APPENDIX H
BIODIVERSITY OFFSETS STRATEGY

MOOLARBEN COAL PROJECT STAGE 2

Biodiversity Offset Strategy

For:

Hansen Bailey

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Final Report

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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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Purpose

Cumberland Ecology was commissioned by Hansen Bailey on behalf of Moolarben Coal Mines Pty Limited (MCM) to develop a Biodiversity Offset Strategy for the Moolarben Coal Stage 2 Preferred Project (the Preferred Project). The purpose of this document is to present a recommended Biodiversity Offset Strategy and to demonstrate how this Strategy can address project impacts on threatened species and ecological communities.

Impact Summary

The area proposed to be cleared (the disturbance area) is centred upon a valley, within which largely cleared grazing lands occur. The hillsides around the periphery of this area and some riparian areas in the centre of the valley have native forest and woodland. However, much of the valley consists of highly modified grassland and shrubland and although such vegetation contains native plants, it is largely dominated by exotic grasses and herbs and has a very low diversity of native species.

Woodland and open forest areas support a higher diversity of native plant and animal species. Some of the woodland and forest types are a form of the ecological community listed as endangered under the NSW *Threatened Species Conservation Act (*TSC Act*)* and listed as critically endangered under the *Commonwealth Environment Protection and Biodiversity Conservation Act* (EPBC Act). That C/EEC is referred to here as *Box Gum Woodland and Derived Native Grassland* or Box Gum Woodland.

The Preferred Project will entail the removal of approximately 902 hectares of remnant native forest and woodland vegetation. This includes 123 hectares of *Box Gum Woodland and Derived Native Grassland*. It also includes habitat for a suite of threatened flora and fauna species including threatened woodland birds and bats, Squirrel Glider and other species summarised within this report. Although modifications to the mine disturbance footprint have resulted in a very minor increase overall, an additional 33 ha of C/EEC has been avoided.

Offsets Required

The Preferred Project has been designed to avoid impacts (to the extent possible for an open cut coal mine), mitigate impacts through such measures as rehabilitation of mined land, and where there would otherwise be a net loss of native vegetation, to provide compensatory habitats as ecological offsets.

The Preferred Project will require an offset package that addresses the loss of C/EEC *Box Gum Woodland and Derived Native Grassland* and the loss of other forest and woodland that comprises habitat for threatened species. Based on a review of recent mining project proposals and in consultation with state and federal government authorities, MCM has aimed

to offset the direct clearing impacts of the Preferred Project on remnant native vegetation at ratio of at least 3:1 (offset ha to impact area ha), including seeking to offset direct impacts on Box Gum Woodland at a ratio of 5:1. Therefore, to achieve the target ratios, offset land needs to total at least 2,707 ha of native vegetation, of which at least 616.5 ha should consist of, or have the potential to regenerate or be rehabilitated to *Box Gum Woodland and Derived Native Grassland*.

The proposed Biodiversity Offset Strategy has also been designed to comply with current guidelines for offsets in use by the State and Commonwealth Governments. Namely the NSW DECC Interim Offset Principles (DECCW 2010) and the Commonwealth Draft Environmental Offset Policy (DEWR, 2007).

Approach to Developing Offsets

Cumberland Ecology undertook a considered approach in developing the Biodiversity Offset Strategy for the Preferred Project comprising the three key steps outlined below:

1. Identifying the desirable features of an offset package. This assisted in the identification of potentially suitable offset land;

2. Implementing a series of actions to prioritise potential land for further investigation; and

3. Conducting preliminary flora and fauna surveys to map vegetation communities, survey for threatened species and verify the ecological suitability of candidate properties.

In considering available offset areas, MCM has endeavoured to source land that is not within a mining lease, that has good potential for restoration and conservation, and which supports habitat for threatened species and Box Gum Woodland that occur in the proposed disturbance area.

A key consideration was also to ensure that offsets contained substantial areas of land that have been partially cleared but which could feasibly be regenerated to forest and woodland with appropriate conservation management. The rationale for this was to ensure that a net gain in the area of forest and woodland could be achieved in the medium to long term through appropriate conservation management.

Much of the forest and woodland habitats to be impacted by the Preferred Project occur on sandstone landscapes that are relatively well represented in nearby National Parks. Little is available for consideration as offsets and so this has to an extent restricted the range of offset land available for consideration by MCM.

The Offset Strategy

The investigation for potential offset properties yielded the following properties:

- Property 9 “Dun Dun” in Hargraves (Lots 60 & 61 DP 704158, Lots 79 & 80 DP 704159 and Lots 14 & 15 DP 756867);
- Property 17 in Windeyer (Lot 112 DP 756864);
- Property 18 in Ulan (Lot 279 DP 40917, Lot 1 DP 592376, Lots 1 & 2 DP 809642); and
- Area within the Preferred Project boundary and outside the Disturbance boundary (MCM owned).

The total area of native vegetation provided by the offsets is approximately 3,516 ha, of which 620 ha is C/EEC (Table S.2). Thus these offsets meet the required offset ratios summarised above. This translates to an overall ratio of 3.9 ha offset for every hectare of vegetation cleared for the Preferred Project and within this, a ratio of 5 ha of C/EEC offset for every hectare of C/EEC cleared.

Table S.1.1 Summary of Offsets that will be Secured

Vegetation Component	Impact (ha)	Actual Offset (ha)	Ratio
Total Remnant Native Vegetation (including C/EEC)	902.4	3,516.0	3.9
Total C/EEC	123.3	620.2	5.0

The native vegetation within the proposed offsets has been verified through field survey to provide habitat for a suite of threatened flora and fauna that are predicted to be impacted by the Preferred Project, including threatened species that are listed as Matters of National Environmental Significance (Regent Honeyeater, Swift Parrot, Spotted-tailed Quoll and others). These properties contain:

- A diversity of intact forest and woodland habitat that currently provides habitat for threatened species;
- An estimated 850ha of native grassland that can be restored to add to the amount of wooded vegetation in the long term;
- Creek frontage and other permanent water sources that will help to form refugia for animals;
- Areas of native pastures that have good potential to be rehabilitated to forest and woodland; and
- Diversity of elevation, aspect and contour of land, including ridges, gullies and flat areas.

Rehabilitation and Offset Management Plan

The proposed offsets are to be conserved in perpetuity and conservation management will be guided by a Rehabilitation and Offset Management Plan (ROMP) that is to be prepared for the Preferred Project. The ROMP will include:

- Management of land that contains and/or can be regenerated to provide habitat for C/EECs as well as non-EEC vegetation;
- Management and improvement of land that includes habitat for all relevant threatened flora and fauna species that could be impacted by the Preferred Project;
- Management of land that contributes to any existing regional biodiversity conservation strategies;
- Prescriptions for specific management actions regarding weeds, feral animals, tracks, revegetation, monitoring, etc.;
- Ensure that offset management objectives are compliant with existing recovery plans for C/EECs and threatened species (**Sections 4.3 to 4.6**); and
- Address funding and permanent conservation mechanisms (such as handover to National Parks estate if relevant, or establishment of Voluntary Conservation Agreements).

Conclusions

The Biodiversity Offset Strategy will result in a net gain in vegetation and fauna habitat in the long term by adding 2,100 ha of existing forest and woodland to conservation tenure and by regenerating 850 ha of grassland to forest and woodland. It provides an opportunity to regenerate degraded vegetation, improve the resilience and quality of existing native vegetation and provide permanent conservation for threatened species and ecological communities

The Biodiversity Offset Strategy provides for a ratio of 3.9:1 offset requirements for native vegetation and a 5:1 offset ratio for Box Gum Woodland.

The Biodiversity Offset Strategy's key advantages are:

- Offsets consisting of three strategically located properties, two link to other areas of forest and woodland, the other links to riparian corridors and is large enough to form a conservation reserve in its own right;
- The offsets contain like for like habitats, or better and have verified habitat for a range of fauna species, including:
    - At least 9 of the 16 bat species potentially impacted by the development, two of which are threatened species (*Chalinolobus dwyeri* and *Miniopterus*

orianae oceanensis). Additionally the offset properties contain two bat species that have not been detected in the impact area; and

- At least 100 of 170 bird species recorded on the impact site (nearly 60%), including four threatened bird species under the TSC Act and two migratory species under the EPBC Act. This is likely to be an underestimate of the diversity of the offset properties considering the far greater survey effort for the impact area. Additionally the offset properties contain five bird species that have not been detected in the impact area.

- The offset properties are freehold land that are outside of coal mining tenements;
- They contain appropriate vegetation communities in good condition, comparable to or in better condition than the vegetation proposed to be cleared for the Preferred Project;
- They contain habitat for threatened species that are predicted to be impacted by the Preferred Project – the quality of such habitat will be improved by management such as livestock removal;
- Contain a large diversity of good quality micro-habitats (such as creeks, dams, gullies and ridges), which provide verified habitat for threatened fauna species;
- One of the properties, "Dun Dun", is large and could be used as a nucleus for future offsets for other projects; and
- Potential to increase environmental value by appropriate management on all offset properties.

Chapter 1

Introduction

Cumberland Ecology was commissioned by Hansen Bailey on behalf of Moolarben Coal Mines Pty Limited (MCM) to develop a Biodiversity Offset Strategy for the Moolarben Coal Stage 2 Preferred Project (the Preferred Project). The purpose of this document is to present a recommended Biodiversity Offset Strategy and to demonstrate how this Strategy can address project impacts on threatened species and ecological communities.

This document will form part of a Preferred Project Report (PPR) being prepared by Hansen Bailey. The PPR will support application 08_0135 under Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act) that will facilitate the development of a 24 year open cut and underground coal mine, associated infrastructure and integration with the existing Stage 1 operations.

The structure of the report is as follows:

- Chapter 1 – Provides background information, introduces the aims and objectives of the document, summarises what the residual Preferred Project impacts are and outlines the offset requirements that will adequately address these residual impacts;
- Chapter 2 – Describes and explains the approach that was taken in developing the Biodiversity Offset Strategy;
- Chapter 3 – Presents the Biodiversity Offset Strategy for the Preferred Project;
- Chapter 4 – Assesses the adequacy of the Biodiversity Offset Strategy against the State and Commonwealth offsetting principles; and
- Chapter 5 – Summarises the key points in this document.

1.1 Terms and Abbreviations

This report uses the following terms and abbreviations:

Box Gum Woodland and Derived Native Grassland

Abbreviated name for the State and Commonwealth listed threatened community, *White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland*

C/EEC Critically Endangered or Endangered Ecological Community;

DP&I Department of Planning and Infrastructure (former Department of Planning);

EA Stage 2 Environmental Assessment;

EEC Endangered Ecological Community;

EP&A Act NSW *Environmental Planning and Assessment Act 1979*;

EPBC Act Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*;

LGA Local Government Area;

Locality Is the area within a 10 km radius of the Preferred Project Boundary;

MCM Moolarben Coal Mines Pty Ltd;

ML Mining Lease;

Mtpa Million tonnes per annum;

PPR Preferred Project Report;

OC Open cut (e.g. OC4);

OEH NSW Office of Environment and Heritage (former NSW Department of Environment Climate Change and Water);

Preferred Project Disturbance Boundary

When referring to all disturbances associated with the Preferred Project infrastructure area, Northern Out of Pit Emplacement Area and Open Cut 4; and

SEWPaC Commonwealth Department of Sustainability, Environment, Water, Population and Communities;

The Preferred Project Stage 2 of the Moolarben Coal Preferred Project as revised in the PPR.

1.2 Requirement for a Revised Offset Strategy

An Environmental Assessment (EA) for Stage 2 of the Moolarben Coal Preferred Project was submitted to the NSW Department of Planning and Infrastructure (DP&I) in 2009 on behalf of MCM (Wells Environmental Services & Coffey Natural Systems, 2009). The EA included an ecological impact assessment by Ecovision Consulting (2008).

Since exhibition of the EA, the DP&I has responded with a letter issued to MCM on the 25th March 2010[1] requesting the provision of a Preferred Project Report (PPR) before an approval can be determined.

The PPR requirements relevant to ecological issues as outlined in the letter, are to:

- Demonstrate all reasonable and feasible measures have been taken to avoid impacts on State and Commonwealth Endangered Ecological Communities (EECs), paying particular attention to the proposed emplacement areas;
- Include a clear proposal to offset the residual biodiversity impacts; and
- Include a clear mine plan with detailed maps and figures, that consolidates all the changes that have been made to both stages of the Preferred Project during the assessment process.

This report addresses the second item and presents a revised Biodiversity Offset Strategy to meet the DP&I's requirements for offsetting development impacts.

The following steps have been taken to comply with the first item, i.e. to minimise impacts:

- Modification to Open Cut 4 (OC4) footprint to achieve avoidance of impacts to C/EEC;
- Construction of one Northern Out-Of-Pit (OOP) in lieu of two southern OOP emplacement areas to reduce impact to C/EEC and potential interaction with Munghorn Gap Nature Reserve;
- Avoidance of 2.7 km of Murragamba Creek (previously proposed to be mined through);
- Modification to the OC4 haul road to avoid C/EEC;
- Development of a ROM coal transfer conveyor to minimise noise and dust impacts; and
- Total reduction in impacts to C/EEC of 33.56 ha.

