native Grassland (Box Gum Woodland)	EEC	CEEC	3.31
Low Diversity Derived Native Grassland/Exotic Pasture	-	-	2.97
Total[+]			**9.07**

TSC Act / EPBC Act Status: EEC = Endangered Ecological Community, CEEC = Critically Endangered Ecological Community

^ *Area calculations are approximate*

3.2.1 Grey Box / White Box Intergrade Grassy Woodland

TSC Act Status: EEC (White Box - Yellow Box - Blakely's Red Gum Woodland)

EPBC Act Status: CEEC (White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland)

Grey Box/White Box Intergrade Grassy Woodland typically occurs as mid to tall grassy woodland on clay soils derived from Permian, Carboniferous or Quaternary geology. It is concentrated in the north of the Hunter region where rainfall is relatively low, on undulating slopes and hills that surround the floodplains along the Hunter River.

Within the Modification to Disturbance Boundary, this community occurs as regenerating woodland, consisting predominately of *Eucalyptus crebra* (Narrow-leaved Ironbark), with a small number of *Angophora floribunda* (Rough-barked Apple) occurring adjacent to a creek bed. The canopy consists of scattered mature trees, around which in most areas dense regrowth is occurring, consisting of *Eucalyptus crebra* juveniles of a shrub to small tree size. Scattered shrubs are also present and consist of the native species *Maireana microphylla*

(Small-leaf Bluebush), and the noxious weed species *Lycium ferocissimum* (African Boxthorn).

The open grassy understorey contains a ground layer of native herbs, forbs and grasses, with exotic weed species present and common in most areas (**Photograph 3.1** The groundcover is dominated by the native grass *Aristida ramosa* (Threeawn Wiregrass), in most areas, and other commonly occurring species include *Microlaena stipoides* (Weeping Grass), *Panicum effusum* (Hairy Panic), *Bothriochloa decipiens* var. *decipiens* (Pitted Bluegrass), and *Chloris ventricosa* (Windmill Grass). The grass *Austrostipa verticillata* (Slender Bamboo Grass) is also common in the community, and dominant in areas adjacent to the creek bed. ,Common native forbs present include *Dichondra repens* (Kidney Weed), *Solanum cinereum* (Narrawa Burr), and, *Sida corrugata* (Corrugated Sida), with others such as *Calotis lappulacea* (Yellow Burr-daisy), *Desmodium varians* (Variable Tick-trefoil), and *Einadia trigonos* (Fishweed) occurring less frequently.

Forbs of exotic weed species present in large numbers throughout the community include *Anagallis arvensis* (Scarlet Pimpernel), and the Weed of National Significance, *Senecio madagascariensis* (Fireweed). Less common species include *Marrubium vulgare* (White Horehound), *Modiola caroliniana* (Redflower Mallow), and *Stachys arvensis* (Staggerweed). Common exotic grasses include the species *Cynodon dactylon* (Couch), and *Lolium perenne* (Ryegrass).

Photograph 3.1 **Grey Box/White Box Intergrade Grassy Woodland within the Modifcation Disturbance Area**

3.2.2 Derived Native Grassland (Box Gum Woodland)

TSC Act Status: EEC (White Box - Yellow Box - Blakely's Red Gum Woodland)

EPBC Act Status: CEEC (White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland)

This community is a native grassland that has been derived from the previous clearing of canopy trees of Upper Hunter White Box - Ironbark Grassy Woodland and Grey Box / White Box Intergrade Grassy Woodland and is characterised by an assemblage of understorey species representative of the understorey that typifies the woodland community (**Photograph 3.2**). Within the Disturbance Modification Area, this community occurs in areas that have not recently been heavily impacted by grazing.

To be considered as conforming to Box Gum Woodland, these grasslands support over 12 native non-grass species and at least one grazing-sensitive species within a 0.1 ha area. Examples of grazing-sensitive species include *Calotis lappulacea* (Yellow Burr-daisy) or *Cheilanthes sieberi* (Poison Rock Fern) and various lilies, daisies, pea plants and orchids. The dominant groundcover in this derived native grassland unit is typically a native grass species. Derived Native Grassland (Box Gum Woodland) is typically grassland of moderate to good condition that has some potential for assisted natural woodland regeneration if livestock grazing and other land disturbances were removed.

The occurrence of the community within the Disturbance Modification Area is dominated by the native grasses *Aristida ramosa* (Purple Wiregrass), and *Chloris ventricosa* (Tall Chloris). Native forbs recorded include the species *Phyllanthus virgatus*, *Chrysocephalum apiculatum* (Common Everlasting), *Wahlenbergia communis* (Tufted Bluebell), and *Lagenophora stipitata* (Blue Bottle-daisy). The native shrub *Maireana microphylla* is present, and a small patch of regrowth *Casuarina glauca* (Swamp Oak) juveniles is present in a single area within a paddock.

Exotic weed species recorded include the shrubs *Gomphocarpus fruticosus* (Cottonbush), *Opuntia stricta* (Prickly Pear), *Lycium ferocissimum* (African Boxthorn), and forbs such as *Sida rhombifolia* (Paddy's Lucerne), *Cirsium vulgare* (Spear Thistle), and *Senecio madagascariensis* (Fireweed).

Photograph 3.2 **Derived Native Grassland (Box Gum Woodland) in eastern section of the Modification to Disturbance Boundary**

3.2.3 Low Diversity Derived Native Grassland / Exotic Pasture

TSC Act Status: Not listed

EPBC Act Status: Not listed

Low Diversity Derived Native Grassland / Exotic Pasture comprises areas that have been intensively ploughed for cultivation; pasture-improvement; or have been subject to prolonged grazing by dairy cattle in the past. These areas have typically suffered from a moderate to high level of soil disturbance (**Photograph 3.3**).

Scattered trees are present in the community within the Disturbance Modification Area of the *Eucalyptus albens* (White Box) *Eucalyptus moluccana* (Grey Box) intergrade, and *Eucalyptus crebra*. Regrowth individuals of a shrub to small-tree size are present in association with trees in some areas, predominately of the species *Eucalyptus crebra*. The native shrubs *Bursaria spinosa* (Blackthorn) and *Maireana microphylla* are present in some areas. The exotic shrubs *Lycium ferocissimum*, *Gomphocarpus fruticosus*, and *Opuntia stricta*

The ground layer of the more disturbed areas within the Disturbance Modification Area is dominated by exotic grass species such as *Cynodon dactylon* (Couch Grass) and *Paspalum dilatatum*, which commonly occur with *Sida rhombifolia* (Paddys Lucerne) and *Medicago* spp. (Medics). Concentrations of weed species were locally dominant, particularly *Galenia pubescens* (Galenia), and *Plantago lanceolata* (Lamb's Tongues).

The less disturbed areas are dominated by one or two hardy native grasses such as *Aristida ramosa* (Purple Wiregrass) and *Dichanthium sericeum* (Queensland Bluegrass), but lack grazing sensitive native herbs like *Calotis lappulacea* (Common Everlasting). Native forbs recorded include *Linum marginale* (Native Flax), *Asperula conferta* (Common Woodruff), and *Geranium solanderi* (Native Geranium).

Low Diversity Derived Native Grassland / Exotic Pasture are typically of significantly poorer condition and would not naturally regenerate to woodland without active rehabilitation measures. These areas are not listed TECs under the EPBC Act and TSC Act.

Photograph 3.3 **Low Diversity Derived Native Grassland in the Modification to Disturbance Boundary**

3.3 Flora Species

3.3.1 General Species

The vegetation within the Modification to Disturbance Boundary supports vegetation containing a relatively low diversity of native species, due mostly to widespread degradation caused by past land clearance and grazing. The majority of the species recorded are ground layer species. The dominant plant families in the canopy and shrub layer are Myrtaceae and Chenopodiaceae, represented mostly by the genera of *Eucalyptus* and *Maireana*.

3.3.2 Threatened Species

No threatened flora species have previously been recorded within the Modification to Disturbance Boundary.

A number of threatened flora species have been recorded from the locality, or have been predicted to occur. **Appendix A** analyses the likelihood of occurrence within the Modification to Disturbance Boundary for each threatened flora species recorded or predicted to occur within the locality. **Table 3.2** lists the threatened flora species considered to potentially occur within the Modification to Disturbance Boundary. Of these species, only *Cymbidium canaliculatum* (Tiger Orchid) has been recorded within the previously delineated Disturbance Boundary of Bengalla Mine.

Table 3.2 Threatened flora species potentially occurring within the Modification to Disturbance Boundary

Scientific Name	Common Name	TSC Act Status	EPBC Act Status
Cymbidium canaliculatum	*Cymbidium canaliculatum* population in the Hunter Catchment	EP	-
Diuris tricolor	Pine Donkey Orchid	V	-
*Prasophyllum sp. Wybong / Prasophyllum petilum**	Tarengo Leek Orchid	E	CE/E*
Thesium australe	Austral Toadflax	V	V

TSC Act / EPBC Act Status: V = Vulnerable, E = Endangered, EP = Endangered Population, CE = Critically Endangered

** Taxonomic changes have combined Prasophyllum sp. Wybong and Prasophyllum petilum; however they are still listed under two status levels under the EPBC Act*

i. Cymbidium canaliculatum population in the Hunter Catchment

Cymbidium canaliculatum (Tiger Orchid) is an epiphytic orchid which grows in the hollows and forks of eucalypts and wattles, usually occurring singly or as a single clump, typically between two and six metres above the ground (OEH, 2013c). Within the Hunter catchment, *Cymbidium canaliculatum* (Tiger Orchid) is most commonly found in *Eucalyptus albens* (White Box) dominated woodlands and has also been found less commonly on *Eucalyptus dawsonii* (Slaty Gum), *Eucalyptus crebra* (Narrow-leaved Ironbark), *Eucalyptus moluccana* (Grey Box), *Angophora floribunda* (Rough-barked Apple), *Acacia salicina* (Cooba) and on some other species, including dead stags (OEH, 2013c). This species has a scattered distribution across northern and eastern Australia and is restricted in NSW to the north-eastern quarter of the state (OEH, 2013c). A disjunct population of the species occurs in the Hunter Valley at the south-eastern distributional limit of the species' range (OEH, 2013c).

This species has not previously been recorded within the Modification to Disturbance Boundary; however records exist within the previously delineated Disturbance Boundary. This species has the potential to occur within woodland and scattered trees occurring within the Modification to Disturbance Boundary.

ii. Diuris tricolor

Diuris tricolor (Pine Donkey Orchid) is a terrestrial orchid growing to 20–40 cm high (Botanic Gardens Trust, 2015). This species grows in sclerophyll forest among grass, often with native Callitris species and is found in sandy soils, either on flats or small rises (OEH, 2014e). Associated species include *Callitris glaucophylla* (White Cypress Pine), *Eucalyptus populnea* (Poplar Box), *Eucalyptus intertexta* (Gum Coolibah), Ironbark and Acacia shrubland (OEH, 2014e). The understorey is often grassy with herbaceous plants such as Bulbine species (OEH, 2014e). *Diuris tricolor* (Pine Donkey Orchid) is sporadically distributed on the western slopes of NSW, extending from south of Narrandera all the way to the north of NSW.

This species has not previously been recorded within the Modification to Disturbance Boundary or the previously delineated Disturbance Boundary. This species has the potential to occur within woodland and derived native grassland within the Modification to Disturbance Boundary.

iii. Prasophyllum sp. Wybong / Prasophyllum petilum

Prasophyllum sp. Wybong / *Prasophyllum petilum* (Tarengo Leek Orchid) is a terrestrial orchid that grows to approximately 30 cm high (DoE, 2015b). It grows in; open sites within Natural Temperate Grassland at the Boorowa and Delegate sites; grassy woodland in association with River Tussock *Poa labillardierei*, Black Gum *Eucalyptus aggregata* and tea-trees *Leptospermum* spp. at Captains Flat; and grassy ground layer dominated by Kangaroo Grass under Box-Gum Woodland at Ilford (OEH, 2013d). Natural populations are known from a total of five sites, including Boorowa, Captains Flat, Ilford and Delegate in NSW and Hall in the Australian Capital Territory (OEH, 2013d).

This species has not previously been recorded within the Modification to Disturbance Boundary or the previously delineated Disturbance Boundary. This species has the potential to occur within woodland and derived native grassland within the Modification to Disturbance Boundary.

iv. Thesium australe

Thesium australe (Austral Toadflax) is a small, straggling herb to 40 cm tall and is semi-parasitic on roots of a range of grass species (OEH, 2013a). This species occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast and is often found in association with *Themeda australis* (Kangaroo Grass) (OEH, 2013a). Within NSW, *Thesium australe* (Austral Toadflax) is found in very small populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands (OEH, 2013a).

This species has not previously been recorded within the Modification to Disturbance Boundary or the previously delineated Disturbance Boundary. This species has the potential to occur within woodland and derived native grassland within the Modification to Disturbance Boundary.

3.4 Fauna Habitat

Extensive historical vegetation clearing has converted much of the Modification to Disturbance Boundary to grassland with varying degrees of native plant species diversity. Such vegetation supports a much lower diversity of native fauna than the treed landscapes. Agricultural land uses have simplified and/or removed the majority of ground habitat features such as logs and rocks. The resultant landscape has simplified and fragmented habitats typical of many rural areas that support a subset of the pre-European fauna. The integrity of habitats is further challenged by the abundance of feral animals such as foxes and rabbits, which prey upon or compete with native fauna.

Despite the modified nature, the Modification to Disturbance Boundary still offers some broad habitat features for native fauna including:

- Regenerating woodland and scattered paddock trees that may facilitate dispersal for woodland birds;
- Limited understorey vegetation and ground cover, leaf litter and fallen timber for small terrestrial fauna species;
- Limited tree hollows suitable as shelter and breeding habitat for a range of hollow-dependant fauna; and
- Blossom-producing trees suitable as forage habitat for a range of nectarivores.

3.5 Fauna Species

3.5.1 General Species

The Modification to Disturbance Boundary is not considered to support a high diversity of fauna species, mostly due to the simplified and highly modified habitat present. The majority of the species known from the surrounding areas have been recorded from the more intact areas of forest and woodland. A large proportion of recorded species are represented by birds and microchiropteran bats, which are highly mobile species. Reptiles, arboreal mammals and terrestrial mammals, which are less mobile, are not as well represented. A number of feral animals have also been recorded including foxes (*Vulpes vulpes*) and rabbits (*Oryctolagus cuniculus*).

3.5.2 Threatened Species

No threatened fauna species have previously been recorded within the Modification to Disturbance Boundary.

A number of threatened fauna species have been recorded from the locality, or have been predicted to occur. **Appendix B** analyses the likelihood of occurrence within the Modification to Disturbance Boundary for each threatened fauna species recorded or predicted to occur within the locality. **Table 3.4** lists the threatened fauna species considered likely to occur, or considered possible to occur within the Modification to

Disturbance Boundary. The fragmented nature of the habitat within the Modification to Disturbance Boundary and the distance to larger, more intact patches of woodland habitat, including rocky habitat, has resulted in fewer species being considered likely to occur than within the previously delineated Disturbance Boundary. Species considered likely to occur within the Modification to Disturbance Boundary are assessed further in this report.