[1] David Kitto, Director of Industry and Mining, to Ian Callow, Felix Resources, 25 March 2010, Personal files of Moolarben Coal Mining Pty Limited, North Sydney

1.3 Background Information

1.3.1 Preferred Project Description

The Preferred Project, for which the PPR is being prepared, will consist of:

- The construction and operation of an open cut (OC) mining operation (OC4) extracting up to 12 Million tonnes per annum (Mtpa) Run of Mine (ROM) coal and up to 13 Mtpa combined rate with the Stage 1 open cuts;
- The construction and operation of two underground (UG) mining operations (UG1 and UG2) extracting up to 4 Mtpa ROM coal cumulative with the Stage 1 underground;
- The construction and operations of the Stage 2 ROM coal facility;
- Extension of the life of the Coal Handling and Preparation Plant (CHPP) to Year 24 of Stage 2 and increased throughput of up to 17 Mtpa (13 Mtpa open cut and 4 Mtpa underground);
- The development of the Northern Out Of Pit (OOP) emplacement area;
- The construction and operation of two conveyors and associated facilities between the Stage 2 ROM coal facility and Stage 1 CHPP;
- The construction and operation of a Mine Access Road;
- The construction and operation of administration, workshop and related facilities;
- The partial relocation of Murragamba and Eastern Creeks;
- The construction and operation of water management infrastructure; and
- The installation of supporting power and communications infrastructure.

1.3.2 Summary of Preferred Project Impacts

i. Vegetation Loss

The area proposed to be cleared (the disturbance area) is centred upon a valley, within which largely cleared grazing lands occur. The hillsides around the periphery of this area and some riparian areas in the centre of the valley have native forest and woodland. However, much of the valley consists of highly modified grassland and shrubland and although such vegetation contains native plants, it is largely dominated by exotic grasses and herbs and has a very low diversity of native species.

Woodland and open forest areas support a higher diversity of native plant and animal species. Some of the woodland and forest types are a form of the ecological community listed as endangered under the NSW *Threatened Species Conservation Act (*TSC Act*)* and

listed as critically endangered under the *Commonwealth Environment Protection and Biodiversity Conservation Act* (EPBC Act). That C/EEC is referred to here as *Box Gum Woodland and Derived Native Grassland* or Box Gum Woodland.

The Preferred Project has undergone a series of design changes in an effort to reduce the loss of native remnant vegetation and consequently, threatened ecological communities and habitat for threatened species.

The current disturbance footprint is shown in **Figure 1.1**. This footprint will result in a clearance of approximately 1,546 ha of land. This includes approximately 779 ha of remnant native vegetation (non-threatened) and an additional 123 ha of the *Box Gum Woodland and Derived Native Grassland* C/EEC (**Figure 1.2**). The remaining areas of potential disturbance comprise secondary grasslands and heavily modified or existing cleared areas. These are dominated largely by exotic grasses and herbs and hardy native grasses.

Table 1.1 summarises the vegetation types and areas that will be removed by the Preferred Project. Although modifications to the mine disturbance footprint have resulted in a very minor increase overall, an additional 33 ha of C/EEC has been avoided.

Table 1.1 Total Vegetation Communities to be cleared from Disturbance Area

Vegetation Type	EIA (Ecovision 2008)	Reduction (-) or Increase (+)	Vegetation to be cleared (ha)
Native Forest and Woodland:			
Blakely's Red Gum - Rough-Barked Apple Woodland #	53.21	-16.41	36.8
Blakely's Red Gum - Yellow Box - Rough-Barked Apple Grassy Woodland #	59.78	-10.78	49.0
Blakely's Red Gum - Yellow Box Grassy Woodland #	40.82	-11.22	29.6
White Box - Yellow Box Grassy Woodland #	2.95	+4.95	7.9
Western Slopes Dry Sclerophyll Forest	362.53	+96.07	458.6
Murragamba Sands Woodland	331.88	-11.38	320.5
Non-native Vegetation:			
Secondary Grassland and Shrublands*	644.07	-12.57	631.5
Disturbed / No Natural Vegetation*	11.76	+0.04	11.8
Total C/EEC Cleared #	**156.76**	**-33.46**	**123.3**
Total Remnant Forest and Woodland to be cleared (including C/EEC)	**851.17**	**+51.23**	**902.4**
Total Vegetation Cleared	**1,507.00**	**+38.70**	**1,545.7**

 # (Critically) Endangered Ecological Community (C/EEC) Box Gum Woodland and Derived Native Grassland

** Not remnant native vegetation. It is heavily modified pasture consisting of exotic pasture species with some hardy native plants, including perennial grasses and other herbs, and some shrubs.*

ii. Threatened Species

The clearance of remnant native vegetation also represents the loss of habitat for flora and fauna species. A suite of threatened species (**Table 1.2**) were identified as being potentially present in the Preferred Project Disturbance Boundary, or were confirmed as being present during field studies (Ecovision, 2008). Species that were found within the Preferred Project Disturbance Boundary and have been listed as threatened since 2008 have also been included in this report. All these species are listed in **Table 1.2** and are considered target species for this proposed Biodiversity Offset Strategy.

Table 1.2 Threatened Species potentially impacted by the Preferred Project

Scientific Name	Common Name	TSC Act	EPBC Act
Birds			
Barking Owl	*Ninox connivens*	V	
Black-chinned Honeyeater	*Melithrephtus gularis gularis*	V	
Brown Treecreeper	*Climacteris picumnus*	V	
Bush Stone-curlew	*Burhinus grallarius*	E	
Diamond Firetail	*Stagonopleura guttata*	V	
Gang-gang Cockatoo	*Callocephalon fimbriatum*	V	
Gilbert's Whistler	*Pachycephala inornata*	V	
Glossy Block-Cockatoo	*Calyptorhynchus lathami*	V	
Grey-crowned Babbler	*Pomatostomus temporalis*	V	
Hooded Robin	*Melanodryas cucullata*	V	
Little Eagle*	*Hieraaetus morphnoides*	V	
Little Lorikeet*	*Glossopsitta pusilla*	V	
Painted Honeyeater	*Grantiella picta*	V	
Powerful Owl	*Ninox strenua*	V	
Rainbow Bee-eater	*Merops ornatus*		M
Regent Honeyeater	*Anthochaera phrygia*	CE	E, M
Satin Flycatcher	*Myiagra cyanoleuca*		M
Scarlet Robin*	*Petroica boodang*	V	
Speckled Warbler	*Pyrrholaemus sagittatus*	V	
Spotted Harrier*	*Circus assimilis*	V	
Square-tailed Kite	*Lophoictina isura*	V	
Swift Parrot	*Lathamus discolor*	E	E, M
Turquoise Parrot	*Neophema pulchella*	V	

Table 1.2 Threatened Species potentially impacted by the Preferred Project

Scientific Name	Common Name	TSC Act	EPBC Act
Varied Sittella*	*Daphoenositta chrysoptera*	V	
White-fronted Chat*	*Epthianura albifrons*	V	
White-throated Needletail	*Hirundapus caudacutus*		M
Mammals			
Brush-tailed Rock-wallaby	*Petrogale penicillata*	E	V
Eastern Bentwing Bat	*Miniopterus schreibersii*	V	
Greater Long-eared Bat	*Nyctophilius timoriensis*	V	
Koala	*Phascolarctos cinereus*	V	
Large-eared Bat	*Chalinolobus dwyeri*	V	V
Little Pied Bat	*Chalinolobus picatus*	V	
Spotted-tailed Quoll	*Dasyurus maculata*	E	E
Squirrel Glider	*Petaurus norfolcensis*	V	
Yellow Sheath-tailed Bat	*Saccolaimus flaviventris*	V	
Plants			
-	*Ozothamnus tesselatus*	V	V
Capertee Stringybark	*Eucalyptus cannonii*	V	V
Pine Donkey Orchid	*Diuris tricolor*	V	
Scant Pomaderris	*Pomaderris queenslandica*	E	
Small Purple-pea	*Swainsona recta*	E	E

**Species that have been listed since 2008. V = vulnerable; E = Endangered; CE = Critically Endangered; M = Migratory*

iii. Potential Subsidence as a Result of Underground Mining

Underground mining is an effective form of impact avoidance and will essentially preserve most habitats in their existing form, and/or in a similar form. The forests and woodlands that occur today across much of the site will remain where underground mining takes place. Some subsidence may result in changes to the cliff lines in the area. The ecological significance of potential impacts is discussed in **Section 1.4.3**.

1.4 Offset Requirements

In order to obtain approval, MCM needs to demonstrate that it has, as far as practicable, reduced ecological impacts by the following means:

- Avoid – to the extent possible, the Preferred Project should be designed to avoid or minimise ecological impacts;
- Mitigate – where certain impacts are unavoidable through design changes, mitigation measures should be introduced to ameliorate the ecological impacts of the Preferred Project; and
- Compensate – following the implementation of mitigation measures, the residual impacts of the Preferred Project should be compensated to offset what would otherwise be a net loss of habitat.

The Preferred Project has been modified to the extent practicable to avoid and reduce impacts to flora and fauna. This has been achieved by relocating the two previously proposed out of pit emplacements to an area that avoids C/EEC.

Mitigation measures will be deployed on the site and will include rehabilitation of the mined areas, including areas of secondary grassland that currently have little habitat value, to create forest and woodland. This will provide larger treed areas than currently occur in the proposed disturbance area in the long term.

Notwithstanding the proposed avoidance and mitigation measures, the Preferred Project would clear a substantial area of habitat and could entail a significant impact without the provision of adequate offsets. It will require an offset package that addresses the loss of C/EEC *Box Gum Woodland and Derived Native Grassland* and the loss of other forest and woodland that comprises habitat for threatened species.

1.4.1 Offset Ratios

Based on a review of recent mining project proposals and in consultation with state and federal government authorities, MCM has aimed to offset the direct clearing impacts of the Preferred Project on remnant native vegetation at a ratio of at least 3:1 (offset ha to impact area ha), including seeking to offset direct impacts on Box Gum Woodland at a ratio of 5:1. Therefore, to achieve the target ratios, offset land needs to contain a sum total of 2,707.2 ha of native vegetation, of which at least 616.5 ha should consist of, or have the potential to regenerate or be rehabilitated to *Box Gum Woodland and Derived Native Grassland*.

Table 1.3 Summary of Target Offset Requirements

Vegetation Component	Impact (ha)	Target Offset (ha)	Ratio
Total Remnant Native Vegetation (including C/EEC)	902.4	2,707.2	3. 0
Total C/EEC	123.3	616.5*	5.0

**Note that this should be a subset of the total offset required, i.e. 2,707.2 ha.*

1.4.2 Offset Requirements for Secondary Grassland

Two vegetation types within the impact area (**Table 1.1)** are so heavily modified that they are not considered as remnant native vegetation and are therefore not required to be offset and are not included in the offset ratio calculations. These are:

- 631.5 ha of Secondary Grassland and Shrublands; and
- 11.8 ha of Disturbed / No Natural Vegetation

The low condition of this vegetation was verified by field survey during November 2011. A rapid assessment of eleven representative areas within the Secondary Grassland was conducted in November 2011. Details are listed in **Appendix D**. The data collected clearly shows that these areas are in very poor condition, with high proportion of weeds and pasture grasses, with some areas having been ploughed in the past. While this degraded grassland is not included in this current offset strategy, the land area currently occupied by it will be progressively rehabilitated to woodland/grassland once mining has ceased, resulting in a net environmental gain.

1.4.3 Potential Subsidence as a Result of Underground Mining

The potential subsidence of cliff line habitats due to underground mining may impact upon cave roosting bats, particularly Large-eared Pied Bat (*Chalinolobus dwyeri*), which are known to occur in the proposed mining area and surrounds. This bat species is listed as a vulnerable species under both the Commonwealth EPBC Act and the NSW TSC Act. According to Churchill, S (2008) in her book Australian Bats, this species occurs in areas with extensive cliffs and caves from central eastern Queensland to Bungonia in the Southern Highlands. The term "Vulnerable" denotes the lower level of threatened species category. The higher level of threat is "Endangered".

According to Churchill, the bat is known to roost in "*caves, crevices in cliffs and mines, in colonies of three to 40, clustered in indentations in the ceiling*". It commonly occurs in dry sclerophyll woodlands (which are common on the Moolarben site) but also occurs in wetter forests. The bat roosts in caves and has considerable fidelity to a given cave, returning to roost year after year. There are many records of this cave roosting bat in NSW, including a considerable number around Sydney and also around the proposed mine development, where cliff lines are abundant outside the mine lease.

The Large-eared Pied Bat is a small animal and can roost in relatively small spaces. Given this fact, and the fact that the adjacent Munghorn Gap Nature Reserve and Goulburn River National Park comprise extensive areas of cliff line habitat, many such potential roost sites will remain post mining in and around the Preferred Project area. Furthermore even if cliffs do alter through subsidence, it is likely that faulting and fracturing will occur such that other cracks, crevices and eventually caves will form in the process, providing additional habitats for bats.

The nature and extent of habitat for cave roosting bats is not likely to be significantly altered as a result of the proposed mining in a way that would jeopardise the species in the locality.

Extensive habitats remain on and off site. Furthermore *Chalinolobus dwyeri* has been surveyed on one of the offset properties, where sandstone outcrops provide habitat for this species. For this reason, we conclude that no further offsets or mitigation measures are warranted for this or other species of cave roosting bats.

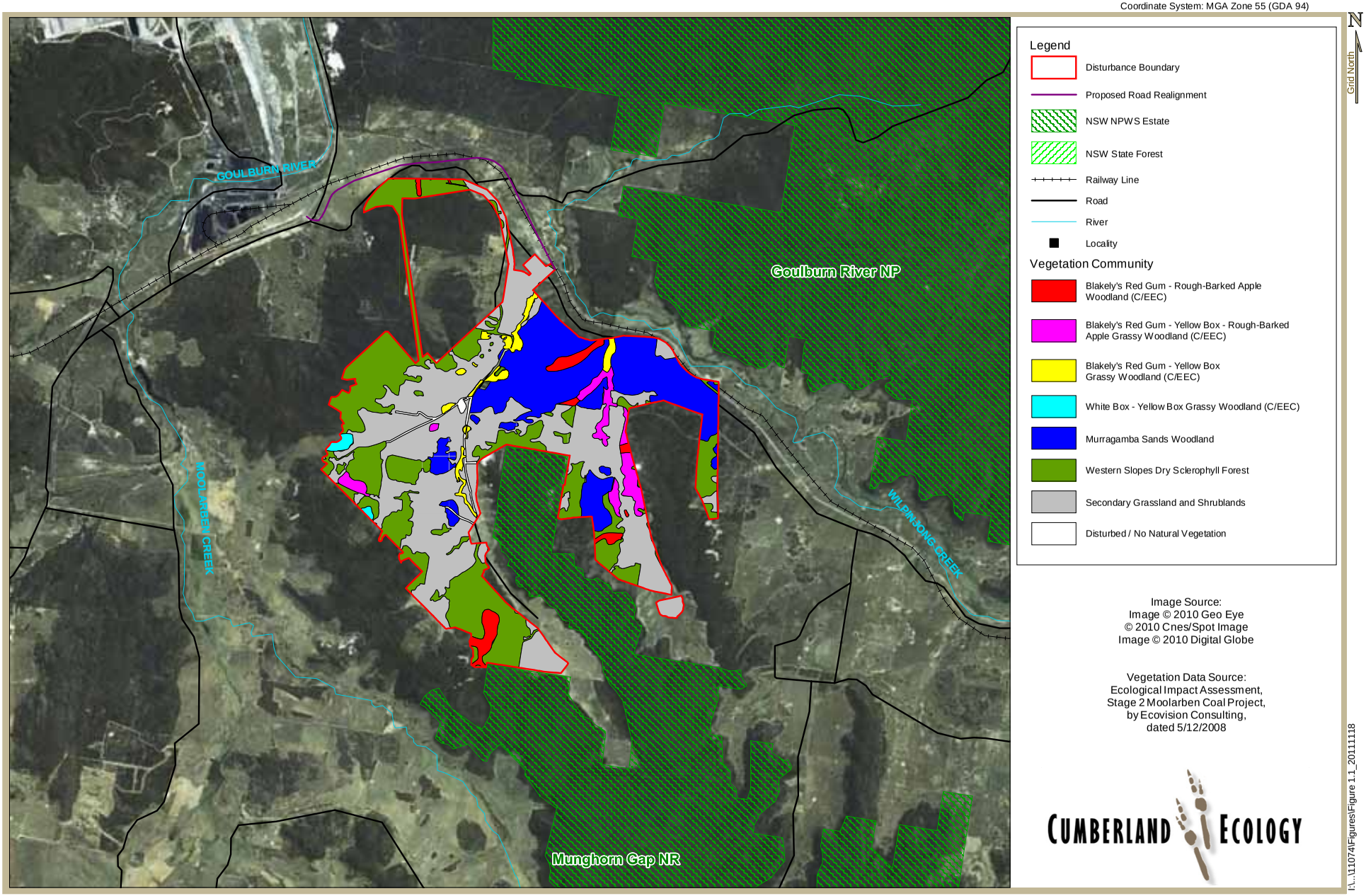

Figure 1.1 Disturbance Boundary and Vegetation Communities

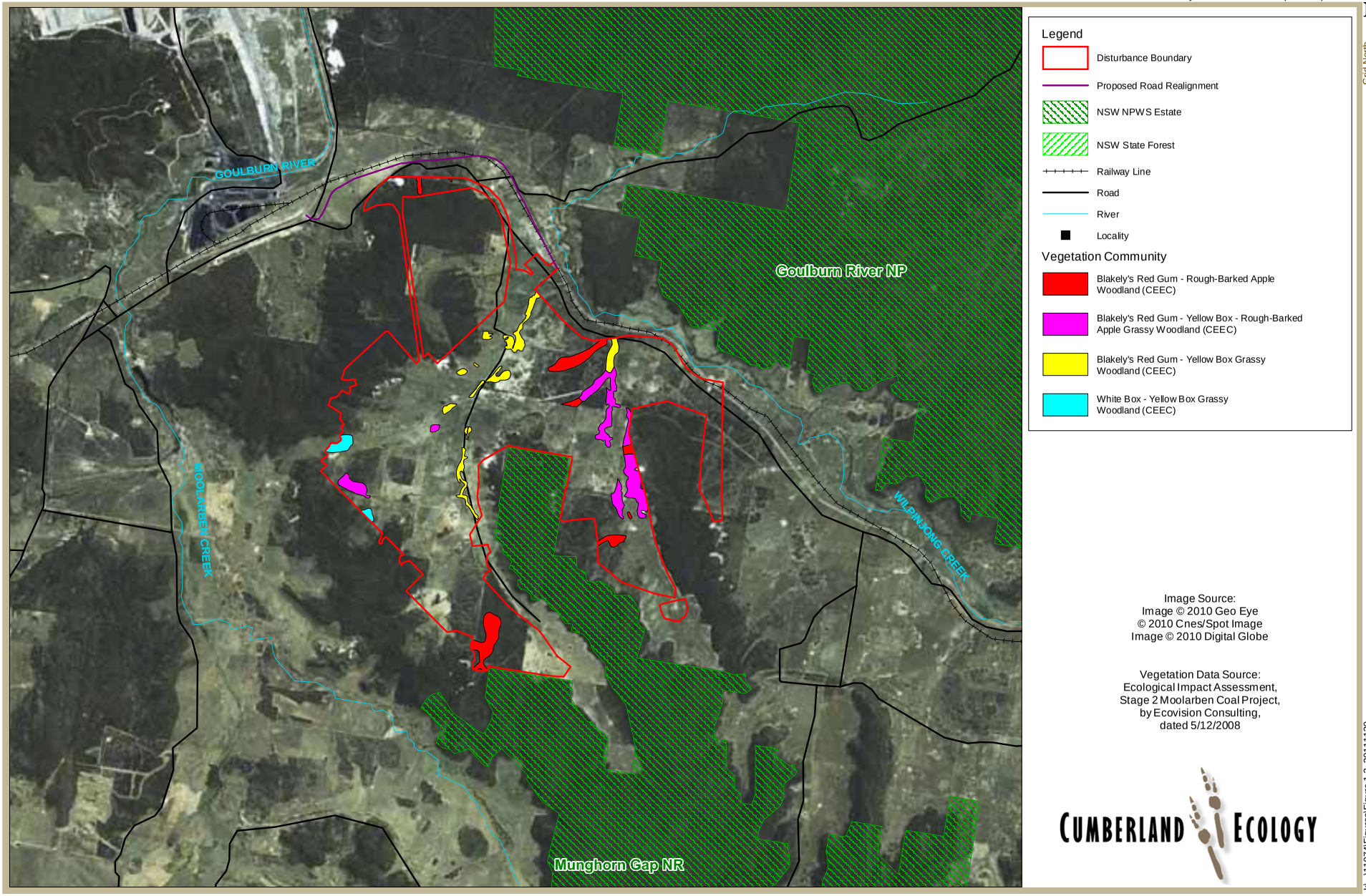

Figure 1.2 Disturbance Boundary and CEECs listed under the EPBC Act

Chapter 2

Methods for Developing the Offset Strategy

This chapter summarises the approach to development of the Offset Strategy and how the flora and fauna habitats of the preferred offsets were verified by field surveys.

Ideally, Biodiversity Offsets should be able to address the impacts of the Preferred Project in a strategic and meaningful way that will deliver a real biodiversity outcome. Cumberland Ecology took a considered approach in developing the Biodiversity Offset Strategy for the Preferred Project comprising the three key steps outlined below:

- Identifying the desirable features of an offset package. This assisted in the identification of potentially suitable offset land;
- Implementing a series of actions to prioritise potential land for further investigation; and
- Conducting field surveys to verify the suitability of habitats within candidate properties.

2.1 Attributes of Preferred Offset Land

In considering available offset areas, MCM has endeavoured to source land that is not within a mining lease, that has good potential for restoration and conservation, and which supports habitat for threatened species and Box Gum Woodland that occur in the proposed disturbance area.

A key consideration was also to ensure that offsets contained substantial areas of land that have been partially cleared but which could feasibly be regenerated to forest and woodland with appropriate conservation management. The rationale for this was to ensure that a net gain in the area of forest and woodland could be achieved in the medium to long term through appropriate conservation management.

Much of the forest and woodland habitats to be impacted by the Preferred Project occur on sandstone landscapes that are relatively well represented in nearby National Parks. Little is available for consideration as offsets and so this has to an extent restricted the range of offset land available for consideration by MCM.

Properties with the following attributes were considered to be desirable contributors to the Biodiversity Offset Strategy and these were targeted when searching for suitable land:

- Land that contains, or could be regenerated to provide *Box Gum Woodland and Derived Native Grassland*;
- Land that includes habitat for relevant threatened flora and fauna species that are predicted to be impacted by the Preferred Project;
- Land that builds onto existing conservation areas;
- Land that forms new, or improves existing ecological corridors;
- Land that is like for like in terms of bioregion, topography, soils, aspect, flora and fauna and habitat values;
- Land that contains or links to sustainable ecological features (particularly permanent water sources);
- Land that builds corridors between woodland areas, such as State Forest, National Parks and State Conservation Area;
- Land that links rehabilitated mining areas to existing vegetation;
- Land that links to other Biodiversity Offsets from other mining projects; and
- Land that is outside any existing coal mining tenement or exploration lease.

2.2 Prioritising Properties for Investigation

Cumberland Ecology completed the following tasks to obtain a list of candidate properties for investigation:

- Investigated lot sizes, tenure, ownership and location of properties in the locality by accessing cadastral information;
- Reviewed the placement of current mining tenements (NSW Department of Primary Industries, 2011) and existing conservation areas (i.e. national parks, reserves, state forests, etc.) in the locality;
- Identified areas of existing vegetation cover by aerial interpretation of the most current available aerial photography;
- Analysis of available desktop information in the locality, including:
    - Existing vegetation mapping data;
    - Predicted and recorded threatened species from databases (DECC, 2009, DSEWPC, 2010);
    - Soils, geology, drainage, topographical data;

- Estimated broad areas of *Box Gum Woodland and Derived Native Grassland* based on interpretation of desktop data; and
- Prioritised a list of properties for investigation.

Once the Proponent investigated potential vendors and short-listed properties for purchase, limited field studies were made to collect data to determine the suitability of each property as an offset.

Land that is already controlled by MCM was also considered for its suitability as an offset. Land that is located within the Preferred Project's predicted zone of impact was also considered, since this land is proximate to the disturbance and would benefit from mitigation works and rehabilitation that would result from future offset management. Note that the properties within the zone of predicted impact have not yet been surveyed for the Biodiversity Offset Strategy and are not included in offset calculations, but have been discussed briefly in this report.

2.3 Database Analysis

Database analysis was conducted for the locality using both the NSW Office of Environment and Heritage (OEH, former Department of Environment, Climate Change and Water DECCW) Atlas of NSW Wildlife Database (OEH, 2011) and the Commonwealth Department of Sustainability, Environment, Water, Population and Communities (SEWPaC) Protected Matters Search Tool (SEWPaC, 2011a).

The Atlas of NSW Wildlife search was used to generate records of threatened flora and fauna species listed under the TSC Act within a 20km radius of the centre of the Impact Site and each of the Offset Properties. The Protected Matters search generated a list of potentially occurring flora, fauna and ecological communities listed under the EPBC Act within a 10 km radius of the centre of the Impact Site. The lists generated from these databases were initially reviewed against available knowledge of the area to ascertain the likelihood of occurrence of threatened species.

2.4 Aerial Photograph Interpretation (API) & GIS

Maps and aerial photography was examined prior to field survey on each property in order to prepare preliminary vegetation maps. These included aerial photographs and geology maps (Australia Geoscience Geology Map (DMR, 2011)).

The dates and source of the aerial photographs used are:

- Image © 2011 GeoEye, dated 20/01/2010 (Windeyer);
- © 2011 Cnes/Spot Image, dated 31/07/2005 (Ulan); and
- © 2011 Cnes/Spot Image, dated 05/02/2007 (Hargraves).

Vegetation maps of adjacent National Parks and Nature Reserves were also examined to help indicate what may be present on the proposed offset sites. The preliminary maps were then verified by field surveys as described below. The vegetation community names in this report are a combination of the dominant canopy species and the vegetation formation (Specht 1970). The closest matching BioBanking vegetation types are listed as well (DECC 2009) for each plant community.