Table 3.3 Threatened fauna species potentially occurring within the Modification to Disturbance Boundary

Scientific Name	Common Name	TSC Act Status	EPBC Act Status
LIKELY			
Birds			
Chthonicola sagittata	Speckled Warbler	V	-
Circus assimilis	Spotted Harrier	V	-
Hieraaetus morphnoides	Little Eagle	V	-
Apus pacificus	Fork-tailed Swift	-	M
Hirundapus caudacutus	White-throated Needletail	-	M
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	V	-
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	V	-
Merops ornatus	Rainbow Bee-eater	-	M
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	V	-
Ninox connivens	Barking Owl	V	-
Mammals			
Petaurus norfolcensis	Squirrel Glider	V	-
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-
Mormopterus norfolkensis	Eastern Freetail-bat	V	-
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-
Pteropus poliocephalus	Grey-headed Flying-fox	V	V
POSSIBLE			
Birds			
Haliaeetus leucogaster	White-bellied Sea-Eagle	-	M
Stagonopleura guttata	Diamond Firetail	V	-
Anthochaera phrygia	Regent Honeyeater	CE	E
Grantiella picta	Painted Honeyeater	V	-

Table 3.3 Threatened fauna species potentially occurring within the Modification to Disturbance Boundary

Scientific Name	Common Name	TSC Act Status	EPBC Act Status
Daphoenositta chrysoptera	Varied Sittella	V	-
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	V	-
Glossopsitta pusilla	Little Lorikeet	V	-
Lathamus discolor	Swift Parrot	E	E
Tyto novaehollandiae	Masked Owl	V	-
Mammals			
Dasyurus maculatus maculatus	Spotted-tailed Quoll	V	E
Chalinolobus dwyeri	Large-eared Pied Bat	V	V
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	-
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V	-
Myotis macropus	Large-footed Myotis	V	-
Nyctophilus corbeni	Corben's Long-eared Bat	V	V
Vespadelus troughtoni	Eastern Cave Bat	V	-

TSC Act / EPBC Act Status: V = Vulnerable, E = Endangered, CE = Critically Endangered, M = Migratory

i. Speckled Warbler

The Speckled Warbler (*Chthonicola sagittata*) inhabits a wide range of *Eucalyptus* dominated communities that have a grassy understorey, often on rocky ridges or in gullies (OEH, 2012c). Typical habitat for this species would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy (OEH, 2012c). This species forages on the ground and in the understorey for arthropods and seeds (NSW Scientific Committee, 2001b). Preferred areas of foraging habitat contain a combination of open grassy patches, leaf litter and shrub cover (NSW Scientific Committee, 2001b). Nests of this species are built using dry grass and strips of bark and are located in a slight hollow in the ground or at the base of a low dense plant, such as grass tussocks, often among fallen branches and other litter (OEH, 2012c) (NSW Scientific Committee, 2001b). The Speckled Warbler occurs from south-eastern Queensland, through central and eastern NSW to Victoria (NSW Scientific Committee, 2001b). In NSW, the Speckled Warbler occurs on the slopes west of the Great Dividing Range, with populations also occurring in drier coastal areas such as the Cumberland Plain, Western Sydney and the Hunter and Snowy River valleys (NSW Scientific Committee, 2001b).

The Speckled Warbler has been recorded in the previously delineated Disturbance Boundary. Speckled Warblers were consistently detected in regenerating woodland at four locations, suggesting the species lives in discrete and stable social groups throughout winter

(Gardner, 2004). This species has also been consistently recorded in woodland and open forests in and near the Mt Arthur Coal Mine lease (Cumberland Ecology, 2009) in Central Hunter Bulloak Forest Regeneration. It has also been recorded in the adjoining Mount Pleasant Project area (Cumberland Ecology, 2010b). There are 90 records of the species within the locality of the Modification to Disturbance Boundary.

ii. Spotted Harrier

The Spotted Harrier (*Circus assimilis*) inhabits grassy open woodland including *Acacia* and mallee remnants, inland riparian woodland, grassland and shrub steppe (NSW Scientific Committee, 2010). It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands (NSW Scientific Committee, 2010). The diet of the Spotted Harrier includes terrestrial mammals, such as bandicoots, bettongs and rodents, birds and reptiles, occasionally large insects and rarely carrion (NSW Scientific Committee, 2010). Nests are located in trees and built from sticks (OEH, 2012d). The Spotted Harrier occurs throughout the Australian mainland, except in densely forested or wooded habitats of the coast, escarpment and ranges, and individuals disperse widely in NSW (NSW Scientific Committee, 2010).

It is expected that this species would forage across woodland and grassland communities within the Modification to Disturbance Boundary as part of a much larger foraging range. There are 12 records of the species within the locality of the Modification to Disturbance Boundary.

iii. Little Eagle

The Little Eagle (*Hieraaetus morphnoides*) inhabits open eucalypt forest, woodland or open woodland, she-oak woodlands, acacia woodlands, and riparian woodland within interior NSW, which have an abundance of prey (NSW Scientific Committee, 2011b). It feeds on birds, reptiles and mammals, occasionally consuming large insects and carrion. Nests are built using large sticks in tall living trees within remnant patches of vegetation (NSW Scientific Committee, 2011b). The Little Eagle is distributed throughout the mainland of Australia, except for the most densely forested parts of the Dividing Range escarpment (NSW Scientific Committee, 2011b).

It is expected that this species would forage across woodland and grassland communities within the Modification to Disturbance Boundary as part of a much larger foraging range. There are six records of the species within the locality of the Modification to Disturbance Boundary.

iv. Fork-tailed Swift

The Fork-tailed Swift (*Apus pacificus*) is a migrant to Australia in the non-breeding season (DoE, 2014a). This species is almost exclusively aerial, flying from less than 1 m to at least 300 m above ground and probably much higher, mostly over inland plains but sometimes above foothills or in coastal areas (DoE, 2014a). Foraging occurs anywhere from 1 m to 300 m above the ground, with the known diet comprising small bees, wasps, termites and moths

(DoE, 2014a). This species breeds in Siberia (DoE, 2014a). In NSW, the Fork-tailed Swift is recorded in all regions, with many records occurring east of the Great Divide (DoE, 2014a).

This species was not recorded during surveys, however, there is potential for this species to fly over the Modification to Disturbance Boundary. This species is expected to forage aerially above the Modification to Disturbance Boundary. There are no records of the species within the locality of the Modification to Disturbance Boundary.

v. White-throated Needletail

The White-throated Needletail (*Hirundapus caudacutus*) is a migrant to Australia in the non-breeding season (DoE, 2014b). This species is almost exclusively aerial, from heights of less than 1 m up to more than 1000 m above the ground, occurring above a wide range of habitats (DoE, 2014b). The diet of this species includes a wide variety of insects including beetles, cicadas, flying ants, bees, wasps, flies, termites, moths, locusts and grasshoppers (DoE, 2014b). This species breeds in Asia (DoE, 2014b). The White-throated Needletail is widespread in eastern and south-eastern Australia, extending inland to the western slopes of the Great Divide and occasionally onto the adjacent inland plains (DoE, 2014b).

This species was not recorded during surveys, however, there is potential for this species to fly over the Modification to Disturbance Boundary. This species is expected to forage aerially above the Modification to Disturbance Boundary. There are four records of the species within the locality of the Modification to Disturbance Boundary.

vi. Brown Treecreeper (eastern subspecies)

The Brown Treecreeper (*Climacteris picumnus victoriae*) inhabits eucalypt woodlands (including box-gum woodland) and dry open forest (OEH, 2012a). The woodlands and forests are usually dominated by stringybarks or other rough-barked eucalypts, typically with an open grassy understorey and sometimes with one or more shrub species (OEH, 2012a). This species forages on tree trunks and on the ground amongst leaf litter and on fallen logs for ants, beetles and larvae (NSW Scientific Committee, 2004). Fallen timber is considered to be an important habitat component for foraging (OEH, 2012a). The Brown Treecreeper nests in hollows in standing dead or live trees and tree stumps are essential for nesting (OEH, 2012a). The Brown Treecreeper occurs through central NSW on the western side of the Great Dividing Range and sparsely scattered to the east of the Divide in drier areas such as the Cumberland Plain of Western Sydney, and in parts of the Hunter, Clarence, Richmond and Snowy River valleys (NSW Scientific Committee, 2004).

The Brown Treecreeper has been recorded within the previously delineated Disturbance Boundary in woodland habitat. It is expected that this species would forage within the grassy woodland of the Modification to Disturbance Boundary. The scattered paddock trees are likely to facilitate some dispersal for the species into adjoining woodland areas outside the Modification to Disturbance Boundary. There are 63 records of the species within the locality of the Modification to Disturbance Boundary.

vii. Black-chinned Honeyeater (eastern subspecies)

The Black-chinned Honeyeater (*Melithreptus gularis gularis*) inhabits woodlands containing box-ironbark associations and *Eucalyptus camaldulensis* (River Red Gum) within NSW (NSW Scientific Committee, 2001a) and some open forests (OEH, 2014b). Commonly associated species include *Eucalyptus sideroxylon* (Mugga Ironbark), *Eucalyptus albens* (White Box), *Eucalyptus microcarpa* (Grey Box), *Eucalyptus melliodora* (Yellow Box), *Eucalyptus blakelyi* (Blakely's Red Gum) and *Eucalyptus tereticornis* (Forest Red Gum) (OEH, 2014b). This species feeds on arthropods, nectar and lerp from eucalypt foliage and bark (OEH, 2014b). Nesting occurs in crowns of tall eucalyptus, often box or ironbark trees, usually in the uppermost lateral branches, concealed by foliage (OEH, 2014b). Within NSW, this species is widespread with records from the tablelands and western slopes of the Great Dividing Range to the north-west and central-west plains and the Riverina (OEH, 2014b).

The Black-chinned Honeyeater was recorded in woodland in the north western corner of the previously delineated Disturbance Boundary. It has also been recorded in the adjoining Mount Pleasant lease area (Cumberland Ecology, 2010b). There are two records of the species within the locality of the Modification to Disturbance Boundary.

viii. Rainbow Bee-eater

The Rainbow Bee-eater (*Merops ornatus*) occurs mainly in open forests and woodlands, shrublands, and in various cleared or semi-cleared habitats, including farmland and areas of human habitation, often in proximity to permanent water (DoE, 2014c). This species feeds mainly on insects, such as bees and wasps, and on occasion will take earthworms, spiders and tadpoles (DoE, 2014c). Nests of this species are located in long burrows or tunnels that are excavated in flat or sloping ground, in the banks of rivers, creeks or dams, in roadside cuttings, in the walls of gravel pits or quarries, in mounds of gravel, or in cliff-faces (DoE, 2014c). The Rainbow Bee-eater occurs across much of mainland Australia (DoE, 2014c).

It is expected that this species would forage across grassy woodland and derived native grassland within the Modification to Disturbance Boundary. There are 23 records of the species within the locality of the Modification to Disturbance Boundary.

ix. Grey-crowned Babbler (eastern subspecies)

The Grey-crowned Babbler (*Pomatostomus temporalis temporalis*) inhabits box-gum woodlands on the slopes and box-Cypress Pine and open box woodlands on alluvial plains (OEH, 2012b). Woodlands typically have regenerating trees, tall shrubs and an intact ground cover of grass and forbs (NSW Scientific Committee, 2011a). The Grey-crowned Babbler feeds on invertebrates, either by foraging on the trunks and branches of eucalypts and other woodland trees or on the ground, digging and probing amongst litter and tussock grasses (OEH, 2012b). Nests are built from sticks and are usually located in shrubs or sapling eucalypts, however they occasionally build nests in the outermost leaves of low branches of large eucalypts (OEH, 2012b). In NSW, this species occurs on the western slopes and plains and isolated populations are known from coastal woodlands on the North Coast, in the Hunter Valley and from the South Coast near Nowra (NSW Scientific Committee, 2011a).

The Grey-crowned Babbler has been recorded within the previously delineated Disturbance Boundary at multiple locations. The species has also been recorded from surveys of the Mt Arthur Coal Mine lease where it tends to occur along Saddlers Creek and its tributaries (Cumberland Ecology, 2009). It has also been recorded in the adjoining Mount Pleasant Project area (Cumberland Ecology, 2010b). There are 65 records of the species within the locality of the Modification to Disturbance Boundary.

x. Barking Owl

The Barking Owl (*Ninox connivens*) inhabits forests and woodlands of tropical, temperate and semi-arid zones that are typically dominated by eucalypts, often red gum species (NSW NPWS, 2003). It is flexible in its habitat use, and hunting can extend in to closed forest and more open areas (OEH, 2014a). The diet of this species preferentially includes small arboreal mammals such as the Squirrel Glider and Common Ringtail Possum; however they are also known to feed on birds, invertebrates and terrestrial mammals such as rodents and rabbits (OEH, 2014a). This species roosts in or under dense foliage in large trees including rainforest species of streamside gallery forests, *Casuarina cunninghamiana* (River Oak), other *Casuarina* and *Allocasuarina* species, *Eucalypt*, *Angophora* or *Acacia* species (NSW NPWS, 2003). For breeding, this species required hollows in large eucalypts or paperbarks, usually near watercourses or wetlands (NSW NPWS, 2003). In NSW, the occurrence of the Barking Owl is widespread on the coastal plain and foothills and the inland slopes and plains (NSW NPWS, 2003).

It is expected that this species would forage across grassy woodland within the Modification to Disturbance Boundary as part of a much larger foraging range. There are four records of the species within the locality of the Modification to Disturbance Boundary.

xi. Squirrel Glider

The Squirrel Glider (*Petaurus norfolcensis*) inhabits mature or old-growth box / box-ironbark woodland, *Eucalyptus camaldulensis* (River Red Gum) forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heathy understorey in coastal areas (OEH, 2014f). It prefers mixed species stands with a shrub or *Acacia* midstorey (OEH, 2014f). This species feeds on nectar, pollen, plant exudates (e.g. wattle and eucalypt sap), invertebrates, and honeydew (sugary exudate from insects), and rarely small vertebrates such as nestling birds (NSW Scientific Commitee, 2008). The presence of large trees with abundant hollows are critical elements for nesting habitat (NSW Scientific Commitee, 2008). Den and nest sites are in hollows, preferably with a large cavity that can house multiple gliders in a large nest, yet with a small entrance that protects the group from predators (NSW Scientific Commitee, 2008). The Squirrel Glider is distributed from north Queensland to western Victoria, with a few records in extreme south-east South Australia where it may still persist (NSW Scientific Commitee, 2008).

The Squirrel Glider has been recorded within the previously delineated Disturbance Boundary. It has been recorded from surveys of the Mt Arthur Coal Mine lease area (Cumberland Ecology, 2009), Drayton Mine lease area (Hansen Bailey, 2007a) and the Mount Pleasant Project area (Cumberland Ecology, 2010b). There are 13 records of this species within the locality of the previously delineated Disturbance Boundary.

xii. Yellow-bellied Sheathtail-bat

The Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*) inhabits a range of habitats including wet and dry sclerophyll forest, open woodland, *Acacia* shrubland, mallee, grasslands and deserts (Churchill, 2009). The species typically forages above the canopy and lower over open vegetation and along forest edges (Churchill, 2009). Their diet predominantly consists of beetles, but grasshoppers, crickets, leafhoppers, shield bugs, wasps and some flying ants are also consumed (Churchill, 2009). This species is known to roost in tree hollows and buildings, and in treeless areas they are known to utilise mammal burrows (OEH, 2014g). The Yellow-bellied Sheathtail-bat occurs across northern and eastern Australia (OEH, 2014g).