2.5 Field Studies

Field teams of one ecologist and one botanist conducted investigation of candidate properties with reasonable prospects for purchase over December 2010, February 2011 and March 2011. The investigation entailed drives across (or around) the properties; where the following data was collected:

- Quadrat samples to characterise main vegetation types;
- Notes about threatened species habitat;
- Notes about key habitat features observed (rock outcrops, streams, etc);
- Notes about vegetation condition, including:
  - Weed infestation;
  - Stocking rates and/or grazing impacts;
  - Historical and current land use;
- Photographs; and
- GPS data.

Additional surveys of offset properties with high suitability were conducted in November 2011 by two ecologists, an ornithologist and a botanist. The investigations entailed driving and walking across the properties, and included:

- Vegetation quadrats to characterise the main vegetation types and to identify species diversity (including abundance of each species, using a modified Braun-Blanquet Cover Abundance scale). Quadrat data is summarised in **Appendix A** and quadrat location are shown on **Figures 3.4 to 3.7**;
- Rapid vegetation assessments (i.e. taking waypoints and photographs as well as noting dominant species and native/weed ratio of ground covers);
- Anabat survey to identify presence of microchiropteran bats. Bat survey results are presented in **Appendix C** and Anabat locations are shown on **Figures 3.4 to 3.7**;

- Bird surveys including diversity assessment, habitat assessment and likelihood of occurrence of threatened species. The full fauna species list is presented in **Appendix B** and the tracks walked during the bird surveys are shown on **Figures 3.4 to 3.7**;
- Notes about threatened species habitat;
- Notes about key habitat features observed (rock outcrops, streams, etc);
- Photographs; and
- GPS data including locations of all samples taken and routes taken during site inspections.

2.6 Assumptions and Limitations

2.6.1 Assumptions Regarding the Preferred Project Impacts

The vegetation surveys within the Preferred Project Disturbance Boundary were conducted by Ecovision Consulting (2008) as part of the Stage 2 EA assessment and have not been verified by Cumberland Ecology for this report (except for the Secondary Grassland, see **Section 1.4.2**). Cumberland Ecology is therefore assuming that the vegetation within the Preferred Project Boundary has been accurately mapped and assessed for the presence of threatened species and communities.

2.6.2 Availability of Land for Purchase

The development of the offset package was influenced by the availability of land for purchase. The offset land presented in the Biodiversity Offset Strategy represents the best available candidate properties at the time of writing.

A high proportion of the forest and woodland that is predicted to be impacted by the Preferred Project is located on sandstone landscapes, much of which are already conserved in the locality. Potential offset areas were available in land to the west and southwest of the Preferred Project Site but such land was largely on a differing geology because the sandstone landscapes are already so well conserved and have limited availability for purchase. For this reason, different but similar vegetation communities that afforded habitat to the same suite of fauna species that were predicted to be impacted by the Preferred Project were targeted for offsets.

Special emphasis was placed on finding large properties that are located outside existing mining tenements with the potential to link existing conservation areas. As explained in Chapter 3 this significantly reduced the availability of suitable properties, as in the Mudgee area the majority of National Parks and State Forests are directly adjacent to mining tenements. Nevertheless, the offset properties are not located within any mining tenement.

2.6.3 Limitations in Field Investigations

The scale of the field inspections of the potential offset properties is considered to be appropriate and adequate for the identification of target ecological communities and habitat for threatened species; and to gain an understanding of the overall features of the property.

The quantity and quality of data that were collated during field inspections of candidate properties were subject to access and time limitations. Some properties were extensive and contained areas of difficult access. Notwithstanding this, properties that were apparently suitable after an initial inspection were subject to repeated visits. Furthermore, a conservative interpretation of the extent of *Box Gum Woodland and Derived Native Grassland* was made where there was insufficient information to confirm predicted mapping.

One of the properties that were difficult to access is Property 17, where only the eastern edge has been surveyed. Assumptions have been made regarding the vegetation communities in the parts of the property that have not been surveyed (**Figure 3.6**). While this property (which is owned by MCO) will be used as an offset due to its location adjacent to Avisford Nature Reserve, it has not been included in the offset ratio calculations due to having an existing 'restriction on the use of the land' which does not allow clearing of vegetation.

The high proportion of threatened fauna species that were known or predicted to occur on the offset sites, in the relatively limited times for survey, when combined with database information for localities surrounding the proposed offset sites, give a high degree of confidence that the offsets provide suitable habitat for the majority of threatened species predicted to be impacted by the Preferred Project.

Chapter 3

Biodiversity Offset Strategy

3.1 Summary of Offset Properties

The following offset properties proposed for inclusion in the Biodiversity Offset Strategy (see **Figure 3.1**):

- Property 9 "Dun Dun" in Hargraves (Lots 60 & 61 DP 704158, Lots 79 & 80 DP 704159 and Lots 14 & 15 DP 756867);
- Property 17 in Windeyer (Lot 112 DP 756864);
- Property 18 in Ulan (Lot 279 DP 40917, Lot 1 DP 592376, Lots 1 & 2 DP 809642); and
- Area within the Preferred Project boundary and outside the Disturbance boundary.

The total area of native vegetation provided by the offsets is approximately 3,516 ha, of which 620 ha is C/EEC (**Table 3.1**). Thus these offsets meet the target offset areas as shown in **Table 1.3**. This translates to an overall ratio of 3.9 ha offset for every hectare of native forest and woodland vegetation cleared for the Preferred Project and within this, a ratio of 5 ha of C/EEC offset for every hectare of C/EEC cleared.

Further information regarding the types and extent of vegetation recorded in the offset properties are discussed in **Section 3.3** within this chapter.

Table 3.1 Summary of Offsets that will be Secured

Vegetation Component	Impact (ha)	Actual Offset (ha)	Ratio
Total Remnant Native Vegetation (including C/EEC)	902.4	3,516.0	3.9
Total C/EEC	123.3	620.2	5.0

**This area is a subset of the total remnant vegetation in the offset.*

The above offset properties also provide habitat for most of the target threatened species identified in **Section 1.3.2** of this report. This is discussed in further detail in **Section 3.6** of this report.

Special emphasis was placed on finding large properties that are located outside existing mining tenements with the potential to link existing conservation areas. As shown in **Figure 3.1** this significantly reduced the availability of suitable properties, as in the Mudgee area the majority of National Parks and State Forests are directly adjacent to mining tenements. Nevertheless, the offset properties are not located within any mining tenement.

Property 18 provides an excellent stepping stone towards creating a corridor connecting Goulburn River National Park and Cope State Forest in the long term. This is in line with previous offset strategies by MCM and adjacent mines. See **Figure 3.2** for details.

Property 17 is the southern extension of Avisford Nature Reserve. Avisford Nature Reserve was created in June 1985, and covers an area of 2,437 ha. Avisford Nature Reserve protects areas of relatively high ridge lands typified by steep sloping gullies and hills with open forest and woodlands. These ridge lands provide habitat for diverse fauna and flora populations.

The major benefits of property 9 are the location away from mining tenements, the large size, the fact that most of the property has never been cleared and that it could be a conservation reserve with potential to add surrounding properties in the future. Additionally, the property contains 225 ha of C/EEC woodland, 293 ha of C/EEC grassland and 344 ha of mixed grassland. While this grassland is mapped as low diversity derived native grassland, it does contain pockets of predominantly native grasses. All grassland can be regenerated into C/EEC woodland once grazing has ceased. This property provides habitat for many threatened flora and fauna species.

The offset properties are described in more detail below.

3.2 Description of the Offset Properties

3.2.1 Property 9 "Dun Dun" (Hargraves)

"Dun Dun" is a large property under Agreement with MCM and divided into two, the eastern and the western part, separated by a distance of approximately 1km. The eastern part (hereafter called 9E) is 1,776 ha in size and the western part (hereafter called 9W) is 959 ha.

On 9E (**Figure 3.4**) the southern boundary runs along Pyramul Creek, which contains permanent fresh water. The northern and eastern boundaries are defined by Doughertys Junction Road. The property is of irregular shape and contains undulating hills and ridge-lines between 650m and 900m above sea level.

The riparian vegetation along Pyramul Creek is on Crown land and has been excluded from grazing. Permanent water within the property boundary consists of several farm dams. The grassland is currently being grazed by sheep at a very low stocking rate. In the past, the property owners used to graze cattle as well. The forested areas in the middle of the property are largely undisturbed and have not been previously cleared.

Property 9W (**Figure 3.5**) is located in steeply undulating terrain between 600m and 870m above sea level. Dun Dun Creek containing permanent fresh water passes through the south eastern corner of the property and Willerang Creek forms most of the western boundary. The eastern half of the property comprises mostly cleared grassland and woodland with occasional patches of dense vegetation. The western half is mostly inaccessible, steeply undulating and covered in forest.

The property provides a stepping stone between other patches of vegetation within a heavily cleared landscape. It also forms part of a riparian corridor along Pyramul Creek. Due to its size and the quality of the habitat present, the property could become a conservation reserve in its own right. It could also be used as a nucleus where adjoining properties are added in the future as offsets for other projects.

3.2.2 Property 17 (Windeyer)

Property 17 in Windeyer is a property of 502.5 ha adjacent to the Avisford Nature Reserve and is owned by MCM (**Figure 3.6**). The property is accessed via a four-wheel-drive track through the neighbouring property from Queens Pinch Road. The western boundary runs along the four-wheel-drive track, the eastern and southern boundaries are bordering on neighbouring properties and the northern boundary is along Avisford Nature Reserve. The property is of almost square shape and contains many undulating hills, ridge-lines and gullies with a predominantly east-west aspect. The elevation is between 770m and 900m above sea level.

The property contains many small ephemeral creek lines. All of the property is covered in native vegetation, most of it being open forest. A small area along the western boundary has been cleared and contains grassland with scattered trees.

The property acts as the southern extension of Avisford Nature Reserve. OEH have indicated an interest in the property forming a southern extension of the Reserve.

3.2.3 Property 18 (Ulan)

Property 18 (**Figure 3.7**) adjacent to Ulan is 372.3 ha in size, intersected by the Gulgong-Sandy Hollow Railway line and is owned by MCM. The northern boundary runs along Sportsmans Hollow Creek, which contains running water all year. Goat Hill just south of the southern boundary is on crown land. Otherwise the property is surrounded by other private properties. It is accessed via Toole Road from the east. The property is of roughly rectangular shape and contains flat land in the northern two thirds and a moderately steep incline towards Goat Hill in the south. The elevation is between 400m and 600m above sea level.

The property contains some riparian vegetation along Sportsmans Hollow Creek and a large dam. Most of the grassland is currently being grazed by cattle and some areas have been cropped in the past. The forested areas in the southern half of the property are partially disturbed and contain some shrubby areas and open forest.

This property is located directly adjacent to the properties predicted to be affected by noise from the MCC and the Offset Areas for Stage 1 by Moolarben Coal. These areas combined provide a stepping stone between Cope State Forest and Goulburn River National Park as shown in **Figure 3.2**.

3.2.4 Area within Preferred Project Boundary

This area (**Figure 3.3**) is located in the southern part of the buffer land between the MCM Preferred Project boundary and the Preferred Project disturbance area on land owned by MCM. It consists of 442.3 ha of woodland and grassland directly adjacent to the Munghorn Gap Nature Reserve. 52.7 ha have been mapped by Ecovision (2008) as Blakely's Red Gum and White Box woodland C/EEC.

Large parts of 189 ha of grassland are likely to contain a viable native soil seed bank due to their proximity to the C/EEC and Munghorn Gap Nature Reserve. It is very likely that the grassland will naturally regenerate into woodland with appropriate management and exclusion of stock. 198 ha of this area are covered in Western Slopes Dry Sclerophyll Forest, which provide habitat for many native flora and fauna species.

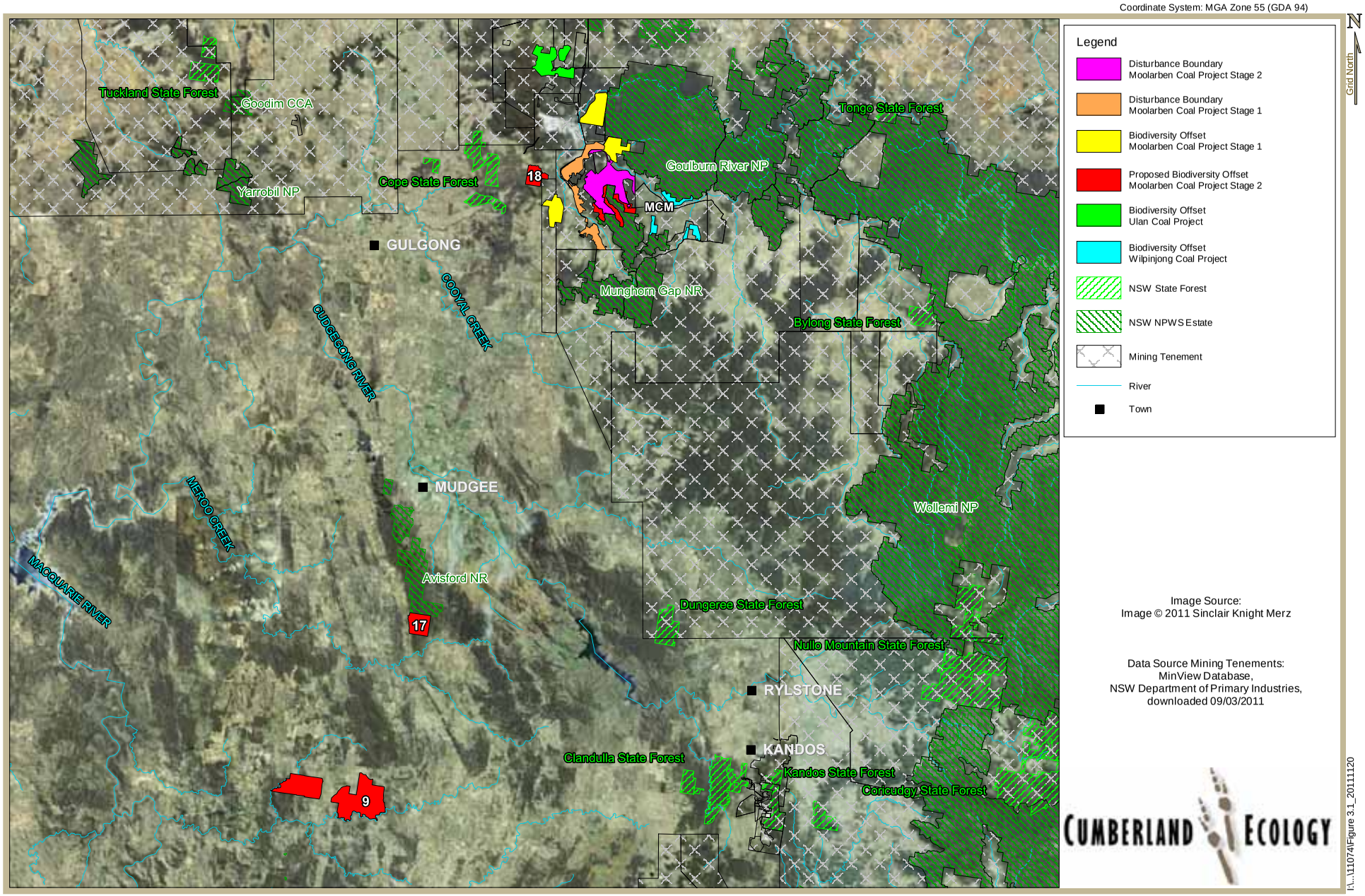

Figure 3.1 Moolarben Coal Stage 2 Offset Strategy

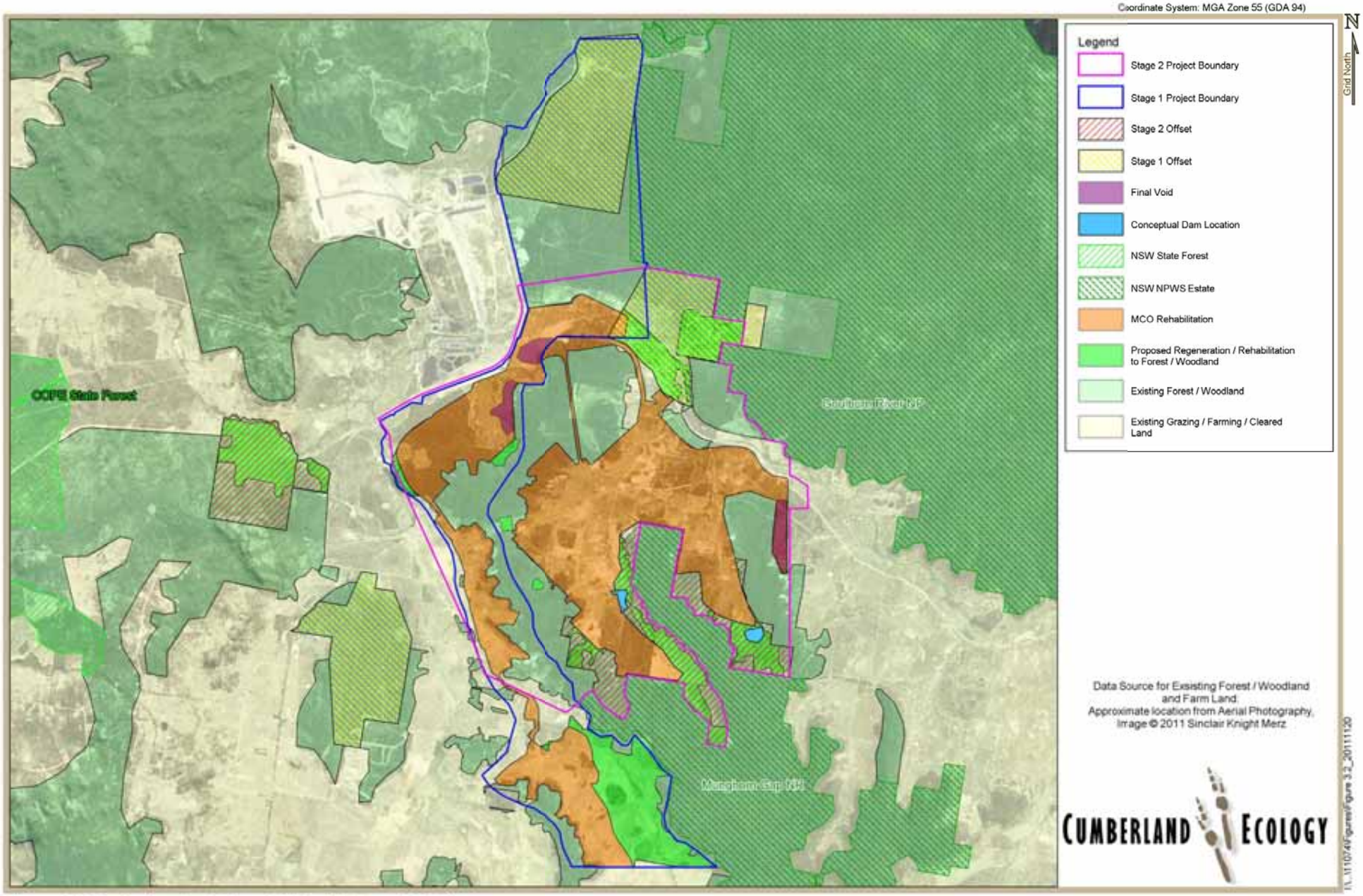

Figure 3.2 Moolarben Coal Stage 2 Offset Strategy Details

3.3 Vegetation Communities within the Offset Properties

The three offset properties contain an approximate total of 3,516 ha of native vegetation of which approximately 620 ha is C/EEC *Box Gum Woodland and Derived Native Grassland* (**Table 3.2**). The largest contribution to these totals comes from Property 9. **Figures 3.4 - 3.7** present approximate maps of the vegetation across Properties 9E, 9W, 17 and 18 respectively.

A total of 267 flora species have so far been recorded on the offset properties, and many more are predicted to be found with further survey, as broad areas of the offset properties have not yet been subject to field survey, and field surveys have only been completed in a limited seasonal window. A full list of flora species and quadrat data can be found in **Appendix A**.

Table 3.2 Vegetation within Offset Properties

Vegetation Type	Properties					Total
	9E	**9W**	**17**	**18**	**MCM**	
White Box-Yellow Box-Blakely's Red Gum Woodland (C/EEC)	114.6	111.2	114.9	48.4	52.7	**327.0**
White Box-Yellow Box-Blakely's Red Gum Derived Native Grassland (C/EEC)	293.2		12.0			**293.2**
Ironbark Open Forest				118.0		**118.0**
River Oak Riparian Forest		12.7		3.9		**16.5**
Red Stringybark - Red Box Woodland		95.7				**95.7**
Scribbly Gum-Red Stringybark Woodland		23.9				**23.9**
Red Stringybark-Scribbly Gum-Peppermint-Open Forest	1,281.3	371.9	375.6			**1,653.2**
Western Slopes Dry Sclerophyll Forest					198.0	**198.0**
Murragamba Sands Woodland					2.5	**2.5**
Acacia / *Kunzea* Shrubs				13.1		**13.1**
Secondary Grassland and Shrublands					189.1	**189.1**
Low Diversity Derived Native Grassland	86.7	343.9		155.2		**585.8**
Exotic				22.3		**22.3**
Cleared / Farm Dams				4.5		**4.5**
Total Offset Area	**1,775.8**	**959.3**	**502.5**	**365.4**	**442.3**	**4,045.3**
Total Native Vegetation (including C/EEC)	**1,775.8**	**959.3**	**N/A***	**338.6**	**442.3**	**3,516.0**
Total C/EEC	**407.8**	**111.2**	**N/A***	**48.4**	**52.7**	**620.2**

* Property 17 is not included in offset ratio calculations

3.3.1 Vegetation Community Descriptions

Descriptions are provided below for the native vegetation communities present in the above offset properties that were surveyed by Cumberland Ecology.

i. ***White Box-Yellow Box-Blakely's Red Gum Woodland (C/EEC)***

Matching BioBanking Vegetation Type: White Box - Yellow Box grassy woodland on basalt slopes in the upper Hunter Valley, Brigalow Belt South

- 114.6 ha on Property 9E
- 111.2 ha on Property 9W
- 114.9 ha on Property 17
- 48.4 ha on Property 18

This is a variable community that conforms to the State and Commonwealth listed *Box Gum Woodland and Derived Native Grassland*. The understorey is predominantly grassy and exhibits a large range of native grasses, herbs, climbers and forbs that are typical for this vegetation type.

On Property 9E, it is open grassy woodland occurring on the fringes of cleared country in the lower parts of the landscape. It is dominated by Yellow Box (*Eucalyptus melliodora*), Red Stringybark and Red Box. Occurrences of Brittle Gum (*Eucalyptus mannifera*) have been recorded but are rare.

On property 18 it is dominated by *E. melliodora, E. blakelyi and Callitris glaucophylla.*

On property 17 the community features White Box (*Eucalyptus albens*) as a dominant or co-dominant with Red Stringybark and Scribbly Gum. These occurrences have also been recorded on the margins of cleared country on slopes and on the gentle rises above drainage lines.

On Property 9W, this community mainly occupies the central section of the largely cleared part of the property, and extends along small drainage lines. There is significant overlap between this and the Stringybark-Red Box Woodland. The main difference is the occurrence of scattered *Eucalyptus albens* (White Box) in this community and the tendency for it to have a grassier understorey. It is unclear how much of the grassy understorey is attributable to management rather than ecological factors as extensive sections of grassland are being colonised by dense shrub regeneration at the time of the survey. Typical tree species include: *Eucalyptus macrorhyncha* (Red Stringybark), *Eucalyptus bridgesiana* (Apple Box) *Eucalyptus melliodora* (Yellow Box) and *Eucalyptus blakelyi* (Blakelys Red Gum). The small tree stratum generally comprises scattered juvenile canopy trees. *Brachychiton populnea* (Kurrajong) is rare. The shrub stratum is typically sparse and includes: *Olearia elliptica*,

Acacia triptera (Spurwing Wattle), *Cassinia arcuata* (Sifton Bush) and *Lissanthe strigosa* (Peach Heath). Ground cover species typically comprise: *Aristida* spp., *Danthonia sp.*, *Hydrocotyle laxiflora*, *Hibbertia obtusifolia* and *Austrostipa scabra* (a Spear Grass).

This community was sampled in Quadrats 2, 9, 18, 20 and 23 to 25 (**Appendix A**).

Table 3.3 Typical Floristics & Structure of Box Gum Woodland

Stratum	Main species	Height (metres)	Proj. foliage cover
Canopy	*Eucalyptus macrorhyncha, Eucalyptus bridgesiana, Eucalyptus melliodora, Eucalyptus blakelyi, Eucalyptus polyanthemos*	10-15	5-30%
Small tree	*Acacia implexa* & juvenile canopy spp.	5-10	Absent-5%
Shrub	*Olearia elliptica, Acacia triptera, Cassinia arcuata, Lissanthe strigosa*	0.3-1.7	1-20%
Ground cover	*Aristida vagans, Danthonia sp., Austrostipa scabra, Hydrocotyle laxiflora, Hibbertia obtusifolia, Lomandra spp.,*	0-0.5	5-50%

Photograph 3.1 White Box-Yellow Box-Blakely's Red Gum Woodland (C/EEC) on Property 18

Photograph 3.2 White Box-Yellow Box-Blakely's Red Gum Woodland (C/EEC) on Property 9W

ii. ***White Box-Yellow Box-Blakely's Red Gum Derived Native Grassland (C/EEC)***

Matching BioBanking Vegetation Type: White Box - Yellow Box grassy woodland on basalt slopes in the upper Hunter Valley, Brigalow Belt South

- 293.2 ha on Property 9E
- 12.0 ha on Property 17

These are areas of native pastures derived from the clearing of *Box Gum Woodland and Derived Native Grassland*. These areas contain a high diversity of forbs in the understorey such that they meet the condition criteria outlined in the EPBC Policy Statement (Threatened Species Scientific Committee, 2006). This means that the EPBC Act recognises these areas of native grassland to be part of the C/EEC community.

Some of the common ground-cover species are *Microlaena stipoides, Hydrocotyle laxiflora, Gonocarpus sp., Hypericum sp., Trifolium sp*. and *Wahlenbergia sp*.

This community was sampled in Quadrats 6 and 7 (**Appendix A**).