The Yellow-bellied Sheathtail-bat was recorded within the previously delineated Disturbance Boundary. It has also been recorded from surveys of the Mt Arthur Coal Mine lease area (Cumberland Ecology, 2009), Drayton Mine lease area (Hansen Bailey, 2007a) and the Mount Pleasant Project area (Cumberland Ecology, 2010b). There are six records of the species within the locality of the Modification to Disturbance Boundary.

xiii. Eastern Freetail-bat

The Eastern Freetail-bat (*Mormopterus norfolkensis*) occurs in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range (OEH, 2014c). This species roosts mainly in tree hollows, but will also roost under bark or in man-made structures (OEH, 2014c). The Eastern Freetail-bat is found along the east coast from south Queensland to southern NSW (OEH, 2014c).

Available habitat within the Modification to Disturbance Boundary includes woody vegetation for foraging and hollow-bearing trees for roosting. There are 15 records of the species within the locality of the Modification to Disturbance Boundary.

xiv. Greater Broad-nosed Bat

The Greater Broad-nosed Bat (*Scoteanax rueppellii*) inhabits a variety of habitats including moist gullies in mature coastal forest, rainforest, open woodland, Melaleuca swamp woodland, wet and dry sclerophyll forests, cleared paddocks with remnant trees and tree-lines creeks in open areas (Churchill, 2009). Foraging occurs at the edge of isolated trees and forest remnants (Churchill, 2009). Their diet consists mainly of beetles with moths, ants and large flies consumed occasionally (Churchill, 2009). This species roosts in tree hollows, cracks and fissures in trucks and dead branches, under exfoliating bark, as well as the roofs of old buildings (Churchill, 2009). The Greater Broad-nosed Bat occurs mainly in the gullies and river systems that drain the Great Dividing Range, from north-eastern Victoria to the Atherton Tableland, extending to the coast over much of its range (OEH, 2014d).

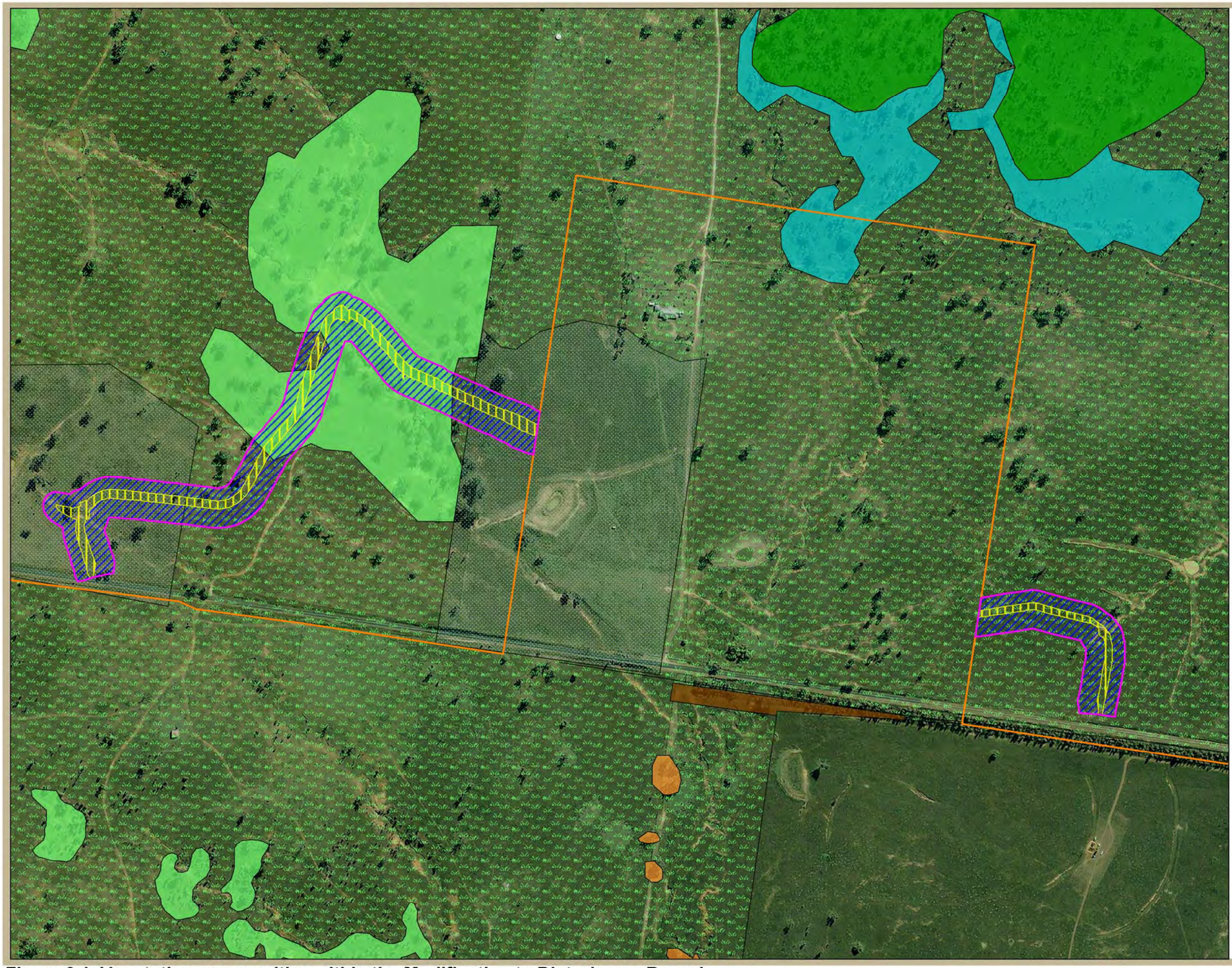
Available habitat within the Modification to Disturbance Boundary includes woody vegetation for foraging and hollow-bearing trees for roosting. There are five records of the species within the locality of the Modification to Disturbance Boundary.

xv. Grey-headed Flying-fox

The Grey-headed Flying-fox (*Pteropus poliocephalus*) inhabits subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops (OEH, 2013b). The primary food source is blossom from eucalypts (genera *Eucalyptus*, *Corymbia* and *Angophora*), melaleucas and banksias, and in some areas it also utilises a wide range of rainforest fruits (DoE, 2014d). As none of the vegetation communities used by this species produces continuous foraging resources throughout the year, it has adopted complex migration traits in response to ephemeral and patchy food resources (DoE, 2014d). Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy (OEH, 2013b). The Grey-headed Flying-fox is generally found within 200 km of the eastern coast of Australia, from Bundaberg in Queensland to Melbourne in Victoria (OEH, 2013b).

The woody vegetation within the Modification to Disturbance Boundary contains eucalypts that may potentially be utilised as foraging habitat. There are five records of the species within the locality of the Modification to Disturbance Boundary.

Coordinate System: MGA Zone 56 (GDA 94)



Legend

- Modification to Disturbance Boundary
- Disturbance Boundary
- Levee
- Buffer

Vegetation Community

- Upper Hunter White Box –Ironbark Grassy Woodland (EPBC CEEC; TSC EEC)
- Grey Box/White Box Intergrade Grassy Woodland (EPBC CEEC; TSC EEC)
- Derived Native Grassland (EPBC CEEC; TSC EEC)
- Hunter Floodplain Red Gum Woodland Complex (TSC Act EEC)
- Upper Hunter Hills Exposed Ironbark Woodland
- Low Diversity Derived Native Grassland/ Exotic Pasture
- Tree and Shrub Plantation

N
Grid North

Image Source:
BMC 2012

CUMBERLAND ECOLOGY

100 0 100 200 300 400m

I:\...\14081\Figures\RP1_Mod Report\20150622\Figure 3.1. Vegetation_Modification

Figure 3.1. Vegetation communities within the Modification to Disturbance Boundary

Chapter 4

Impact Assessment

This chapter considers the ecological impacts of the Project on the biodiversity values within the Modification to Disturbance Boundary and surrounds. The ecological impacts of the Project are largely related to the direct disturbance of vegetation and associated habitat loss, represented by the removal of native and semi-cleared vegetation. Potential indirect impacts of the Project are also discussed.

4.1 Direct Impacts

4.1.1 Vegetation Removal

The Modification to Disturbance Boundary is 9.07 ha in size, comprising 6.1 ha of native vegetation and 2.97 ha of non-native vegetation.

Table 4.1 provides a summary of the areas of each vegetation community within the Modification to Disturbance Boundary and **Figure 3.1** shows their distribution. One TEC, Box Gum Woodland and Derived Native Grassland, occurs within the Modification to Disturbance Boundary. Impacts to this TEC are discussed within ***Section 4.3***.

Table 4.1 Vegetation communities to be removed

Vegetation Community	TSC Act Status	EPBC Act Status	Modification to Disturbance Boundary (ha)^
Upper Hunter White Box –Ironbark Grassy Woodland	EEC	CEEC	
Grey Box/White Box Intergrade Grassy Woodland	EEC	CEEC	2.79
Derived Native Grassland (Box Gum Woodland)	EEC	CEEC	3.31
Hunter Floodplain Red Gum Woodland Complex	EEC		
Upper Hunter Hills Exposed Ironbark Derived Native Grassland			
Low Diversity Derived Native Grassland/Exotic Pasture	-	-	2.97
Total[+]			**9.07**

TSC Act / EPBC Act Status: EEC = Endangered Ecological Community, CEEC = Critically Endangered Ecological Community

[+] *In some cases totals may not equal the appropriate total number due to rounding*

[^] *Area calculations are approximate*

4.1.2 Habitat Removal

The Project will result in the removal of 2.79 ha of woodland habitat and 6.28 ha of grassland habitat within the Modification to Disturbance Boundary. The native and semi-cleared vegetation within the Modification to Disturbance Boundary provides some limited habitat for native flora and fauna; including some species that are listed as threatened or migratory under the TSC Act and/or EPBC Act.

However, of the 9.07 ha of vegetation to be removed, 5.56 ha will be a temporary impact and will be regenerated back to its original condition following completion of the Project. As such, the permanent vegetation loss as a result of the project (the levee) will be 0.59 ha of woodland and 2.93 ha of grassland. **Table 4.2** shows the total disturbed vegetation, temporarily disturbed vegetation and the area of vegetation that will be permanently removed within the Modification to Disturbance Boundary. These areas are shown as the levee and buffer areas in **Figure 3.1**. Mitigation recommendations for the regeneration of the impacted areas are discussed in ***Section 5.1***.

Table 4.2 Temporarily disturbed and permanently removed vegetation within the Modification to Disturbance Boundary

Vegetation Community	TSC Act Status	EPBC Act Status	Permanently removed (Levee) (ha)	Temporarily disturbed (Buffer) (ha)	Total Disturbed Area (ha)
Grey Box/White Box Intergrade Grassy Woodland	EEC	CEEC	0.59	2.2	2.79
Derived Native Grassland	EEC	CEEC	0.65	2.66	3.31
Low Diversity Derived Native Grassland/Exotic Pasture			2.28	0.69	2.97
Total			**3.52**	**5.56**	**9.07**

The woodland remnants occurring within the Modification to Disturbance Boundary are fragmented from other more intact patches of woodland and forest. The condition and nature of the woodland habitats have been greatly altered by existing and historical land uses. The long-term loss of 0.59 ha of woodland habitat within the Modification to Disturbance Boundary is not considered a significant loss of woodland habitat.

The loss of grassland areas is not considered to comprise an important impact in terms of flora and fauna habitat for the large majority of potentially occurring species. None of the threatened fauna species that are considered to have the potential to occur within the

Modification to Disturbance Boundary are likely to rely on such grassland habitats for their survival.

4.2 Indirect Impacts

The Project has the potential to indirectly impact remaining vegetation and habitats. These impacts include:

- Habitat fragmentation - affects biodiversity by reducing the amount of available habitat for some species to occupy due to increased distances between habitat patches. The works associated with the Project include the construction and operation of diversion levees that are 6-15 m wide in the eastern portion and 20-65 m wide in the western portion. Movement of the flora and fauna species likely to occur in the areas surrounding the Modification to Disturbance Boundary is not considered to be significantly impacted by the Project.

- Edge effects – affects biodiversity through microclimatic changes in light, temperature, humidity and wind, which can favour a suite of different species and therefore cause significant changes to the ecology of the patch (Lindenmayer and Fischer, 2006). The potential for edge effects is considered minimal given the already fragmented nature of the habitat within the Modification to Disturbance Boundary.

- Alteration to hydrological regimes – affects biodiversity through modification of hydrology necessary for vegetation and habitat survival, such as surface water drainage patterns and through the construction of hard surfaces. The Project includes the modification of an existing drainage line, which is not considered to result in the significant loss of flora and fauna habitats within proximity to the Modification to Disturbance Boundary.

- Increased sedimentation and erosion – affects biodiversity through the smothering of vegetation, increasing turbidity of waterways and transportation of weed matter and nutrients. Without the implementation of appropriate mitigation measures, the Project may increase sedimentation and erosion impacts on downstream environments.

4.3 Impacts to Threatened Ecological Communities

One TEC, Box Gum Woodland and Derived Native Grassland, will be directly impacted within the Modification to Disturbance Boundary. A discussion of the impacts to this TEC is provided below.

i. Significance of the Community

Box Gum Woodland and Derived Native Grassland is listed as an EEC under the TSC Act as it is likely to become extinct in NSW unless the circumstances and factors threatening its survival or evolutionary development cease to operate (NSW Scientific Committee, 2002).

Box Gum Woodland and Derived Native Grassland is listed as a CEEC under the EPBC Act due to its very severe decline in geographic distribution and due to its integrity being very severely reduced across most of its geographic range (Threatened Species Scientific Committee, 2006). It was once a geographically wide-spread community spanning three different states and covering an estimated pre-European area of several million hectares. Approximately 10% of its pre-European extent is estimated to remain today; the decline is primarily attributed to the community being situated largely on fertile, arable land in prime agricultural areas (DECCW (NSW), 2010).

ii. Impacts

The following communities within the Modification to Disturbance Boundary conform to the TSC Act and EPBC Act listed Box Gum Woodland and Derived Native Grassland:

- Grey Box/White Box Intergrade Grassy Woodland; and
- Derived Native Grassland (Box Gum Woodland).

Table 4.1 and **Table 4.2** shows the breakdown of each component of this community within the Modification to Disturbance Boundary. A total of 6.1 ha of this community will be disturbed including 1.55 ha being permanently removed, including 0.59 ha of woodland form and 0.65 ha of grassland form. Within the Modification to Disturbance Boundary, this community has been previously impacted by clearing and ongoing agricultural land uses and currently exists in a modified form of the original community. Within the woodland form of the community in the Modification to Disturbance Boundary, the Project may require the removal of some mature trees.

As a result of the Project, there will be interfaces between the Modification to Disturbance Boundary and the remaining areas of Box Gum Woodland and Derived Native Grassland. Clearing of vegetation at these interfaces will increase edge effects on the retained portion of Box Gum Woodland and Derived Native Grassland and as a result, the community may be impacted by indirect impacts such as weed invasion and soil erosion.

The direct and indirect impacts have been considered within the Assessments of Significance within **Appendix C** (TSC Act listed community) and **Appendix D** (EPBC Act listed community). These assessments take into account the mitigation measures outlined within **Chapter 5** that have sought to minimise impacts to Box Gum Woodland and Derived Native Grassland. Assuming that the recommended mitigation measures are implemented, these assessments determined that the Project is not considered to result in a significant impact to Box Gum Woodland and Derived Native Grassland.