Photograph 3.3 **White Box-Yellow Box-Blakely's Red Gum Derived Native Grassland (C/EEC) on Property 9E**

iii. ***Ironbark Open Forest***

Matching BioBanking Vegetation Type: Narrow-leaved Ironbark shrubby open forest on hills of the central Hunter Valley, Sydney Basin

- 118 ha on Property 18

This is an open grassy forest dominated by Narrow-leaved Ironbark (*Eucalyptus crebra*). It occurs in areas of higher relief on comparatively stonier or more skeletal soils to that of the surrounding pasture. The tree canopy is dominated by *E. crebra*. Small proportions of other canopy trees included: *Callitris endlicheri*, *Eucalyptus macroryncha*, *Eucalyptus racemosa* ssp *rossii* (Inland Scribbly Gum), *Eucalyptus dealbata* (Tumbledown Red Gum) and *Eucalyptus melliodora*. The small tree stratum is generally absent but where present contains juvenile canopy trees and species such as *Acacia* sp., *Eucalyptus dwyeri* (Dwyers Red Gum). Shrubs are typically common, especially *Cassinia arcuata*, *Leucopogon muticus*, *Brachyloma daphnoides*, *Hibbertia obtusifolia*, *Pultenaea sp.* and *Calytrix tetragona* (Fringe Myrtle). The ground cover is mostly leaf litter with scattered clumps of natives herbs/grasses such as *Astroloma humifusum*, *Pomax umbellata*, *Gonocarpus sp.* and *Aristida* spp.

This community was sampled in Quadrat 22 (**Appendix A**).

Table 3.4 Typical Floristics & Structure of Ironbark Open Forest

Stratum	Main species	Height (metres)	Proj. foliage cover
Canopy	*Eucalyptus crebra, Eucalyptus melliodora, Eucalyptus bridgesiana, Angophora floribunda*, *Eucalyptus macroryncha*	10-15	5-30%
Small tree	Juvenile canopy spp.	5-10	5-30%
Shrub	*Leucopogon muticus, Brachyloma daphnoides, Cassinia arcuata, Styphelia triflora, Hibbertia spp.*	0.3-1.7	25-50%
Ground cover	*Aristida vagans, Astroloma humifusum, Dichelachne sp., Lomandra spp., Podolepis jaceoides, Pomax umbellata*	0-0.9	5-30%

Photograph 3.4 Ironbark Open Forest on the slopes of Property 18

iv. ***River Oak Riparian Forest***

Matching BioBanking Vegetation Type: River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions

- 12.7 ha on Property 9W
- 3.9 ha on Property 18

This vegetation community is widespread in NSW on the banks of rivers and larger creeks on alluvium and colluvium. The structure is usually open forests to woodland with variable understorey, generally herbaceous or grassy and highly disturbed where accessed by stock. *Casuarina cunninghamiana* (River Oak) is the dominant canopy species, sometimes forming monospecific stands. Associated trees are *E. camaldulensis*, *E. blakelyi, E. melliodora*, *E. viminalis* and *Angophora floribunda*. Thickets of *Callistemon sieberi* (River Bottlebrush) occasionally form a closed tall shrub layer. Associated shrubs are usually Callistemon and many Acacia species. The understorey is generally devoid of small trees or shrubs. Occasional shrubs were observed, including *Hymenanthera dentata* (Tree Violet) and the introduced *Rosa rubiginosa* (Briar Rose) and *Rubus fruticosus* (Blackberry). The ground cover is grassy with *Microlaena stipoides* (Weeping Meadow-grass) dominating and clumps *Carex appressa* and scattered *Rumex brownii* being the main additional species. Species from adjoining communities occur at the margins of this plant community.

This community was sampled at Quadrat 17 (**Appendix A**).

Table 3.5 Typical Floristics & Structure of River Oak Riparian Forest

Stratum	Main species	Height (metres)	Proj. foliage cover
Canopy	*Casuarina cunninghamiana*	10-20	50%
Small tree	Absent apart from juvenile canopy trees	4-7	1%
Shrub	Largely absent. *Rosa rubiginosa, Hymenanthera dentata, Rubus fruticosus*	0.3-1.2	<1%
Ground cover	*Microlaena stipoides, Carex appressa, Rumex brownii, Dichondra repens*	0-0.9	85%

Photograph 3.5 River Oak Riparian Forest on property 9W

Photograph 3.6 River Oak Riparian Forest on property 18

v. Red Stringybark-Scribbly Gum-Peppermint Open Forest

Matching BioBanking Vegetation Type: Apple Box – Broad-leaved Peppermint dry open forest of the South Eastern Highlands

- 1,281.3 ha on Property 9E
- 371.9 ha on Property 9W
- 375.6 ha on Property 17

This is an open forest that occurs on thin stony soils on slopes and ridgelines. Owing to the especially poor soil in an area of relatively low nutrient soils, these areas and others with high proportions of Scribbly Gum were left uncleared. The vegetation type is dominated by Scribbly Gum (*Eucalyptus rossii*), Broad-leaved Peppermint (*Eucalyptus dives*), Red Stringybark (*Eucalyptus macrorhyncha*), with the occasional Snappy Gum (*Eucalyptus racemosa* ssp *rossii)* and Red Box (*Eucalyptus polyanthemos*). In some areas, the dominance of Scribbly Gum is replaced by Red Box. It has a sparse shrub stratum containing natives such as *Acacia triptera*, *Melichrus urceolata*, *Dillwynia parvifolia*, *Styphelia triflora* and *Dodonaea* sp. The understorey is sparsely grassy with W*ahlenbergia gracilis, Joycea pallida*, *Austrostipa scabra, Goodenia hederacea* and *Lomandra* spp.

This community was sampled in Quadrats 4, 5, 8 and 11 (**Appendix A**).

Table 3.6 Typical Floristics & Structure of Stringybark-Scribbly Gum-Peppermint Open Forest

Stratum	Main species	Height (metres)	Proj. Foliage cover
Canopy	*Eucalyptus macrorhyncha, Eucalyptus racemosa ssp rossii, Eucalyptus dives, Eucalyptus polyanthmos*	8-12	10-25%
Small tree	Juvenile canopy spp.	4-7	1-5%
Shrub	*Acacia triptera, Dodonaea sp., Cassinia arcuata, Leucopogon muticus, Styphelia triflora, Dillwynia parvifolia, Acacia linearifolia.*	0.3-2	2-20%
Ground cover	*Joycea pallida, Austrostipa scabra, Goodenia hederacea, Lomandra filiformis ssp coriacea*	0-0.5	10-25%

Photograph 3.7 **Stringybark-Scribbly Gum-Peppermint Open Forest on Property 17**

Photograph 3.8 **Stringybark-Scribbly Gum-Peppermint Open Forest on Property 9W**

Photograph 3.9 **Stringybark-Scribbly Gum-Peppermint Open Forest on Property 9E**

vi. ***Red Stringbark-Red Box Woodland***

Matching BioBanking vegetation type: Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion

- 95.7 ha on Property 9W

This vegetation type tends to occur on more stony soils and often has a high proportion of its understorey dominated by shrubs. In a large proportion of the remnant woodland in the mostly cleared, eastern half of 9W, there is considerable overlap between this and the Box Gum Woodland plant community. Several pockets of this community could be considered to form part of the Box Gum Woodland C/EEC. *Eucalyptus macrorhyncha and Eucalyptus polyanthemos* (Red Box) are generally dominant. Small proportions of other canopy trees include: *Eucalyptus racemosa* ssp *rossii* (Inland Scribbly Gum), *Eucalyptus melliodora, Eucalyptus bridgesiana and occasional Eucalyptus dives* (Broad-leaved Peppermint). The small tree stratum is generally absent but where present contains juvenile canopy trees and species such as *Acacia implexa* (Hickory Wattle). Two localised individuals of *Callitris endlicheri* (Black Cypress Pine) were observed on ridges in what was likely to have been this community previously. It is not known how widespread this species was prior to clearing but it is assumed that it would have been far more common on the property. Shrubs are typically common, especially *Cassinia arcuata*, *Melichrus urceolata* (Urn Heath), *Dillwynia parvifolia* and *Lissanthe strigosa*. In some very rocky situations the shrub and ground cover strata are largely absent. The ground cover is generally sparse, containing species such as: *Wahlenbergia sp.*, *Poranthera microphylla*, *Joycea pallida* and *Aristida* spp.

This community was sampled in Quadrat 14 (**Appendix A**).

Table 3.7 Typical Floristics & Structure of Red Stringybark-Red Box Woodland

Stratum	Main species	Height (metres)	Proj. foliage cover
Canopy	*Eucalyptus macrorhyncha, Eucalyptus polyanthemos, Eucalyptus racemosa ssp rossii, Eucalyptus melliodora, Eucalyptus bridgesiana, Eucalyptus dives*	8-12	5-30%
Small tree	Largely absent. *Acacia implexa*, juvenile canopy spp.	4-7	5-10%
Shrub	*Olearia elliptica, Cassinia arcuata, Acacia decora, Cassinia ?aculeata*.	0.3-1.5	2-50%
Ground cover	*Wahlenbergia sp., Joycea pallida, Poranthera microphylla, Aristida vagans*	0-0.3	5-10%

Photograph 3.10 Red Stringybark-Red Box Woodland on Property 9W

vii. ***Scribbly Gum-Red Stringbark Woodland***

Matching BioBanking Vegetation Type: Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion

- 23.9 ha on Property 9W

Three localised concentrations of this community were recorded on the elevated ground. The largest and highest patch is in the north-eastern corner of the property and owing to its low nutrient, rocky soil has been left unaltered. *Eucalyptus racemosa* ssp *rossii* is the dominant canopy species in these patches. *Eucalyptus macrorhyncha* is generally less common but occurs throughout the stands. Other species occur in small numbers, including *Eucalyptus polyanthemos* and *Eucalyptus dives*. The small tree stratum is largely absent except for small proportions of regenerating canopy trees. The shrub stratum is generally sparse, containing *Hibbertia obtusifolia*, *Melichrus urceolata* and *Persoonia linearis* (Narrow-leaved Geebung). The ground cover is also typically sparse with *Joycea pallida*, Poa sp. and *Hibbertia obtusifolia*, being the most common.

This community was sampled in Quadrat 16 (**Appendix A**).

Table 3.8 Typical Floristics & Structure of Scribbly Gum-Red Stringybark Woodland

Stratum	Main species	Height (metres)	Proj. foliage cover
Canopy	*Eucalyptus racemosa ssp rossii, Eucalyptus macrorhyncha, Eucalyptus melliodora*	10-12	5-20%
Small tree	Juvenile canopy spp.	5-10	5-20%
Shrub	*Melichrus urceolatus, Persoonia linearis, Indigofera sp., Cassinia arcuata*	0.2-2	1-5%
Ground cover	*Joycea pallida, Poa sp., Stypandra glauca, Poranthera microphylla, Wahlenbergia sp., Veronica calycina*	0-0.5	2-10%

Photograph 3.11 Scribbly Gum-Red Stringybark Woodland on Property 9W

viii. ***Acacia / Kunzea Shrubs***

Closest BioBanking Vegetation Type: Heathy shrublands on rocky outcrops of the western slopes

- 13.1 ha on Property 18

This unit is mapped upslope of the low woodland and is dominated by *Acacia* and *Kunzea* regrowth. It contains few emergent trees and exists as small pockets surrounded by ironbark forest on the north-facing slopes. These areas may have once been a form of eucalypt forest (perhaps contiguous with the surrounding forest) but could have been historically cleared. The canopy in these patches is dominated by *Kunzea ambigua* and *Acacia linearifolia* with a few scattered *Eucalyptus dwyeri.* The lower shrub stratum generally comprises: *Calytrix tetragona*. The groundcover mainly consists of native herbs such as *Pomax umbellata* and *Cheilanthes sieberi*.

This plant community was sampled in Quadrat 21 (**Appendix A**).

Table 3.9 Typical Floristics & Structure of Acacia/Kunzea Shrubs

Stratum	Main species	Height (metres)	Proj. Foliage cover
Canopy	*Acacia sp.*, with scattered *Eucalyptus*	5-7	5-10%

Table 3.9 Typical Floristics & Structure of Acacia/Kunzea Shrubs

Stratum	Main species	Height (metres)	Proj. Foliage cover
	dealbata, *Eucalyptus dwyeri* and *Callitris endlicheri*		
Small tree	Absent		
Shrub	*Kunzea ambigua*, localised *Calytrix tetragona*, *Hibbertia monogyna*, *Brachyloma daphnoides*, *Melichrus urceolatus*, *Leucopogon muticus* and scattered juvenile eucalypts	0.3-2.5	20-75%
Ground cover	*Astroloma humifusum, Pomax umbellata, Gonocarpus tetragyna, Cheilanthes sieberi*, Wahlenbergia sp., *Aristida spp*.	0-0.3	2-10%

Photograph 3.12 Patches of Acacia / Kunzea Shrubs on Property 18

ix. ***Low Diversity Derived Native Grassland***

- 86.7 ha on Property 9E
- 343.9 ha on Property 9W
- 155.2 ha on Property 18

Low diversity native grassland, often with widely scattered paddock trees, was observed in areas of native pastures, dominated by a low diversity of native grasses and supported by very few and infrequent forb species. These grasslands do not appear to have undergone pasture improvement and are currently being grazed. The stocking rates and grazing regimes differ between the properties, which may account for the differences in frequency and diversity of pasture weeds present and diversity of native species present.