4.4 Impacts to Flora Species

The Project has the potential to result in a number of direct and indirect impacts to flora species within the Modification to Disturbance Boundary and immediate surrounds. In addition to the direct removal of habitat within the Modification to Disturbance Boundary, potential indirect impacts to flora species include:

- Weed invasion;
- Run-off, erosion and sedimentation; and
- Modification of microhabitat features resulting from long and short-term edge effects (e.g. changes in light filtration).

A number of mitigation measures are proposed to minimise these impacts. These are discussed further in **Chapter 5**.

No threatened flora species listed under the TSC Act or EPBC Act have been recorded within the Modification to Disturbance Boundary. Four species are considered to have the potential to occur. The direct and indirect impacts have been considered within the Assessments of Significance within **Appendix C** (TSC Act listed species) and **Appendix D** (EPBC Act listed species). These assessments take into account the mitigation measures outlined within **Chapter 5** that have sought to minimise impacts to habitat for these species. Assuming that the recommended mitigation measures are implemented, these assessments determined that the Project is not considered to result in a significant impact to the potentially occurring threatened flora species.

4.5 Impacts to Fauna Species

The proposed development has the potential to result in a number of direct and indirect impacts to fauna species within the Modification to Disturbance Boundary and immediate surrounds. In addition to the direct removal of habitat within the Modification to Disturbance Boundary, potential indirect impacts to fauna species include:

- Habitat disturbance during the construction phase of the Project;
- Runoff, erosion and sedimentation;
- Increased pollution;
- Hydrological changes resulting in altered fauna habitats; and
- Modification of microhabitat features resulting from long and short-term edge effects (e.g. changes in light filtration).

No threatened fauna species listed under the TSC Act or EPBC Act have been recorded within the Modification to Disturbance Boundary. A total of 15 species are considered likely to occur. These species are highly mobile and are considered to utilise the Modification to Disturbance Boundary as part of larger foraging ranges. The habitat to be removed within the Modification to Disturbance Boundary exists in a fragmented landscape.

The direct and indirect impacts have been considered within the Assessments of Significance within **Appendix C** (TSC Act listed species) and **Appendix D** (EPBC Act listed species). These assessments take into account the mitigation measures outlined within **Chapter 5** that have sought to minimise impacts to habitat for these species. Assuming that

the recommended mitigation measures are implemented, these assessments determined that the Project is not considered to result in a significant impact to the potentially occurring threatened fauna species.

Chapter 5

Mitigation Measures

A number of mitigation measures are recommended for the Project. These measures should be implemented to minimise impacts to biodiversity values in adjoining habitats.

5.1 Vegetation Protection and Rehabilitation

Mature trees within the buffer area (see **Figure 3.1**) will be avoided where possible and safe to do so to minimise the impacts on the vegetation communities outside of the levees.

To avoid unnecessary removal or damage to Box Gum Woodland and Derived Native Grassland the clearing area should be clearly demarcated and signed, where appropriate, to ensure no vegetation beyond these boundaries is removed. Clearing works and equipment should be excluded from areas outside the Modification to Disturbance Boundaries. Site inductions are to be given to ensure all site workers and visitors are aware of any no-access areas.

Following completion of works, the vegetation communities in the buffer area (see **Figure 3.1**) will be rehabilitated back to its previous condition. This will be achieved by returning the topsoil back to the vegetation communities then the Modification to Disturbance Boundary will be fenced to prevent cattle entering the Modification to Disturbance Boundary whilst the vegetation communities recover. Weed management protocols will be implemented in order to control any establishment or infestation of weeds.

5.2 Erosion, Sedimentation and Pollution Control

Potential impacts to flora and fauna occurring in the construction and operational phases that can be managed include: run-off, sedimentation, erosion and pollution. As the Modification to Disturbance Boundary is located within an existing drainage line and Box Gum Woodland and Derived Native Grassland, precautions need to be taken to minimise impacts to these areas.

To reduce sedimentation on the construction site, erosion control measures should be implemented. This includes minimising the amount of exposed soils on the site at any given time. All soil stockpiles should be adequately covered when not in use to prevent erosion from heavy rainfall. Sediment fences (or equivalent) should be established around the perimeter of the development area to prevent the impacts of sedimentation on the adjoining vegetation. It is also recommended that, where possible, the diversion levees are

revegetated with locally endemic groundcover species from the Box Gum Woodland and Derived Native Grassland community.

During development, precautions should be taken to ensure that no pollution escapes the construction site. Pollution traps and efficient removal of pollution to an off-site location would help to minimise pollution impacts.

5.3 Pre-clearance Assessments and Clearance Supervision

Removal of mature trees will be minimised where possible; however, it is likely that some trees will be required to be removed to faciliate the Project. It is recommended that during the clearance phase of the Project that pre-clearance assessments and clearance supervsion of trees is conducted.

Pre-clearance assessments are to be undertaken by a suitably qualified ecologist to identify any trees, which require to be removed, that may support native fauna. Pre-clearing assessments will include the demarcation of key habitat features as hollow-bearing trees and fallen logs.

To minimise impacts to native fauna species, clearing should be undertaken in the following two-stage process under the supervision of a suitably qualified ecologist:

- The initial phase of clearing will involve clearing around identified habitat features and leaving the features overnight;
- The second stage will involve clearing of the habitat features left overnight followed by an inspection;

If possible, trees marked as containing hollows will be shaken by machinery prior to clearing to encourage any animals remaining to leave the hollows and move on. An ecologist should investigate all hollows for the presence of fauna following felling of the tree.

An ecologist should be present during clearing operations to rescue any animals injured during the clearance. Provisions will be made to protect any native fauna during clearing operations by the following means:

- All persons working on the vegetation clearing will be briefed about the possible fauna present and should avoid injuring any present;
- Animals disturbed or dislodged during the clearance but not injured should be assisted to move to the adjacent bushland; and
- If animals are injured during the vegetation clearance, appropriate steps will be taken to humanely treat the animal (either taken to the nearest veterinary clinic for treatment, or if the animal is unlikely to survive, it will be humanely euthanized).

Chapter 6

Conclusion

Despite the impacts of previous disturbance and its location within a fragmented landscape, the Project will require the clearing of native vegetation that forms suitable habitat for some threatened flora and fauna species. Past and current use of the Modification has entailed clearing and modification of the majority of pre-existing native vegetation.

Within the Modification to Disturbance Boundary, 9.07 ha of native and non-native vegetation will be disturbed consisting of approximately 6.1 ha of Box Gum Woodland and Derived Native Grassland and 2.28 ha of Low Diversity Derived Native Grassland/Exotic Pasture will be disturbed for the Project. However, only 1.24 ha of Box Gum Woodland and Derived Native Grassland (0.59 ha of woodland form and 0.65 ha of grassland form) will be permanently removed with the rest of the vegetation rehabilitated back to its previous condition prior to completion of the Project.

The Box Gum Woodland and Derived Native Grassland occurring within the Modification to Disturbance Boundary is listed as an EEC under the TSC Act and a CEEC under the EPBC Act. Within the Modification to Disturbance Boundary this community exists in a modified form. No threatened flora or fauna species have been recorded within the Modification to Disturbance Boundary; however a number of species have been recorded within the locality and have the potential to occur. None of these species are considered to rely upon the habitats to be cleared for the Project.

A number of mitigation measures have been recommended for the Project, including vegetation protection measures and vegetation community rehabilitation; erosion, sedimentation and pollution control; and pre-clearance assessments and clearance supervision.

The direct and indirect impacts of the Project on TSC Act and EPBC Act communities, species and populations have been assessed. Assuming all recommended mitigation measures are implemented, no significant impact to these entities is predicted to occur as a result of the Project.

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Appendix A

Threatened Flora Likelihood of Occurrence

Table 6.1 Likelihood of occurrence of threatened flora species

Family	Scientific Name	Common Name	Locality Count^	TSC Act Status	EPBC Act Status	Habitat Requirements	Likelihood of Occurrence
Apocynaceae	*Cynanchum elegans*	White-flowered Wax Plant	Predicted	E	E	Usually occurs on the edge of dry rainforest vegetation. Other associated vegetation types include littoral rainforest; *Leptospermum laevigatum – Banksia integrifolia subsp. integrifolia* coastal scrub; *Eucalyptus tereticornis* aligned open forest and woodland; *Corymbia maculata* aligned open forest and woodland; and *Melaleuca armillaris* scrub to open scrub. Restricted to eastern NSW where it is distributed from Brunswick Heads on the north coast to Gerroa in the Illawarra region. Has been recorded as far west as Merriwa in the Upper Hunter River valley.	UNLIKELY. No suitable habitat available within the Modification to Disturbance Boundary.
Apocynaceae	*Tylophora linearis*		Predicted	V	E	Occurs in dry scrub and open forest and has been recorded from low-altitude sedimentary flats in dry woodlands of *Eucalyptus fibrosa*, *Eucalyptus sideroxylon*, *Eucalyptus albens*, *Callitris endlicheri*, *Callitris glaucophylla* and *Allocasuarina luehmannii*.	UNLIKELY. Some suitable habitat present; however the Modification to Disturbance Boundary is outside of the known range.
Asteraceae	*Ozothamnus tesselatus*		2	V	V	Grows in eucalypt woodland. Restricted to a few locations in an east-west zone south of Bunnan and between west Bylong and east Ravensworth.	UNLIKELY. Some suitable habitat present; however the Modification to Disturbance Boundary is outside of the known range.

Table 6.1 Likelihood of occurrence of threatened flora species

Family	Scientific Name	Common Name	Locality Count^	TSC Act Status	EPBC Act Status	Habitat Requirements	Likelihood of Occurrence
Brassicaceae	*Lepidium hyssopifolium*	Aromatic Peppercress	2	E	E	Occurs in a variety of habitats including woodland with a grassy understorey and grassland. In NSW, there is a small population near Bathurst, one population at Bungendore, and one near Crookwell.	UNLIKELY. Some suitable habitat present; however the Modification to Disturbance Boundary is outside of the known range.
Fabaceae (Mimosoideae)	*Acacia pendula* - endangered population	Weeping Myall Population in the Hunter Catchment	57	EP		Within the Hunter catchment the species typically occurs on heavy soils, sometimes on the margins of small floodplains, but also in more undulating locations. This Hunter population is known to occur naturally as far east as Warkworth, and extends northwest to Muswellbrook and to the west of Muswellbrook at Wybong.	UNLIKELY. Limited habitat present within the Modification to Disturbance Boundary. Not recorded during surveys.
Geraniaceae	*Pelargonium sp. (G.W. Carr 10345 (syn. Pelargonium sp. striatellum)*		Predicted	E	E	Has a narrow habitat that is usually just above the high-water level of irregularly inundated or ephemeral lakes, in the transition zone between surrounding grasslands or pasture and the wetland or aquatic communities.	UNLIKELY. No suitable habitat available within the Modification to Disturbance Boundary.
Lamiaceae	*Prostanthera cryptandroides subsp. cryptandroides*	Wollemi Mint-bush	51	V	V	Associated communities include: Narrabeen Rocky Heath, Narrabeen Acacia Woodland, Narrabeen Exposed Woodland; Open Heath of *Calytrix tetragona*, *Leptospermum parviflorum* and *Isopogon dawsonii*; and Open Scrubland of *Eucalyptus dwyeri*, *Baeckea densifolia*, *Dillwynia floribunda*, *Aotus ericoides* and *Hemigenia cunefolia*. Distributed between Lithgow and Sandy Hollow	UNLIKELY. No suitable habitat available within the Modification to Disturbance Boundary.

Table 6.1 Likelihood of occurrence of threatened flora species

Family	Scientific Name	Common Name	Locality Count^	TSC Act Status	EPBC Act Status	Habitat Requirements	Likelihood of Occurrence
						on the NSW central west slopes, central tablelands and western parts of the central coast botanical regions.	
Malvaceae	*Androclava procumbens*		Predicted	V	V	Recorded in *Eucalyptus dealbata* and *Eucalyptus sideroxylon* communities, *Melaleuca uncinata* scrub, under mallee eucalypts with a *Calytrix tetragona* understorey, and in a recently burnt Ironbark and *Callitris* area. Mainly confined to the Dubbo-Mendooran-Gilgandra region.	UNLIKELY. No suitable habitat available within the Modification to Disturbance Boundary.
Malvaceae	*Commersonia rosea (syn. Androcalva rosea)*		1	E	E	Occurs on skeletal sandy soils in scrub or heath vegetation with occasional emergents of *Eucalyptus crebra*, *Callitris endlicheri* or *Eucalyptus caleyi* subsp. *caleyi*.	UNLIKELY. No suitable habitat available within the Modification to Disturbance Boundary.
Malvaceae	*Lasiopetalum longistamineum*		2	V	V	Known to occur in grassy woodlands and dry (sclerophyll) forests and rainforests on rich alluvial deposits. Occurs in the Mt Dangar - Gungal area within Merriwa and Muswellbrook Local Government Areas.	UNLIKELY. No suitable habitat available within the Modification to Disturbance Boundary.
Moraceae	*Streblus pendulinus*	Siah's Backbone	Predicted		E	Grows in well developed rainforest, gallery forest and drier, more seasonal rainforest. Occurs from Cape York Peninsula to Milton, south-east New South Wales (NSW), as well as Norfolk Island.	UNLIKELY. No suitable habitat available within the Modification to Disturbance Boundary.
Myrtaceae	*Eucalyptus camaldulensis* - endangered population	River Red Gum Population in the Hunter Catchment	553	EP		May occur with *Eucalyptus tereticornis*, *Eucalyptus melliodora*, *Casuarina cunninghamiana subsp. cunninghamiana* and *Angophora floribunda* on major floodplains. The Hunter population occurs from the west at	UNLIKELY. Limited habitat present within the Modification to Disturbance Boundary.

Table 6.1 Likelihood of occurrence of threatened flora species

Family	Scientific Name	Common Name	Locality Count^	TSC Act Status	EPBC Act Status	Habitat Requirements	Likelihood of Occurrence
						Bylong, south of Merriwa, to the east at Hinton, on the bank of the Hunter River, in the Port Stephens local government area	Not recorded during surveys.
Myrtaceae	*Eucalyptus glaucina*	Slaty Red Gum	2	V	V	Grows in grassy woodland and dry eucalypt forest. Grows on deep, moderately fertile and well-watered soils. Found only on the north coast of NSW and in separate districts: near Casino, and farther south, from Taree to Broke, west of Maitland.	UNLIKELY. Limited habitat present within the Modification to Disturbance Boundary. Not recorded during surveys.
Myrtaceae	*Eucalyptus nicholii*	Narrow-leaved Black Peppermint	2	V	V	Typically grows in dry grassy woodland, on shallow soils of slopes and ridges. Found primarily on infertile soils derived from granite or metasedimentary rock. Sparsely distributed but widespread on the New England Tablelands from Nundle to north of Tenterfield, being most common in central portions of its range.	UNLIKELY. Modification to Disturbance Boundary outside the natural range of the species.
Orchidaceae	*Cryptostylis hunteriana*	Leafless Tongue-orchid	Predicted	V	V	Does not appear to have well defined habitat preferences and is known from a range of communities, including swamp-heath and woodland.	UNLIKELY. Some suitable habitat present; however the Modification to Disturbance Boundary is outside of the known range.
Orchidaceae	*Cymbidium canaliculatum* -	*Cymbidium canaliculatum*	56	EP		Within the Hunter Catchment, it is most commonly found in *Eucalyptus albens* (White Box) dominated woodlands	POTENTIAL. Suitable habitat within woodland

Table 6.1 Likelihood of occurrence of threatened flora species

Family	Scientific Name	Common Name	Locality Count^	TSC Act Status	EPBC Act Status	Habitat Requirements	Likelihood of Occurrence
	endangered population	population in the Hunter Catchment				(including those dominated by the intergrade *E. albens-moluccana*). The Hunter population is known to occur naturally as far south as Weston and Pokolbin in the Lower Hunter, which represents its south-eastern geographic limit, but appears to be more centred in the Upper Hunter, predominantly north of Singleton.	and scattered trees. Recorded at three locations within the Disturbance Boundary. Also recorded within the Mt Arthur Coal lease area and the Drayton South Mine Lease. Not recorded during surveys.
Orchidaceae	*Diuris tricolor* / *Diuris tricolor* - endangered population	Pine Donkey Orchid / Pine Donkey Orchid in the Muswellbrook local government area	643	V / EP		Found in sclerophyll woodland and derived grassland on flats or small rises, on a range of substrates including sandy or loamy soils. The population of Diuris tricolor in the Muswellbrook LGA is at the eastern limit of the geographic range of the species and all other populations of the species are located west of the Great Dividing Range.	POTENTIAL. Suitable habitat present within the Modification to Disturbance Boundary. Recorded within the Mt Arthur Coal lease area and the Drayton South Mine Lease.
Orchidaceae	*Prasophyllum* sp. Wybong / *Prasophyllum petilum*^	Tarengo Leek Orchid	75	E	CE/E^	Grows in open sites within Natural Temperate Grassland. Also grows in grassy woodland in association with River Tussock *Poa labillardierei*, Black Gum *Eucalyptus aggregata* and tea-trees *Leptospermum* spp. and within the grassy ground layer dominated by Kangaroo Grass under Box-Gum Woodland. Natural populations are known from a total of four sites in NSW, including	POTENTIAL. Some suitable habitat present within the Modification to Disturbance Boundary. However the Modification to Disturbance Boundary is outside of the known

Table 6.1 Likelihood of occurrence of threatened flora species

Family	Scientific Name	Common Name	Locality Count^	TSC Act Status	EPBC Act Status	Habitat Requirements	Likelihood of Occurrence
						Boorowa, Captains Flat, Ilford and Delegate.	populations.
Orchidaceae	*Pterostylis gibbosa*	Illawarra Greenhood	Predicted	E	E	Known populations grow in open forest or woodland, on flat or gently sloping land with poor drainage. In the Hunter region, the species grows in open woodland dominated by *Eucalyptus crebra*, *E. tereticornis* and *Callitris endlicheri*. Known from a small number of populations in the Hunter region (Milbrodale), the Illawarra region (Albion Park and Yallah) and the Shoalhaven region (near Nowra).	UNLIKELY. Some suitable habitat present; however the Modification to Disturbance Boundary is outside of the known range within the Hunter Valley.
Rhamnaceae	*Pomaderris queenslandica*	Scant Pomaderris	36	E		Found in moist eucalypt forest or sheltered woodlands with a shrubby understorey, and occasionally along creeks. 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.	UNLIKELY. No suitable habitat available within the Modification to Disturbance Boundary.
Rhamnaceae	*Pomaderris reperta*	Denman Pomaderris	115	CE	CE	Occupies woodland in association with *Eucalyptus crebra*, *E. blakelyi*, *Notelaea microcarpa* and *Allocasuarina littoralis*. Associated soil is a sandy loam on sandstone or conglomerate. Recorded from a small number of sites along a single ridgeline near Denman in the Upper Hunter Valley	UNLIKELY. No suitable habitat available within the Modification to Disturbance Boundary.
Santalaceae	*Thesium australe*	Austral Toadflax	Predicted	V	V	Occurs in grassland or grassy woodland. Often found in damp sites in association with *Themeda australis*. Austral	POTENTIAL. Suitable habitat present. The

Table 6.1 Likelihood of occurrence of threatened flora species

Family	Scientific Name	Common Name	Locality Count^	TSC Act Status	EPBC Act Status	Habitat Requirements	Likelihood of Occurrence
						Toad-flax is found in very small populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands.	species is only known from two localised populations detected elsewhere in the Muswellbrook LGA.
Scrophulariaceae	*Euphrasia arguta*		Predicted	CE	CE	Historic records of the species noted the following habitats: 'in the open forest country around Bathurst in sub humid places', 'on the grassy country near Bathurst', and 'in meadows near rivers'. It was rediscovered in the Nundle area of the NSW north western slopes and tablelands in 2008. Prior to this, it had not been collected for 100 years.	UNLIKELY. Modification to Disturbance Boundary is outside the natural range of the species.

TSC Act / EPBC Act Status: V = Vulnerable, E = Endangered, EP = Endangered population, CE = Critically Endangered

**Data obtained from the Atlas of NSW Wildlife (OEH, 2015) and Protected Matters Search Tool (DoE, 2015a)*

^ Taxonomic changes have combined Prasophyllum sp. Wybong and Prasophyllum petilum; however they are still listed under two status levels under the EPBC Act

Appendix B

Threatened Fauna Likelihood of Occurrence

Table 6.2 Likelihood of Occurrence of Threatened Fauna Species

Family	Species Name	Common Name	Locality Count^	TSC Act Status	EPBC Act Status	Habitat Requirements	Likelihood of Occurrence
Amphibians							
Hylidae	*Litoria booroolongensis*	Booroolong Frog	Predicted	E	E	Live along permanent streams with some fringing vegetation cover such as ferns, sedges or grasses. Adults occur on or near cobble banks and other rock structures within stream margins.	UNLIKELY. No suitable habitat present in the Modification to Disturbance Boundary.
Birds							
Acanthizidae	*Chthonicola sagittata*	Speckled Warbler	90	V	-	Inhabits a wide range of Eucalyptus dominated communities that have a grassy understorey, often on rocky ridges or in gullies.	LIKELY. Recorded during surveys within the Disturbance Boundary.
Accipitridae	*Circus assimilis*	Spotted Harrier	12	V	-	Inhabits grassy open woodland including Acacia and mallee remnants, inland riparian woodland, grassland and shrub steppe. It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands.	LIKELY. Suitable habitat present and likely to hunt over grassland areas within the Modification to Disturbance Boundary on occasion.
Accipitridae	*Haliaeetus leucogaster*	White-bellied Sea-Eagle	3	-	M	Inhabits coastal habitats, particularly those close to the sea-shore, and around terrestrial wetlands in tropical and temperate regions of mainland Australia and its offshore islands. Its habitat is characterised by the presence of large areas of open water including larger rivers, swamps, lakes and the sea, and have been recorded flying over a variety of terrestrial habitats.	POTENITAL. May occasionally fly over the Modification Area.

Table 6.2 Likelihood of Occurrence of Threatened Fauna Species

Family	Species Name	Common Name	Locality Count^	TSC Act Status	EPBC Act Status	Habitat Requirements	Likelihood of Occurrence
Accipitridae	*Hieraaetus morphnoides*	Little Eagle	6	V	-	Inhabits open eucalypt forest, woodland or open woodland, she-oak woodlands, acacia woodlands, and riparian woodland, which have an abundance of prey.	LIKELY. Suitable habitat is present in the Modification to Disturbance Boundary. Has been recorded hunting among scattered paddock trees on a nearby property in 2011.
Accipitridae	*Lophoictinia isura*	Square-tailed Kite	1	V	-	Inhabits coastal and subcoastal eucalypt-dominated open forests and woodlands, and inland riparian woodland.	UNLIKELY. Some suitable habitat present in the Modification to Disturbance Boundary, but few recent records in the locality.
Accipitridae	*Pandion cristatus*	Eastern Osprey		V	M	Favour coastal areas, especially the mouths of large rivers, lagoons and lakes.	UNLIKELY. Limited suitable habitat present in the Modification to Disturbance Boundary. No records in the locality.
Apodidae	*Apus pacificus*	Fork-tailed Swift	Predicted	-	M	The Fork-tailed Swift is almost exclusively aerial, flying from less than 1 m to at least 300 m above ground and probably much higher. The species mostly occurs over inland plains but sometimes above foothills or in coastal areas. They also occur over settled areas, including towns, urban areas and cities. They mostly occur over dry or open habitats, including	LIKELY. Likely to occasionally fly over but not likely to visit.

Table 6.2 Likelihood of Occurrence of Threatened Fauna Species

Family	Species Name	Common Name	Locality Count^	TSC Act Status	EPBC Act Status	Habitat Requirements	Likelihood of Occurrence
						riparian woodland and tea-tree swamps, low scrub, heathland or saltmarsh. They probably roost aerially, but are occasionally observed to land.	
Apodidae	*Hirundapus caudacutus*	White-throated Needletail	4	-	M	This species is almost exclusively aerial, from heights of less than 1 m up to more than 1000 m above the ground, occurring above a wide range of habitats.	LIKELY. Recorded in Mt Arthur Coal lease area in 2006/7 and frequently recorded during 2006 surveys within the Drayton Mine lease area. Likely to fly over from time to time.
Ardeidae	*Ardea ibis*	Cattle Egret	1	-	M	Inhabits tropical and temperate grasslands, wooded lands and terrestrial wetlands and often forages away from water on low lying grasslands, improved pastures and croplands. Within Australia the principal breeding sites of the Cattle Egret are along the central east coast from Newcastle to Bundaberg.	UNLIKELY. Limited suitable habitat present in the Modification to Disturbance Boundary.
Ardeidae	*Ardea modesta*	Eastern Great Egret	Predicted	-	M	Occur a wide range of wetland habitats (for example inland and coastal, freshwater and saline, permanent and ephemeral, open and vegetated, large and small, natural and artificial).	UNLIKELY. Limited suitable habitat present in the Modification to Disturbance Boundary.
Ardeidae	*Botaurus poiciloptilus*	Australasian Bittern	Predicted	E	E	Permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (*Typha* spp.) and spikerushes (*Eleocharis* spp.).	UNLIKELY. No suitable habitat is present in the Modification to Disturbance

Table 6.2 Likelihood of Occurrence of Threatened Fauna Species

Family	Species Name	Common Name	Locality Count^	TSC Act Status	EPBC Act Status	Habitat Requirements	Likelihood of Occurrence
							Boundary.
Cacatuidae	*Calyptorhynchus lathami*	Glossy Black-cockatoo	30	V	-	Lives in coastal woodlands and drier forest areas, open inland woodlands or timbered watercourses where sheoaks, its main food trees, are common.	UNLIKELY. Limited suitable habitat present in the Modification to Disturbance Boundary.
Ciconiidae	*Ephippiorhynchus asiaticus*	Black-necked Stork	1	E	-	Associated with tropical and warm temperate terrestrial wetlands, estuarine and littoral habitats, and occasionally woodlands and grasslands, floodplains. Forages in fresh or saline waters up to 0.5m deep, mainly in open fresh waters, extensive sheets of shallow water over grasslands or sedgeland, mangroves, mudflats, shallow swamps with short emergent vegetation and permanent billabongs and pools on floodplains.	UNLIKELY. No suitable habitat is present in the Modification to Disturbance Boundary.
Climacteridae	*Climacteris picumnus victoriae*	Brown Treecreeper (eastern subspecies)	63	V	-	Inhabits eucalypt woodlands (including box-gum woodland) and dry open forest. The woodlands and forests are usually dominated by stringybarks or other rough-barked eucalypts, typically with an open grassy understorey and sometimes with one or more shrub species.	LIKELY. Suitable habitat present within the Modification to Disturbance Boundary. Recorded during surveys within the Disturbance Boundary.
Estrildidae	*Stagonopleura guttata*	Diamond Firetail	14	V	-	Inhabits eucalypt woodlands, forests and mallee where there is a grassy understorey.	POTENTIAL. Recorded in the Mt Arthur Coal lease area in 2000 and in the Drayton Mine lease area in

Table 6.2 Likelihood of Occurrence of Threatened Fauna Species

Family	Species Name	Common Name	Locality Count^	TSC Act Status	EPBC Act Status	Habitat Requirements	Likelihood of Occurrence
							2006. Suitable habitat present in the Modification to Disturbance Boundary. The species was recorded in a nearby property in 2011.
Falconidae	*Falco subniger*	Black Falcon	3	V	-	Inhabits woodland, shrubland and grassland in the arid and semi-arid zones, especially wooded watercourses and agricultural land with scattered remnant trees and usually associated with streams or wetlands.	UNLIKELY. Limited suitable habitat present in the Modification to Disturbance Boundary and few recent records in the locality.
Laridae	*Hydroprogne caspia*	Caspian Tern	1	-	M	Mostly found in sheltered coastal embayments (harbours, lagoons, inlets, bays, estuaries and river deltas) and those with sandy or muddy margins are preferred. They also occur on near-coastal or inland terrestrial wetlands that are either fresh or saline, especially lakes (including ephemeral lakes), waterholes, reservoirs, rivers and creeks.	UNLIKELY. No suitable habitat is present in the Modification to Disturbance Boundary.
Meliphagidae	*Anthochaera phrygia*	Regent Honeyeater	Predicted	CE	E	Inhabits eucalypt open forests and woodlands, particularly box-ironbark vegetation as well as River Oak gallery forest. Feeds on the nectar of eucalypts and key species include *Eucalyptus sideroxylon*, *Eucalyptus albens* and *Eucalyptus melliodora* as well as the mistletoe *Amyema cambagei* which grows on *Casuarina cunninghamiana*.	POTENTIAL. No records exist for the locality but there is some limited suitable foraging habitat present in the Modification to Disturbance Boundary.

Table 6.2 Likelihood of Occurrence of Threatened Fauna Species

Family	Species Name	Common Name	Locality Count^	TSC Act Status	EPBC Act Status	Habitat Requirements	Likelihood of Occurrence
							May visit in times of food shortage.
Meliphagidae	*Grantiella picta*	Painted Honeyeater	1	V	-	Inhabits Boree, Brigalow and box-gum woodlands and box-ironbark forests. The species feeds on the fruits of mistletoes, particularly those in the Amyema genus, growing on woodland eucalypts and acacias.	POTENTIAL. Some suitable habitat in the Modification to Disturbance Boundary but is rare in the locality.
Meliphagidae	*Melithreptus gularis gularis*	Black-chinned Honeyeater (eastern subspecies)	2	V	-	Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark (*Eucalyptus sideroxylon*), White Box (E. *albens*), Inland Grey Box (*E. microcarpa*), Yellow Box (*E. melliodora*) and Forest Red Gum (*E. tereticornis*).	LIKELY. Suitable habitat present within the Modification to Disturbance Boundary. Recorded during surveys within the Disturbance Boundary.
Meropidae	*Merops ornatus*	Rainbow Bee-eater	23	-	M	Occurs mainly in open forests and woodlands, shrublands, and in various cleared or semi-cleared habitats, including farmland and areas of human habitation, often in proximity to permanent water.	LIKELY. Recorded in Mt Arthur Coal lease area in 2006/7 and during 2006 surveys within the Drayton Mine lease area. Likely to fly over from time to time.
Monarchidae	*Monarcha melanopsis*	Black-faced Monarch	Predicted	-	M	Mainly occurs in rainforest ecosystems, including semi-deciduous vine-thickets, complex notophyll vine-forest, tropical (mesophyll) rainforest, subtropical (notophyll) rainforest, mesophyll (broadleaf) thicket/shrubland, warm	UNLIKELY. No suitable habitat is present in the Modification to Disturbance Boundary.