On 9W the grassland appears to have been largely unimproved however significant invasion by exotic species including grasses has occurred. The proportion of exotics in some locations is estimated to be over 60% of the total projective foliage cover. Other locations contain lower percentages, such as approximately 40%. Some species, such as *Vulpia* sp. and various Asteraceae, are annuals that form large populations in the property but are not visible for part of the year. These varying populations are able to affect the results of assessments of the condition of the grassland depending on the time of year the assessment is made. Owing to the large area of grassland and the limited time available for survey it was not possible to map native and exotic patches.

A generalised survey of the low diversity grasslands indicated that *Vulpia* sp., *Microlaena stipoides* (Weeping Meadow-grass), *Danthonia* spp., *Austrostipa scabra* and *Aristida vagans* are the main grassland species. Significant diversity was also recorded including indigenous and exotic dicots and monocots. Native species includ: *Cheilanthes sieberi*, *Desmodium varians*, *Scutellaria humilis*, *Geranium* spp., *Ajuga australis*, *Asperula conferta*, *Chrysocephalum apiculatum*, *Themeda australis* and *Viola betonicifolia*.

Shrubs are variable but common. In some locations dense regeneration is occurring. Typical species included: *Cassinia arcuata*, *Lissanthe strigosa*, *Swainsona* sp., *Acacia decora and Daviesia genistifolia*.

This plant community was sampled in Quadrats 12, 13, 15 & 27 (**Appendix A**).

Table 3.10 Typical Floristics & Structure of Low Diversity Derived Native Grassland

Stratum	Main species	Height (metres)	Proj. Foliage cover
Canopy	scattered *Eucalyptus macrorhyncha, Eucalyptus melliodora* and *Eucalyptus bridgesiana, Eucalyptus albens*	5-18	0-5%
Small tree	Generally absent		
Shrub	*Cassinia arcuata, Hibbertia obtusifolia*	0.3-1	0-5%
Ground cover	*Vulpia sp. Microlaena stipoides Danthonia spp., Austrostipa scabra, Cheilanthes sieberi*, Wahlenbergia sp., *Aristida spp., Hypochaeris glabra*	0-0.3	50-90%

Photograph 3.13 Low Diversity Derived Native Grassland on Property 9E

Photograph 3.14 Low Diversity Derived Native Grassland on Property 9W

Photograph 3.15 Low Diversity Derived Native Grassland on Property 18

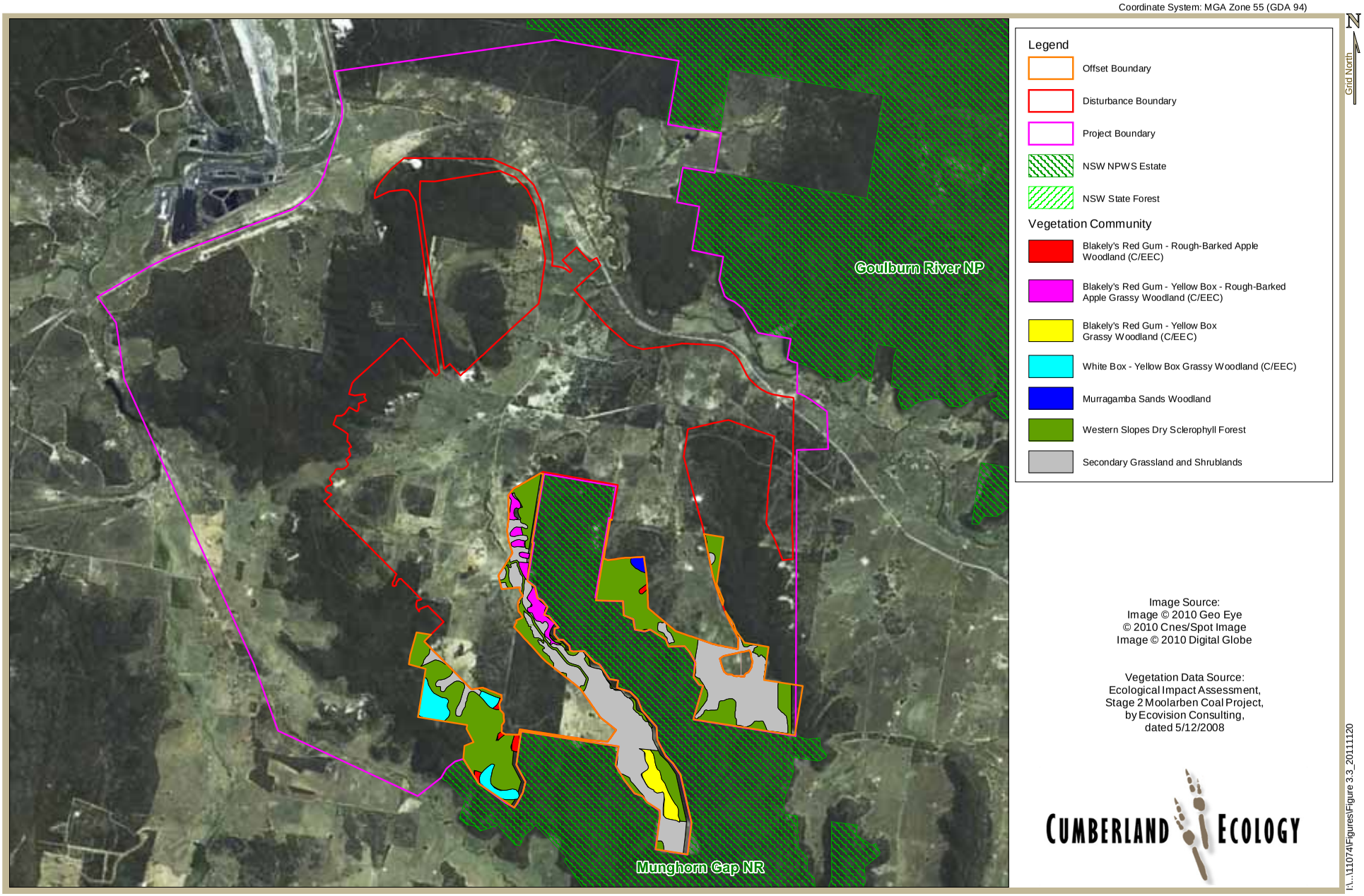

Figure 3.3 Vegetation Communities used as Offset within Project Boundary

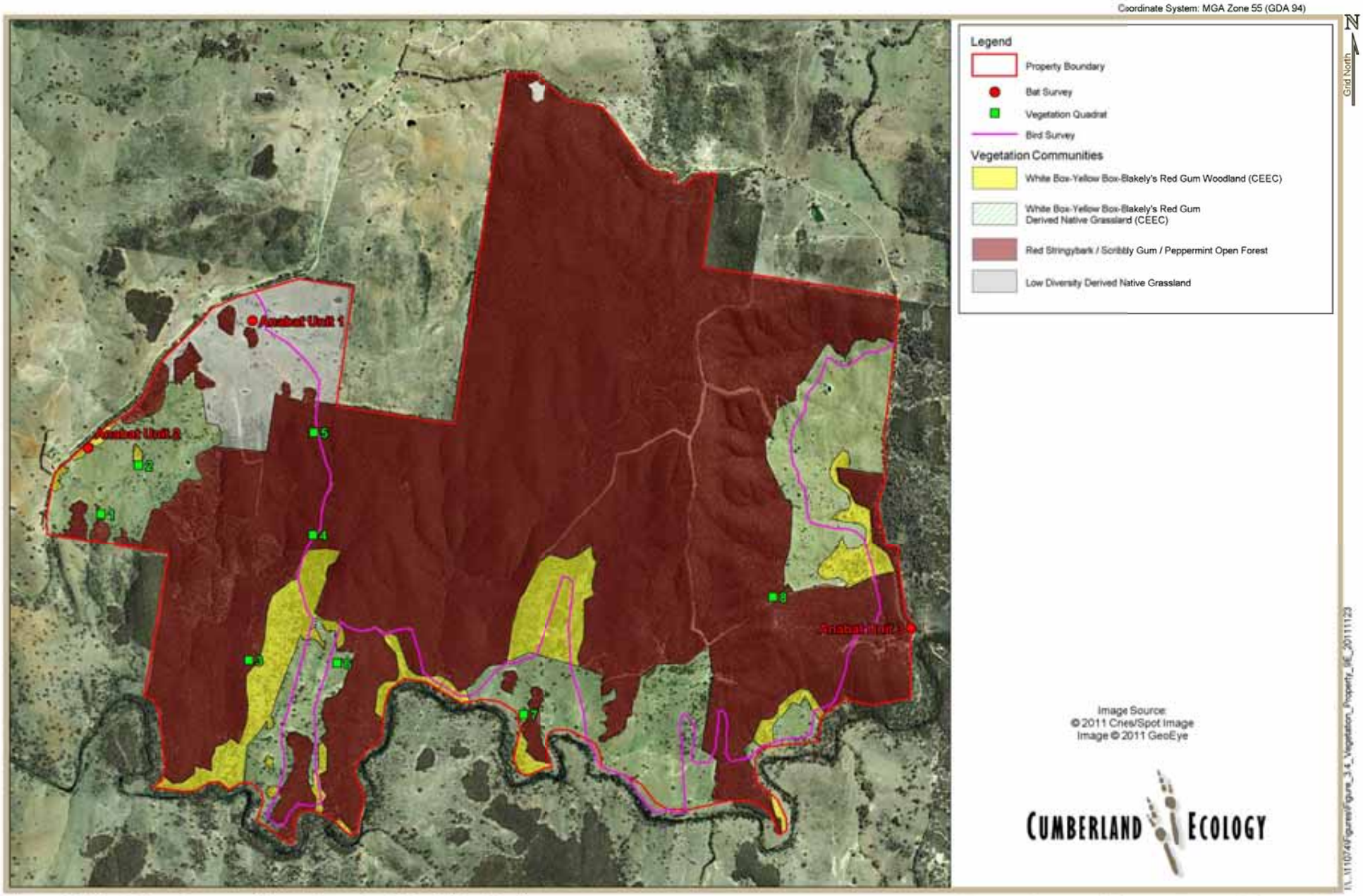

Figure 3.4 Vegetation Communities on Property 9 East "Dun Dun"

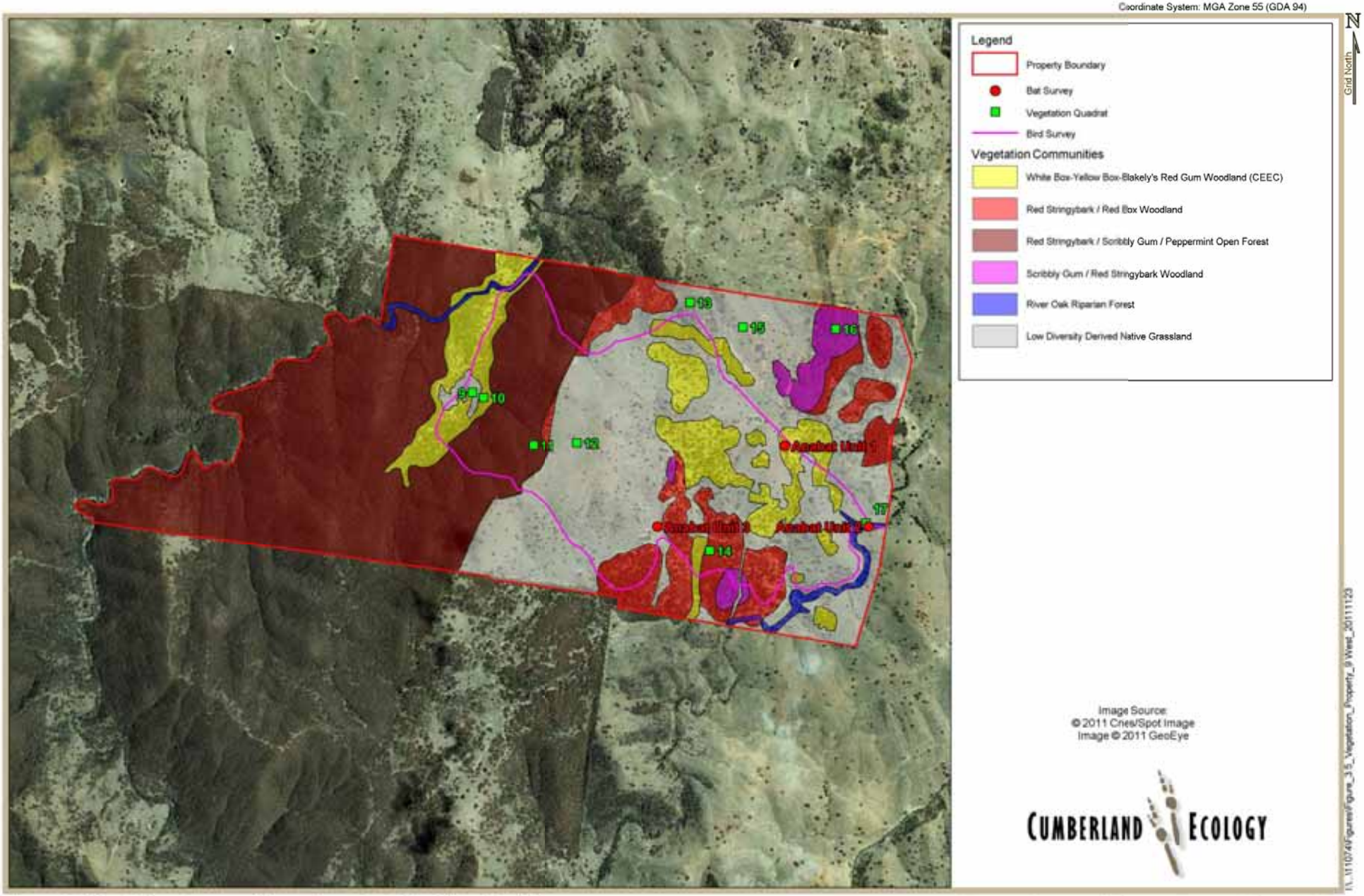

Figure 3.5 Vegetation Communities on Property 9 West "Dun Dun"