Table 6.2 Likelihood of Occurrence of Threatened Fauna Species

Family	Species Name	Common Name	Locality Count^	TSC Act Status	EPBC Act Status	Habitat Requirements	Likelihood of Occurrence
						temperate rainforest, dry (monsoon) rainforest and (occasionally) cool temperate rainforest.	
Monarchidae	*Myiagra cyanoleuca*	Satin Flycatcher	Predicted	-	M	Inhabit heavily vegetated gullies in eucalypt-dominated forests and taller woodlands, and on migration, occur in coastal forests, woodlands, mangroves and drier woodlands and open forests. Widespread on and east of the Great Divide and sparsely scattered on the western slopes in NSW, with very occasional records on the western plains.	UNLIKELY. No suitable habitat is present in the Modification to Disturbance Boundary.
Neosittidae	*Daphoenositta chrysoptera*	Varied Sittella	15	V	-	Inhabits eucalypt forests and woodlands, especially where rough-barked species and mature smooth-barked gums with dead branches are present, as well as mallee and Acacia woodland.	POTENTIAL. Suitable habitat present and known to occur in the locality.
Petroicidae	*Melanodryas cucullata cucullata*	Hooded Robin (south-eastern form)	21	V	-	Inhabits lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas.	POTENTIAL. Recorded in the Mt Arthur Coal lease area in 2000. Suitable habitat present in the Modification to Disturbance Boundary.
Petroicidae	*Petroica boodang*	Scarlet Robin	3	V	-	Inhabits dry eucalypt forests and woodlands, usually in areas where the understorey is open and grassy with few scattered shrubs.	UNLIKELY. Limited suitable habitat present within the Modification to Disturbance Boundary.
Petroicidae	*Petroica phoenicea*	Flame Robin	1	V	-	Inhabits upland tall moist eucalypt forests and woodlands,	UNLIKELY. Limited

Table 6.2 Likelihood of Occurrence of Threatened Fauna Species

Family	Species Name	Common Name	Locality Count^	TSC Act Status	EPBC Act Status	Habitat Requirements	Likelihood of Occurrence
						often on ridges and slopes during breeding season and migrate to drier more open habitats in the lowlands (i.e. valleys below the ranges, and to the western slopes and plains).	suitable habitat present within the Modification to Disturbance Boundary.
Pomatostomidae	*Pomatostomus temporalis temporalis*	Grey-crowned Babbler (eastern subspecies)	65	V	-	Open woodlands dominated by mature eucalypts with regenerating trees, tall shrubs, and an intact ground cover of grass and forbs. This species avoids very wet areas.	LIKELY. Suitable habitat present within the Modification to Disturbance Boundary. Recorded during surveys within the Disturbance Boundary.
Psittacidae	*Glossopsitta pusilla*	Little Lorikeet	7	V	-	Mainly inhabit dry, open sclerophyll forests and woodlands, usually dominated by tall eucalypts, especially box–ironbark species including White Box and Yellow Box, where they forage in the canopy of flowering trees.	POTENTIAL. Suitable habitat present and known to occur in the locality. One sighting from 2005 was recorded just off Edderton Road near the Denman Road intersection.
Psittacidae	*Lathamus discolor*	Swift Parrot	Predicted	E	E	Migrates from its Tasmanian breeding grounds to overwinter in the box-ironbark forests and woodlands of Victoria, NSW and southern Queensland. They occur in areas where eucalypts are flowering profusely or where there are abundant lerp infestations. Favoured feed trees include *Eucalyptus robusta*, *Corymbia maculata*, *Corymbia gummifera*, *Eucalyptus sideroxylon* and *Eucalyptus albens*.	POTENTIAL. Suitable foraging habitat present in the Modification to Disturbance Boundary. May visit in times of food shortage. A pair was recorded foraging in a

Table 6.2 Likelihood of Occurrence of Threatened Fauna Species

Family	Species Name	Common Name	Locality Count^	TSC Act Status	EPBC Act Status	Habitat Requirements	Likelihood of Occurrence
							paddock tree on a nearby property in 2011.
Psittacidae	*Neophema pulchella*	Turquoise Parrot	4	V	-	Inhabits eucalypt and cypress-pine open forests and woodlands, particularly box or box-ironbark woodlands, often in undulating or rugged country.	UNLIKELY. Limited suitable habitat within the Modification to Disturbance Boundary.
Rhipiduridae	*Rhipidura rufifrons*	Rufous Fantail	Predicted		M	Mainly inhabits wet sclerophyll forests, often in gullies dominated by eucalypts such as *Eucalyptus microcorys*, *Eucalyptus cypellocarpa*, *Eucalyptus radiata*, *Eucalyptus regnans*, *Eucalyptus delegatensis*, *Eucalyptus pilularis* or *Eucalyptus resinifera*, usually with a dense shrubby understorey often including ferns.	UNLIKELY. Limited suitable habitat within the Modification to Disturbance Boundary.
Rostratulidae	*Rostratula australis*	Australian Painted Snipe	Predicted	E	V	Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber. Nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds. Roosts during the day in dense vegetation. Forages nocturnally on mud-flats and in shallow water.	UNLIKELY. No suitable habitat present in the Modification to Disturbance Boundary.
Scolopacidae	*Gallinago hardwickii*	Latham's Snipe	Predicted	-	M	Usually inhabits open, freshwater wetlands with low, dense vegetation (e.g. swamps, flooded grasslands or heathlands, around bogs and other water bodies). However, they can also occur in habitats with saline or brackish water, in modified or artificial habitats, and in habitats located close to	UNLIKELY. No suitable habitat present in the Modification to Disturbance Boundary.

Table 6.2 Likelihood of Occurrence of Threatened Fauna Species

Family	Species Name	Common Name	Locality Count^	TSC Act Status	EPBC Act Status	Habitat Requirements	Likelihood of Occurrence
						humans or human activity.	
Strigidae	*Ninox connivens*	Barking Owl	4	V	-	Inhabits forests and woodlands of tropical, temperate and semi arid zones that are typically dominated by eucalypts, often red gum species. Roosts in or under dense foliage in large trees including rainforest species of streamside gallery forests, Casuarina cunninghamiana, other Casuarina and Allocasuarina species, Eucalypt, Angophora or Acacia species. For breeding, this species required hollows in large eucalypts or paperbarks, usually near watercourses or wetlands.	LIKELY. Has been recorded on a nearby property during surveys in 2000. Suitable foraging habitat present in the Modification to Disturbance Boundary.
Strigidae	*Ninox strenua*	Powerful Owl	2	V	-	Inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. Roosting occurs in groves of dense mid-canopy trees or tall shrubs in sheltered gullies, typically on wide creek flats and at the heads of minor drainage lines. This species nests in old hollow eucalypts in unlogged, unburnt gullies and lower slopes within 100 m of streams or minor drainage lines.	UNLIKELY. Limited suitable habitat within the Modification to Disturbance Boundary.
Tytonidae	*Tyto novaehollandiae*	Masked Owl	6	V	-	Inhabits dry eucalypt forests of the tablelands, western slopes and the undulating wet-dry forests of the coast. Optimal habitat includes an open understorey and a mosaic of sparse (grassy) and dense (shrubby) ground cover on gentle terrain. This species nests in old hollow eucalypts, live or dead but commonly live, in a variety of topographic positions from gully to upper slope.	POTENTIAL. Limited suitable habitat present in the Modification to Disturbance Boundary.

Table 6.2 Likelihood of Occurrence of Threatened Fauna Species

Family	Species Name	Common Name	Locality Count^	TSC Act Status	EPBC Act Status	Habitat Requirements	Likelihood of Occurrence
Tytonidae	*Tyto tenebricosa*	Sooty Owl	1	V	-	Roost in large tree hollows, caves and in dense foliage during daylight hours. Rarely seen or heard they can be found in areas with deep gullies in moist forests, where smooth-barked gum trees, tree ferns and wet forest under-storey are present.	UNLIKELY. No suitable habitat present in the Modification to Disturbance Boundary.
Mammals							
Dasyuridae	*Dasyurus maculatus maculatus*	Spotted-tailed Quoll	19	V	E	Inhabits a wide range of forest habitat types, although all appear to be characterised by relatively high (>600 mm/year) and predictable seasonal rainfall. Individual animals use hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites.	POTENTIAL. Suitable habitat present in the Modification to Disturbance Boundary and known to occur in the locality.
Dasyuridae	*Phascogale tapoatafa*	Brush-tailed Phascogale	1	V	-	Prefer dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter. Also inhabit heath, swamps, rainforest and wet sclerophyll forest.	UNLIKELY. No suitable habitat present in the Modification to Disturbance Boundary.
Emballonuridae	*Saccolaimus flaviventris*	Yellow-bellied Sheathtail-bat	6	V	-	Inhabits a range of habitats including wet and dry sclerophyll forest, open woodland, Acacia shrubland, mallee, grasslands and deserts. This species is known to roost in tree hollows and buildings, and in treeless areas they are known to utilise mammal burrows.	LIKELY. Suitable habitat present within the Modification to Disturbance Boundary. Recorded during surveys within the Disturbance Boundary.
Macropodidae	*Petrogale penicillata*	Brush-tailed Rock-wallaby	1	E	V	Inhabits rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and	UNLIKELY. No suitable habitat is present in the

Table 6.2 Likelihood of Occurrence of Threatened Fauna Species

Family	Species Name	Common Name	Locality Count^	TSC Act Status	EPBC Act Status	Habitat Requirements	Likelihood of Occurrence
						ledges, often facing north. A range of vegetation types are associated with the habitat of this species, including dense rainforest, wet sclerophyll forest, vine thicket, dry sclerophyll forest, and open forest.	Modification to Disturbance Boundary.
Molossidae	*Mormopterus norfolkensis*	Eastern Freetail-bat	15	V	-	Inhabits dry and wet sclerophyll forests, coastal woodland. Roosts in tree hollows and buildings. Have been found roosting under the bark of trees.	LIKELY. Recorded in the Mt Arthur Coal lease area in 2006, Drayton Mine lease area in 2006 and Mount Pleasant Coal lease area in 2009. Suitable habitat present in the Modification to Disturbance Boundary.
Muridae	*Pseudomys novaehollandiae*	New Holland Mouse	Predicted	-	V	Inhabits open heathland, open woodland with a heathland understorey and vegetated sand dunes with peak abundances during the early to mid stages of vegetation succession three to five years after fire.	UNLIKELY. No suitable habitat present in the Modification to Disturbance Boundary.
Petauridae	*Petaurus australis*	Yellow-bellied Glider	1	V	-	Occur in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils. Den, often in family groups, in hollows of large trees.	UNLIKELY. No suitable habitat present in the Modification to Disturbance Boundary.
Petauridae	*Petaurus norfolcensis*	Squirrel Glider	13	V	-	Inhabits mature or old-growth box / box-ironbark woodland, Eucalyptus camaldulensis forest west of the Great Dividing	LIKELY. Recorded during surveys of the Disturbance

Table 6.2 Likelihood of Occurrence of Threatened Fauna Species

Family	Species Name	Common Name	Locality Count^	TSC Act Status	EPBC Act Status	Habitat Requirements	Likelihood of Occurrence
						Range and Blackbutt-Bloodwood forest with heathy understorey in coastal areas. The presence of large trees with abundant hollows are critical elements for nesting habitat.	Boundary. Also known from the Mount Pleasant, Mt Arthur and Drayton Mine lease areas.
Phascolarctidae	*Phascolarctos cinereus*	Koala	6	V	V	Widespread in sclerophyll forest and woodlands. Requires relatively large home ranges. . Eucalypt woodlands and forests. Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species.	UNLIKELY. Limited woodland habitat and connected tree canopy available; although individuals are known to travel across open landscapes. The Modification to Disturbance Boundary does not support core habitat.
Pteropodidae	*Pteropus poliocephalus*	Grey-headed Flying-fox	5	V	V	Inhabits subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. The primary food source is blossom from eucalypts (genera Eucalyptus, Corymbia and Angophora), melaleucas and banksias.	LIKELY. Recorded in the Mount Pleasant lease area in 2009 and the Drayton Mine lease area in 2006. Suitable habitat present in the Modification to Disturbance Boundary and may occasionally fly over.
Vespertilionidae	*Chalinolobus dwyeri*	Large-eared Pied Bat	14	V	V	Inhabits a range of vegetation types including dry and wet sclerophyll forest, *Callitris glaucophylla* dominated forest; tall	POTENTIAL. Suitable foraging habitat present in

Table 6.2 Likelihood of Occurrence of Threatened Fauna Species

Family	Species Name	Common Name	Locality Count^	TSC Act Status	EPBC Act Status	Habitat Requirements	Likelihood of Occurrence
						open eucalypt forest with a rainforest sub-canopy; sub-alpine woodland; and sandstone outcrop country. The species requires a combination of sandstone cliff/escarpment to provide roosting habitat that is adjacent to higher fertility sites, particularly box gum woodlands or river/rainforest corridors which are used for foraging.	the Modification to Disturbance Boundary and known from the locality. Was recorded during surveys of a nearby property in 2006.
Vespertilionidae	*Falsistrellus tasmaniensis*	Eastern False Pipistrelle	3	V	-	Inhabits wet sclerophyll and coastal mallee, preferring tall and wet forests where trees are more than 20m in height and the understorey is dense. Typically roosts in tree hollows, however there are a few records in caves and old buildings..	POTENTIAL. Recorded in the Mount Pleasant lease area in 2009. Limited suitable habitat present in the Modification to Disturbance Boundary.
Vespertilionidae	*Miniopterus australis*	Little Bentwing-bat	3	V	-	Inhabits well timbered areas including rainforest, vine thicket, wet and dry sclerophyll forests, Melaleuca swamps and coastal forests. A cave-dwelling species with roosting occurring in caves, abandoned mines, tunnels, stormwater drains and occasionally buildings.	UNLIKELY. Sub-optimal habitat exists in the Modification to Disturbance Boundary and the species is rare for the locality.
Vespertilionidae	*Miniopterus schreibersii oceanensis*	Eastern Bentwing-bat	25	V	-	Inhabits a variety of habitats including rainforest, wet and dry sclerophyll forest, monsoon forest, open woodland, melaleuca forests and open grasslands. Caves are the primary roosting habitat, but they also use derelict mines, storm-water tunnels, buildings and other man-made structures.	POTENTIAL. Suitable foraging habitat present in the Modification to Disturbance Boundary and known from the Disturbance Boundary

Table 6.2 Likelihood of Occurrence of Threatened Fauna Species

Family	Species Name	Common Name	Locality Count^	TSC Act Status	EPBC Act Status	Habitat Requirements	Likelihood of Occurrence
Vespertilionidae	*Myotis macropus*	Large-footed Myotis	10	V	-	Known from a range of habitats close to water from lakes, small creeks to large lakes and mangrove lined estuaries.	POTENTIAL. Suitable foraging habitat present in the Modification to Disturbance Boundary and known from the Disturbance Boundary.
Vespertilionidae	*Nyctophilus corbeni*	Corben's Long-eared Bat	1	V	V	Inhabits a wide variety of vegetation types including *Eucalyptus camaldulensis*, *Eucalyptus largiflorens*, *Allocasuarina*, *Casuarina cristata*, mallee, open woodlands and savannahs. Roosting occurs in hollow-bearing trees where hollows and is also known to roost in tree crevices and under loose bark.	POTENTIAL. Has been recorded on a nearby property during surveys in 2000. Suitable foraging habitat present in the Modification to Disturbance Boundary.
Vespertilionidae	*Scoteanax rueppellii*	Greater Broad-nosed Bat	5	V	-	Inhabits a variety of habitats including moist gullies in mature coastal forest, rainforest, open woodland, Melaleuca swamp woodland, wet and dry sclerophyll forests, cleared paddocks with remnant trees and tree-lines creeks in open areas. Roosts in tree hollows, cracks and fissures in trucks and dead branches, under exfoliating bark, as well as the roofs of old buildings.	LIKELY. Recorded in the Mount Pleasant lease area in 2009, and in the Mt Arthur and Drayton Mine lease areas in 2006. Suitable habitat present in the Modification to Disturbance Boundary.
Vespertilionidae	*Vespadelus troughtoni*	Eastern Cave Bat	13	V	-	Inhabits tropical mixed woodland, wet and dry sclerophyll forest located in close proximity to sandstone or volcanic	POTENTIAL. Suitable foraging habitat present in

Table 6.2 Likelihood of Occurrence of Threatened Fauna Species

Family	Species Name	Common Name	Locality Count^	TSC Act Status	EPBC Act Status	Habitat Requirements	Likelihood of Occurrence
						escarpments. Roosting can take place in sandstone overhang caves, boulder piles, mines and occasionally in buildings. Maternity colonies have been observed in shallow sandstone caves.	the Modification to Disturbance Boundary and known from the Disturbance Boundary.
Reptiles							
Pygopodidae	*Aprasia parapulchella*	Pink-tailed Legless Lizard	Predicted	V	V	Occurs in primary and secondary grassland, grassy woodland and woodland communities including mallee, and box-ironbark forest.	UNLIKELY. Some suitable habitat present within the Modification to Disturbance Boundary; however no records in the locality.

TSC Act / EPBC Act Status: V = Vulnerable, E = Endangered, EP = Endangered population, CE = Critically Endangered

**Data obtained from the Atlas of NSW Wildlife (OEH, 2015) and Protected Matters Search Tool (DoE, 2015a)*

Appendix C

Assessment of Significance (NSW)

C.1 Introduction

This appendix contains formal Assessments of Significance according to Section 5A of the EP&A Act. The Assessments of Significance provide a means by which to gauge the significance of predicted impacts to threatened species, populations and ecological communities listed under the TSC Act. They have been prepared to help examine the magnitude of impacts to local occurrences of threatened biota.

Both direct and indirect impacts are taken into account within these assessments. Direct impacts have been quantified within the assessments and are represented by the Project Disturbance Boundary. Whilst it is acknowledged that indirect impacts can potentially be significant for a variety of species, such impacts cannot be mapped or accurately calculated in advance.

Each Assessment of Significance is a series of questions (shown as italicised text below) for which a response has been supplied beneath in plain text. The assessments have been prepared without considering the ameliorative and compensatory measures proposed for the Project as instructed under the *Threatened Species Assessment Guidelines* (DECC (NSW), 2007):

> *"Proposed measures that mitigate, improve or compensate for the action, development or activity should not be considered in determining the degree of the effect on threatened species, populations or ecological communities, unless the measure has been used successfully for that species in a similar situation".*

However, it is noted that the Project a number of mitigation measures are proposed to minimise impacts to biodiversity values. The ultimate conclusions to this Ecological Assessment take such measures into consideration when assessing the long term implications for threatened species, populations and communities.

C.2 Box Gum Woodland and Derived Native Grassland

Assessment of Significance

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

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

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

The Project will disturb 6.1 ha of Box Gum Woodland and Derived Native Grassland but of this only 1.24 ha will be permanently removed formed of 0.59 ha of woodland form and 0.65 ha of grassland form within the Modification to Disturbance Boundary. This community has previously been substantially cleared and or modified within the Modification to Disturbance Boundary and surrounds. The works associated with the Project include the construction and operation of diversion drains that are 6-15 m wide in the eastern portion and 20-65 m wide in the western portion of the Modification to Disturbance Boundary. Removal of vegetation within these narrow corridors is not considered to place the local occurrence at risk of extinction. Areas of this community will remain outside of the Modification to Disturbance Boundary and Disturbance Boundary.

Within the Modification to Disturbance Boundary, a substantial change will occur to the species composition of Box Gum Woodland and Derived Native Grassland, as it will be entirely removed. The remaining extent of this community has the potential to be indirectly impacted by the Project. These changes are expected to be localised and overall are not considered to cause a substantial change in species composition such that the local occurrence of the community is likely to be placed at risk of extinction.

(d) in relation to the habitat of a threatened species, population or ecological community:

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

(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

(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

A total of 6.1 ha of Box Gum Woodland and Derived Native Grassland will be disturbed within the Modification to Disturbance Boundary, with 1.24 ha permanently removed and 4.86 ha rehabilitated following completion of the Project.

The Project is not considered to significantly increase fragmentation of Box Gum Woodland and Derived Native Grassland within the immediate vicinity of the Modification to Disturbance Boundary. The treed vegetation within the Modification to Disturbance

Boundary has previously been cleared and/or modified through agricultural practices. The works associated with the Project include the construction and operation of diversion drains that are 6-15 m wide in the eastern portion and 20-65 m wide in the western portion of the Modification to Disturbance Boundary. It is anticipated that dispersal of flora species between the remaining patches will continue.

The patch of Box Gum Woodland and Derived Native Grassland occurs within a fragmented landscape between existing approved mining projects. The patch of Box Gum Woodland and Derived Native Grassland has been modified through previous and current land uses. As such, is not considered to be important for the long-term survival of the community in the locality.

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

No critical habitat for Box Gum Woodland and Derived Native Grassland has been identified by OEH.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

The *National Recovery Plan for White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland* (DECCW, 2011) has an overall aim to promote the recovery and prevent the extinction of Box Gum Woodland and Derived Native Grassland. The direct removal of 1.24 ha of Box Gum Woodland and Derived Native Grassland is an action that is not consistent with the recovery plan. However, the local extent of the community is not considered to be placed at risk of extinction as a result of the Project.

No threat abatement plans are relevant to Box Gum Woodland and Derived Native Grassland within the Modification to Disturbance Boundary.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

The following key threatening processes (KTPs) are relevant to Box Gum Woodland and Derived Native Grassland and have the potential to be exacerbated by the Project:

- 'Clearing of native vegetation' as this reduces the area habitat available for this community; and
- 'Invasion of native plant communities by exotic perennial grasses' that readily invade disturbed sites and communities as they can dominate and suppress native flora species.

The primary KTP relevant to the Project is the clearing of native vegetation, as 1.24 ha of Box Gum Woodland and Derived Native Grassland will be removed within the Modification to Disturbance Boundary. The Project is not considered to exacerbate the KTP of invasion by exotic perennial grasses further than current conditions.

Conclusion

The Project will result in the direct loss of 1.24 ha of Box Gum Woodland and Derived Native Grassland. The extent of the community to be removed exists in a modified form within a fragmented landscape between existing mining approvals. The Project is not considered to result in a significant impact to Box Gum Woodland and Derived Native Grassland.

C.3 Flora Species

The following Assessment of Significance has been provided to assess impacts of the Project on the following potentially occurring threatened flora species:

- *Cymbidium canaliculatum* population in the Hunter Catchment;
- *Diuris tricolor* (Pine Donkey Orchid);
- *Prasophyllum* sp. Wybong / *Prasophyllum petilum* (Tarengo Leek Orchid); and
- *Thesium australe* (Austral Toadflax).

Assessment of Significance

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

No individuals of *Diuris tricolor* (Pine Donkey Orchid), *Prasophyllum* sp. Wybong / *Prasophyllum petilum* (Tarengo Leek Orchid) and *Thesium australe* (Austral Toadflax) have been recorded within the Modification to Disturbance Boundary or adjoining Bengalla Mine Approved Operations Area or Mount Pleasant Project area. The direct impact of the Project is the removal of 1.24 ha of potential habitat in the form of grassy woodland and derived native grassland. Given that these species have not been recorded within the Modification to Disturbance Boundary it is not considered that the Project will result in the extinction of a local population of these species.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

No individuals of *Cymbidium canaliculatum* (Tiger Orchid) have been recorded within the Modification to Disturbance Boundary. Individuals of this population have previously been recorded at scattered locations within Bengalla Mine Approved Operations Area and Mount Pleasant Project area. The direct impact of the Project is the removal of 0.59 ha of potential habitat in the form of grassy woodland and some scattered trees. Given that this species has not been recorded within the Modification to Disturbance Boundary it is not considered that the Project will result in the extinction of a local population of the species.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

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

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable.

(d) in relation to the habitat of a threatened species, population or ecological community:

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

(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

(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

A total of 1.24 ha of native grassy woodland and derived native grassland will be lost within the Modification to Disturbance Boundary, including 0.59 ha of woodland form and 0.65 ha of grassland form. This are of native vegetation provides potential habitat for the assessed flora species.

The Project is not considered to significantly increase fragmentation within the area surrounding the Modification to Disturbance Boundary. The majority of this land has historically been modified through agricultural practices and it occurs between existing approved mines.

Given that no individuals of the assessed species have been recorded within the Modification to Disturbance Boundary, the habitat present is not considered to be important for the long-term survival of the species.

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

No critical habitat for the assessed species has been identified by OEH.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

Draft NSW and National Recovery Plan for the Tarengo Leek Orchid (Prasophyllum petilum) (NSW NPWS, 2000) has an overall aim to maintain or enhance the populations of the

species at the known sites by controlling threatening processes and improving conditions for growth and recruitment. The removal of potential habitat within an area where the species is not known is not considered to be inconsistent with this aim.

No recovery plans have been prepared for *Cymbidium canaliculatum* population in the Hunter Catchment, *Diuris tricolor* (Pine Donkey Orchid), *Prasophyllum petilum* (Tarengo Leek Orchid) and *Thesium australe* (Austral Toadflax).

No threat abatement plans are relevant to the assessed flora species.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

The following KTPs are relevant to the assessed flora species and have the potential to be exacerbated by the Project:

- 'Clearing of native vegetation' as this reduces the area habitat available for these species; and
- 'Invasion of native plant communities by exotic perennial grasses' that readily invade disturbed sites and communities as they can dominate and suppress native flora species.

The primary KTP relevant to the Project is the loss of 1.24 ha of native grassy woodland and derived native grassland within the Modification to Disturbance Boundary that comprises potential habitat for the assessed species. The Project is not considered to exacerbate the KTP of invasion by exotic perennial grasses further than current conditions.

Conclusion

No individuals of *Cymbidium canaliculatum* (Tiger Orchid), *Diuris tricolor* (Pine Donkey Orchid), *Prasophyllum* sp. Wybong / *Prasophyllum petilum* (Tarengo Leek Orchid) and *Thesium australe* (Austral Toadflax) have been recorded within the Modification to Disturbance Boundary. The Project will remove potential habitat for these species in the form of grassy woodland and derived native grassland. The removal of this potential habitat is not considered to result in a significant impact to the assessed flora species.

C.4 Fauna Species

The following Assessment of Significance has been provided to assess impacts of the Project on the following potentially occurring threatened fauna species:

- Speckled Warbler (*Chthonicola sagittata*);
- Spotted Harrier (*Circus assimilis*);
- Little Eagle (*Hieraaetus morphnoides*);

- Brown Treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*);
- Black-chinned Honeyeater (eastern subspecies) (*Melithreptus gularis gularis*);
- Grey-crowned Babbler (eastern subspecies) (*Pomatostomus temporalis temporalis*);
- Barking Owl (*Ninox connivens*);
- Squirrel Glider (*Petaurus norfolcensis*);
- Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*);
- Eastern Freetail-bat (*Mormopterus norfolkensis*);
- Greater Broad-nosed Bat (*Scoteanax rueppellii*); and
- Grey-headed Flying-fox (*Pteropus poliocephalus*).

Assessment of Significance

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

No individuals of the assessed threatened fauna species have been recorded within the Modification to Disturbance Boundary. The direct impact of the Project is the loss of 0.59 ha of grassy woodland, 0.65 ha of derived native grassland and 2.28 ha of low diversity native grassland/exotic pasture. Given that these species have not been recorded within the Modification to Disturbance Boundary it is not considered that the Project will result in the extinction of a local population of these species.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

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

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable.

(d) in relation to the habitat of a threatened species, population or ecological community:

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

(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

(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

A breakdown of the areas of impact to each of these species is shown below.

Scientific Name	Common Name	Preferred Habitat^	Habitat within Modification to Disturbance Boundary (ha)
Chthonicola sagittata	Speckled Warbler	W	1.0
Circus assimilis	Spotted Harrier	W, G, G/P	3.1
Hieraaetus morphnoides	Little Eagle	W, G, G/P	3.1
Apus pacificus	Fork-tailed Swift	W	1.0
Hirundapus caudacutus	White-throated Needletail	W	1.0
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	W	1.0
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	W	1.0
Merops ornatus	Rainbow Bee-eater	W, G	2.0
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	W	1.0
Ninox connivens	Barking Owl	W	1.0
Mammals			
Petaurus norfolcensis	Squirrel Glider	W	1.0
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	W	1.0
Mormopterus norfolkensis	Eastern Freetail-bat	W	1.0
Scoteanax rueppellii	Greater Broad-nosed Bat	W	1.0
Pteropus poliocephalus	Grey-headed Flying-fox	W	1.0

^ *Preferred habitat: W = woodland, G = derived native grassland; G/P = low diversity grassland/exotic pasture*

The Project is not considered to significantly increase fragmentation of the available habitat within the immediate vicinity of the Modification to Disturbance Boundary. The treed vegetation within the Modification to Disturbance Boundary has previously been cleared and/or modified through agricultural practices. The works associated with the Project include the construction and operation of diversion drains that are 6-15 m wide in the eastern portion and 20-65 m wide in the western portion of the Modification to Disturbance Boundary. It is anticipated that dispersal of fauna species between the remaining patches will continue, for the assessed species as they are highly mobile.

The fauna habitat within the Modification to Disturbance Boundary occurs within a fragmented landscape between existing approved mining projects. The patch of habitat has been modified through previous and current land uses. No threatened fauna species have

been recorded within the Modification to Disturbance Boundary. As such, is not considered to be important for the long-term survival of the species in the locality.

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

No critical habitat for the assessed species has been identified by OEH.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

Given that none of the assessed threatened fauna species have been recorded within the Modification to Disturbance Boundary, and the small amount of habitat available to these species, the Project is expected to be consistent with the objectives or actions of recovery plans or draft recovery plans for the following species:

- Barking Owl (draft); and
- Grey-headed Flying-fox (draft National Recovery Plan).

The Project is also expected to be consistent with any threat abatement plans.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

The following KTPs are relevant to these species within the Modification to Disturbance Boundary:

- 'Clearing of native vegetation' as this reduces the area of forage and nesting habitat available for the species;
- 'Loss of hollow-bearing trees' as this reduces the abundance of nesting habitat for some species;
- 'Removal of dead wood and dead trees' as this reduces the abundance of important ground foraging and nesting habitat;
- 'Invasion of native plant communities by exotic perennial grasses' as this results in the loss of key food plants and habitat and encourages flock-foraging species;

The primary KTP relevant to the Project is the loss of 0.59 ha of grassy woodland, 0.65 ha of derived native grassland and 2.28 ha of low diversity native grassland/exotic pasture within the Modification to Disturbance Boundary that comprises potential habitat for the assessed species.

Conclusion

No individuals of the assessed threatened fauna species have been recorded within the Modification to Disturbance Boundary. The Project will remove potential habitat for these species in the form of grassy woodland, derived native grassland and low diversity grassland/exotic pasture. It is likely that the species assessed forage in the Modification to Disturbance Boundary on occasion as part of their larger home ranges. Accordingly no significant impacts are predicted to occur to these species as a result of the Project.

Appendix D

Assessment of Significance (Commonwealth)

D.1 Introduction

This appendix contains assessments of significance according to the Matters of National Environmental Significance (MNES) *Significant Impact Guidelines 1.1* (DoE, 2013). They are intended to assist in determining whether the impacts of the Project on any MNES are likely to be significant. They provide a means by which to gauge the significance of predicted impacts to threatened species, populations and ecological communities and have been prepared to examine the magnitude of impacts to threatened biota.

Both direct and indirect impacts are taken into account within these assessments. Direct impacts have been quantified within the assessments and are represented by the Modification to Disturbance Boundary. Whilst it is acknowledged that indirect impacts can potentially be significant for a variety of MNES, such impacts cannot be mapped or accurately calculated in advance.

Each assessment of significance reproduces the significant impact criteria in italicised text, beneath which a response is supplied in plain text. The responses have been prepared under the scenario that no mitigation or compensatory measures are applied. That is, to determine the significance of impacts, the assessments of significance consider the impacts without amelioration.

The Project does however include substantial mitigation and offset measures. The ultimate conclusions to this Ecological Assessment take such measures into consideration when assessing the long term implications for MNES.

D.2 Box Gum Woodland and Derived Native Grassland

Assessment of Significance

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

reduce the extent of an ecological community

A total of 6.1 ha of Box Gum Woodland and Derived Native Grassland will be disturbed within the Modification to Disturbance Boundary. Of the 6.1 ha disturbed, 1.24 ha will be permanently lost including 0.59 ha of woodland form and 0.65 ha of grassland form with the remaining 4.86 ha rehabilitated back to its previous condition upon completion of the Project.

fragment or increase fragmentation of an ecological community

The Project is not considered to significantly increase fragmentation of Box Gum Woodland and Derived Native Grassland within the immediate vicinity of the Modification to Disturbance Boundary. The treed vegetation within the Modification to Disturbance Boundary has previously been cleared and/or modified through agricultural practices. The works associated with the Project include the construction and operation of diversion drains that are 6-15 m wide in the eastern portion and 20-65 m wide in the western portion of the Modification to

Disturbance Boundary. It is anticipated that dispersal of flora species between the remaining patches will continue.

adversely affect habitat critical to the survival of an ecological community

The patch of Box Gum Woodland and Derived Native Grassland occurs within a fragmented landscape between existing approved mining projects. The patch of Box Gum Woodland and Derived Native Grassland has been modified through previous and current land uses. As such, is not considered to be critical to the survival of the community in the locality.

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

Within the Modification to Disturbance Boundary, the extent of Box Gum Woodland and Derived Native Grassland will be entirely removed. The portions of this community occurring at this interface have the potential to be indirectly impact. The Project includes the construction and operation of diversion levees. These leveeswill be located with the existing flow path within the Modification to Disturbance Boundary. Surface water will continue to be accessed by the community.

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

Within the Modification to Disturbance Boundary, a change will occur to the species composition of Box Gum Woodland and Derived Native Grassland, as it will be entirely removed. There is potential for changes to species composition at the interface between the Modification to Disturbance Boundary and adjoining land. These changes are expected to be localised and overall are not considered to cause a substantial change in species composition.

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, 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, or

Box Gum Woodland and Derived Native Grassland has previously been substantially cleared and or modified within the Modification to Disturbance Boundary and surrounds. Invasive flora species are known to occur within this community, however the Project is not considered to exacerbate this threat further than current conditions.

The Project will not result in the regular mobilisation of chemicals that kill or inhibit the growth of plant species into Box Gum Woodland and Derived Native Grassland.

interfere with the recovery of an ecological community.

The Project will remove approximately 1.24 ha of Box Gum Woodland and Derived Native Grassland, including 0.59 ha of woodland form and 0.65 ha of grassland form. Box Gum Woodland and Derived Native Grassland has previously been substantially cleared and or modified within the Modification to Disturbance Boundary and surrounds. The Project is not considered to interfere with the recovery of this community.

Conclusion

The Project will result in the direct loss of 1.24 ha of Box Gum Woodland and Derived Native Grassland. The extent of the community to be removed exists in a modified form within a fragmented landscape between existing mining approvals. The Project is not considered to result in a significant impact to Box Gum Woodland and Derived Native Grassland.

D.3 Flora Species

D.3.1 Prasophyllum *sp. Wybong / Prasophyllum petilum (Tarengo Leek Orchid)*

Assessment of Significance

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

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

No individuals of *Prasophyllum* sp. Wybong / *Prasophyllum petilum* (Tarengo Leek Orchid) have been recorded within the Modification to Disturbance Boundary.

reduce the area of occupancy of the species

No individuals of *Prasophyllum* sp. Wybong / *Prasophyllum petilum* (Tarengo Leek Orchid) have been recorded within the Modification to Disturbance Boundary. The direct impact to this species is the removal of potential habitat in the form of 1.24 ha of potential habitat in the form of grassy woodland and derived native grassland.

fragment an existing population into two or more populations

No individuals of *Prasophyllum* sp. Wybong / *Prasophyllum petilum* (Tarengo Leek Orchid) have been recorded within the Modification to Disturbance Boundary. As such the Project is not considered to result in the fragmentation of an existing population.

adversely affect habitat critical to the survival of a species

The direct impact to this species is the removal of potential habitat in the form of 1.24 ha of potential habitat in the form of grassy woodland and derived native grassland. However no individuals of *Prasophyllum* sp. Wybong / *Prasophyllum petilum* (Tarengo Leek Orchid) have

been recorded within the Modification to Disturbance Boundary. The Modification to Disturbance Boundary is not considered critical to the survival of the species.

disrupt the breeding cycle of a population

No individuals of *Prasophyllum* sp. Wybong / *Prasophyllum petilum* (Tarengo Leek Orchid) have been recorded within the Modification to Disturbance Boundary. As such the Project is not considered to result in the fragmentation of an existing population. Therefore the action will not disrupt the life cycle of a local population.

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

The direct impact to this species is the removal of potential habitat in the form of 1.24 ha of potential habitat in the form of grassy woodland and derived native grassland. However no individuals of *Prasophyllum* sp. Wybong / *Prasophyllum petilum* (Tarengo Leek Orchid) have been recorded within the Modification to Disturbance Boundary. The Modification to Disturbance Boundary is not considered to result in the decline of the species.

result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat

The action will generate indirect impacts associated within the construction and operation of the Project. The Modification to Disturbance Boundary occurs within a highly fragmented landscape which is currently impacted by weeds and feral animals. As such, it is considered unlikely that the Project will result in invasive species becoming further established within the potential habitat for this species.

introduce disease that may cause the species to decline, or

The Project is considered unlikely to introduce disease that may cause a population of *Prasophyllum* sp. Wybong / *Prasophyllum petilum* (Tarengo Leek Orchid) to decline.

interfere with the recovery of the species.

Prasophyllum sp. Wybong / *Prasophyllum petilum* (Tarengo Leek Orchid) has not been recorded within the Modification to Disturbance Boundary and therefore no known populations will be affected. The Project will remove 1.24 ha of potential habitat in the form of grassland and grassy woodland vegetation. The Project is not expected to interfere with the recovery of this species.

Conclusion

Given that no individuals of this species have been recorded within the Modification to Disturbance Boundary and the small amount of potential habitat removed, the Project is not considered to result in a significant impact to this species.

D.3.2 Thesium australe (Austral Toadflax)

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

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

The species has not been recorded within the Modification to Disturbance Boundary. It is therefore considered that the Modification to Disturbance Boundary does not support an important population of *Thesium australe* (Austral Toadflax), further to this, it is also considered unlikely that the proposed action will lead to a long-term decrease in the size of an important population of the species. The amount of suitable potential habitat for the species within the Project Disturbance Boundary represents a small portion of the available habitat within the locality.

reduce the area of occupancy of an important population

As it is considered that the Modification to Disturbance Boundary does not support an important population of *Thesium australe* (Austral Toadflax) it is also considered unlikely that the action will reduce the area of occupancy of an important population. The Project will remove 1.24 ha potential habitat in the form of grassland and grassy woodland vegetation.

fragment an existing important population into two or more populations

As it is considered that the Modification to Disturbance Boundary does not support an important population of *Thesium australe* (Austral Toadflax) it is also considered unlikely that the action will fragment an existing important population into two or more populations. The action is not considered to significantly increase fragmentation within the immediate surrounds of the Modification to Disturbance Boundary. The majority of the Modification to Disturbance Boundary has previously been modified through agricultural practices.

adversely affect habitat critical to the survival of a species?

Thesium australe (Austral Toadflax) has not been recorded from within the Modification to Disturbance Boundary and therefore the potential habitat to be removed is not considered to be critical to its survival. Extensive areas of similar habitat occurs within the locality, however there are no records held within the Atlas of NSW Wildlife of this species within this area.

disrupt the breeding cycle of an important population

As it is considered that the Modification to Disturbance Boundary does not support an important population of *Thesium australe* (Austral Toadflax) it is also considered unlikely that the action will disrupt the life cycle of an important population. Extensive areas of similar habitat occur within the locality, however there are no records held within the Atlas of NSW Wildlife of this species within this area.

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

No individuals of *Thesium australe* (Austral Toadflax) were recorded within the Modification to Disturbance Boundary. The Project will remove potential habitat in the form of grassland and grassy woodland vegetation. Potential indirect impacts resulting from the Project may also impact the potential habitat within the adjoining areas. The potential changes to habitat are expected to be localised and overall are not considered to cause a substantial change in potential habitat.

result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

The action will generate indirect impacts associated within the construction and operation of the Project. The Modification to Disturbance Boundary occurs within a highly fragmented landscape which is currently impacted by weeds and feral animals. As such, it is considered unlikely that the Project will result in invasive species becoming further established within the potential habitat for this species.

introduce disease that may cause the species to decline

The Project is considered unlikely to introduce disease that may cause the local population of *Thesium australe* (Austral Toadflax) to decline as no local population of *Thesium australe* (Austral Toadflax) was identified within the Modification to Disturbance Boundary or its surrounds.

interfere substantially with the recovery of the species

Thesium australe (Austral Toadflax) has not been recorded within the Modification to Disturbance Boundary and therefore no known populations will be affected. The Project will remove 1.24 ha of potential habitat in the form of grassland and grassy woodland vegetation. The Project is not expected to interfere substantially with the recovery of this species.

Conclusion

Given that no individuals of this species have been recorded within the Modification to Disturbance Boundary and the small amount of potential habitat removed, the Project is not considered to result in a significant impact to this species.

D.4 Fauna Species

D.4.1 Grey-headed Flying-fox

Assessment of Significance

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

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

The species has not been recorded within the Modification to Disturbance Boundary. The Modification to Disturbance Boundary is not considered to support an important population of the Grey-headed Flying-fox. It is also considered unlikely that the action will lead to a long-term decrease in the size of an important population of the species. The amount of suitable potential habitat for the species within the Modification to Disturbance Boundary represents a small portion of the available habitat within the locality.

reduce the area of occupancy of an important population

As it is considered that the Modification to Disturbance Boundary does not support an important population of the Grey-headed Flying-fox it is also considered unlikely that the action will reduce the area of occupancy of an important population. The Project will directly impact approximately 0.59 ha of suitable potential foraging habitat for the species.

fragment an existing important population into two or more populations

As it is considered that the Modification to Disturbance Boundary does not support an important population of the Grey-headed Flying-fox it is also considered unlikely that the action will fragment an existing important population into two or more populations. The action is not considered to significantly increase fragmentation within the Modification to Disturbance Boundary for the species, which is highly mobile. The majority of the Modification to Disturbance Boundary has previously been modified through agricultural practices.

adversely affect habitat critical to the survival of a species

The Grey-headed Flying-fox has not been recorded from within the Modification to Disturbance Boundary. The closest known Grey-headed Flying-fox camp is in Singleton. The species typically travels 20 km to forage from roost sites and it is likely that individuals will fly over and potentially forage in the Modification to Disturbance Boundary and elsewhere in the locality as part of their extensive home range. The 0.59 ha of habitat within the Modification to Disturbance Boundary is not considered critical to the survival of the species.

disrupt the breeding cycle of an important population

As it is considered that the Modification to Disturbance Boundary does not support an important population of the Grey-headed Flying-fox it is also considered unlikely that the action will disrupt the breeding cycle of an important population. The closest known Grey-headed Flying-fox camp is in Singleton.

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

The Project will directly impact approximately 0.59 ha of suitable potential habitat for the species. The species typically travels 20 km to forage from roost sites. The loss of a small amount of foraging habitat within the Modification to Disturbance Boundary is not considered to result in a decline of the species.

result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

The action will generate indirect impacts associated within the construction and operation of the Project. Feral species known from the Modification to Disturbance Boundary and immediate surrounds are not considered a threat to the Grey-headed Flying-fox.

introduce disease that may cause the species to decline

The Project is considered unlikely to introduce disease that may cause a potentially occurring population of the Grey-headed Flying-fox to decline.

interfere substantially with the recovery of the species

The Grey-headed Flying-fox has not been recorded within the Modification to Disturbance Boundary. The Project will directly impact approximately 0.59 ha of suitable potential habitat for the species. Extensive areas of similar habitat also occur within the locality. Accordingly the Project is not expected to interfere with the recovery of this species.

Conclusion

The Project is expected to directly impact on approximately 0.59 ha of suitable potential habitat for the Grey-headed Flying-fox. Known camps exist elsewhere in the region and based on a lack of records, the Modification to Disturbance Boundary does not support a local population. It is likely that the species forages in the Modification to Disturbance Boundary on occasion as part of a much larger home range. Accordingly no significant impacts are predicted to occur to this species as a result of the Project.

D.4.2 Migratory Species

The following Assessment of Significance has been prepared as a composite test for migratory species listed under the EPBC Act that are likely to occur within the Modification to Disturbance Boundary. These include the following:

- Fork-tailed Swift;
- White-throated Needletail; and
- Rainbow Bee-eater.

Assessment of Significance

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

substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species

The area of habitat within the Modification to Disturbance Boundary to be impacted by the Project is not considered important habitat for these migratory species and it represents a

relatively small area of suitable habitat within a regional context. As such, the action will not substantially modify, destroy or isolate an area of important habitat for these species.

> *result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species, or*

The area of habitat within the Modification to Disturbance Boundary to be impacted by the Project is not considered important habitat for these migratory species. Feral species known from the Modification to Disturbance Boundary and immediate surrounds are not considered a threat to the assessed species.

> *seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.*

The action will not seriously disrupt the lifecycle of an ecologically significant proportion of these species. A relatively small amount of suitable habitat will be directly impacted by the Project, however this is a small area in the broader scale of the species' range, and significant areas of suitable foraging and breeding habitat will continue to exist within the locality.

Conclusion

The habitat occurring within the Modification to Disturbance Boundary is not considered important for the known and potentially occurring migratory species. The area of suitable habitat is considered small compared to the amount of suitable habitat within the species' range, thus no significant impact is predicted to occur to these species as a result of the Project.