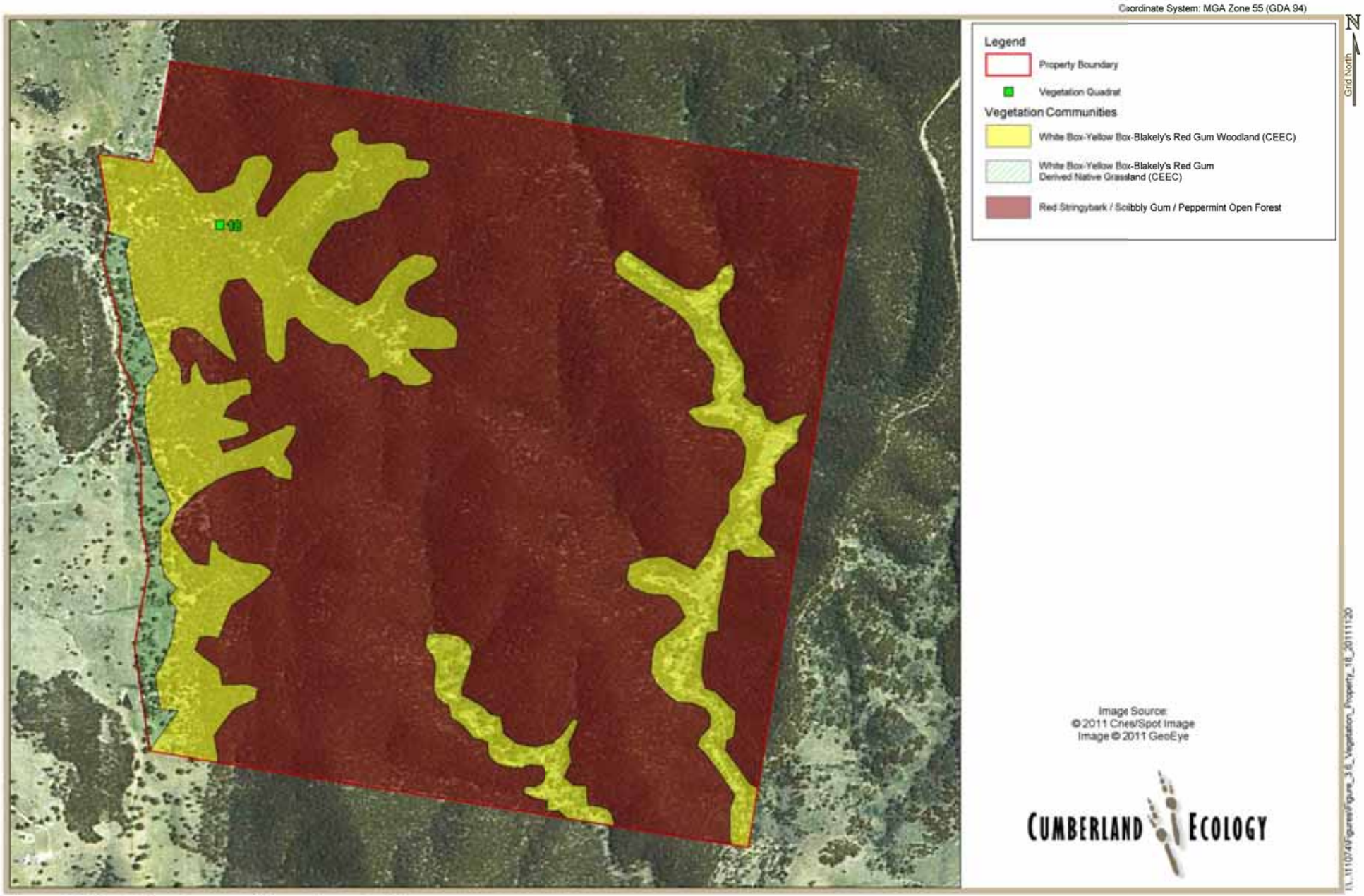

Figure 3.6 Vegetation Communities on Property 17

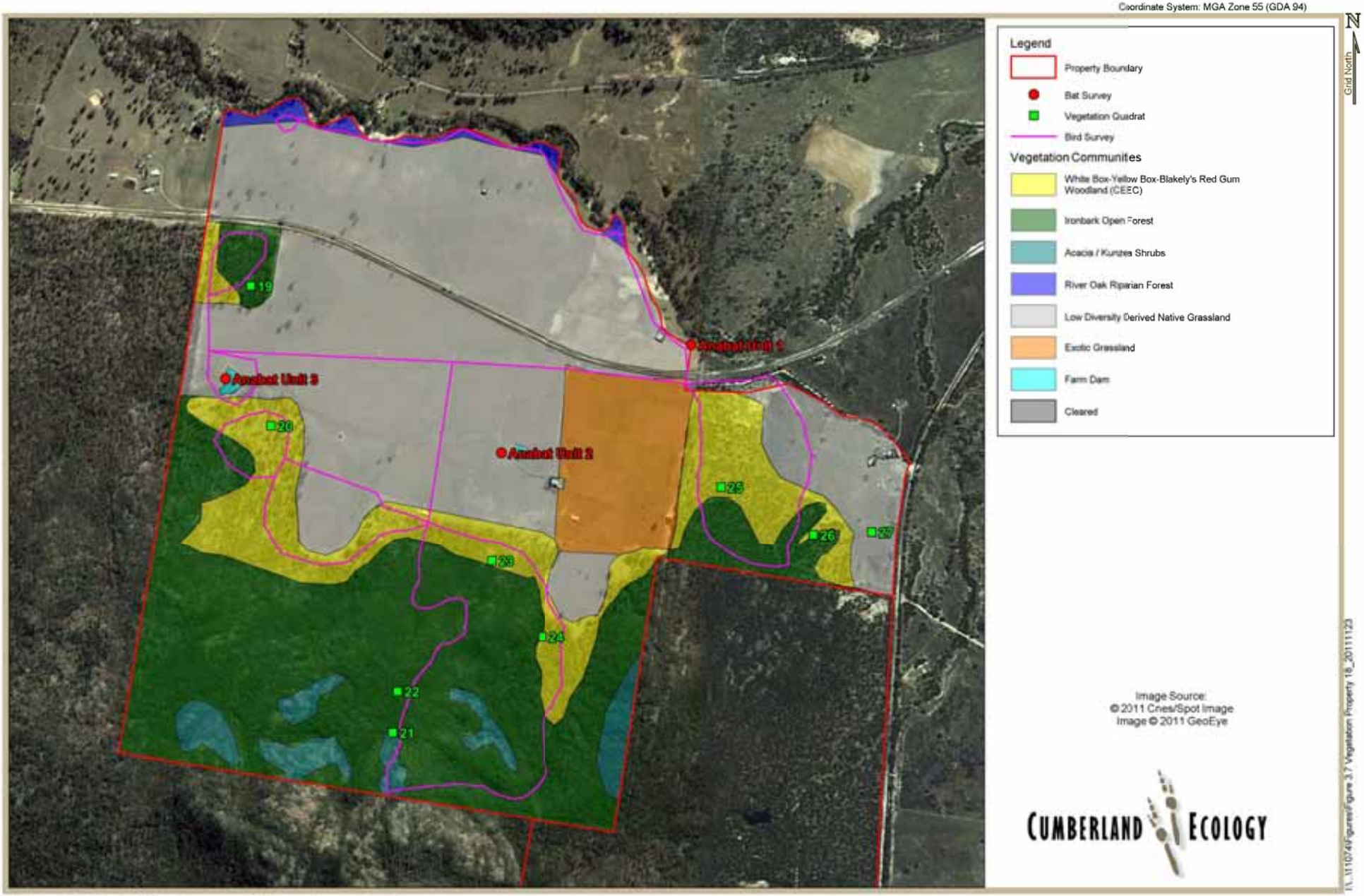

Figure 3.7 Vegetation Communities on Property 18

3.4 Current Condition of Vegetation within the Offset Properties

The offset properties exist in a pastoral landscape, which has a long history of agricultural use. A proportion of the properties are currently used for grazing cattle and sheep. Cleared areas of the properties occur largely in the low-lying sections of the country where the land is relatively more fertile and flat and is proximate to permanent water (i.e. dams and/or creek). Although details about stocking rates and grazing rotation are not known, the properties do not appear to be under any intense commercial grazing. The cleared grazing areas do not appear to have been pasture-improved and support a variable diversity of native species in the understorey. Localised areas of native pasture suffer from invasion and competition with pasture weeds such as thistle and blackberry but the weeds do not appear to be unmanageable. Degradation of creek and river banks due to stock trampling is common.

The forested areas of all properties have not been recently cleared and are largely intact. The forested areas persist in positions of higher relief that are generally less suited to agricultural activities such as cropping and stock grazing. As such, there is a reasonably good diversity of native species in the understorey. Natural recruitment into adjacent cleared grasslands seems to be promising with management, although more detailed assessment is required at a later date.

The vegetation quadrat data for each vegetation type is listed in the flora species list in **Appendix A**.

3.5 Habitat for Threatened Species

There are extensive areas of intact forest and remnant woodland. The native vegetation within the offset properties provides habitat for the threatened flora and fauna and migratory fauna that are predicted to be impacted by the Preferred Project, as indicated in **Table 3.3**. The offset area inside the Project boundary was not assessed in **Table 3.11** below, as it was surveyed as part of the Stage 2 Ecological Impact Assessment (Ecovision, 2008). There are extensive areas of intact forest and remnant woodland that provide good quality habitat for a wide variety of species. Only one species, the Brush-tailed Rock Wallaby (*Petrogale penicillata*), is unlikely to be supported by the habitat available on the offset properties. This is because this species requires very specialised habitat on sandstone escarpments, outcrops and cliffs that feature complex structures with fissures, caves and ledges. The closest recorded sighting of this species was in 1997, 3km south of property 9W. There are no known records for threatened species on any of the offset properties, most likely due to the fact that these are private properties and no surveys have been conducted and/or no survey data has been submitted.

The main types of habitat that are present on the offset properties are summarised as follows:

- Open Forest;

- Open Grassy Woodland;
- Grassland; and
- Riparian Vegetation.

These are discussed briefly in the following sections. There is some riparian forest, aquatic habitat and roosting/nesting sites for cave-dependent fauna and these are also discussed in the following sections.

3.5.1 Open Forest / Open Grassy Woodland

The offset properties feature over 2,100 ha of open forests and grassy woodland habitat, which are the most abundant habitat types and typical of the country on the Western Slopes. The forested ridgelines, slopes and shallow gullies grade into rolling hills that contain woodland, all of which support relatively mature, intact vegetation comprising mixed species of mature and juvenile trees, understorey shrubs and grasses and abundant fallen timber and debris.

Particular habitat variables that are present or are likely to be present in these areas include:

- Ground cover, leaf litter, fallen timber and rocky outcrops;
- Understorey vegetation;
- Tree hollows; and
- Blossom-producing and feed trees.

Thus the offset properties are likely to support the fauna that depend on these habitats, such as microchiropteran bats, small arboreal and ground-dwelling fauna and woodland birds such as the Speckled Warbler (*Pyrrholaemus saggitatus*), Diamond Firetail (*Stagonopleura guttata*) Grey-crowned Babbler (*Pomatostomus temporalis temporalis*), Hooded Robin (*Melanodryas cucullata*) and Brown Treecreeper (*Climacteris picumnus*).

The offset properties are also able to provide foraging habitat for the Regent Honeyeater (*Anthochaera phrygia*), Swift Parrot (*Lathamus discolor*), Spotted-tail Quoll (*Dasyurus maculatus maculatus*) and Large-eared Pied Bat (*Chailnolobus dwyeri*), which are all EPBC Act listed species.

The threatened flora species *Eucalyptus cannonii*, *Diuris tricolor*, *Pomaderris queenslandica* and *Swainsona recta* are also likely to occur in the open forest/woodland habitat.

3.5.2 Grassland Habitat

A total of 850 ha of open grassland areas are present in the offset properties. On all three properties, grasslands are directly adjacent to woodland or open forest, which allows native fauna to forage in the grassland and find shelter and refuge from predators in the adjacent tree canopy or shrubs. This makes the grassland habitat valuable for native birds such as

the Diamond Firetail (*Stagonopleura guttata*), White-fronted Chat (*Epthianura albifrons*) Hooded Robin (*Melanodryas cucullata*), Little Eagle (*Hieraaetus morphnoides*) and Spotted Harrier (*Circus assimilis*). Habitat values of such grassland areas will be improved by regeneration of tree and shrub cover with appropriate conservation management.

3.5.3 Riparian Habitat

The offset properties contain significant areas of riparian habitat which is highly valuable habitat for many native species and often provides wildlife corridors throughout the landscape. Property 9E contains over 6km of riparian vegetation along the permanent Pyramul Creek, property 9W over 5km along Willerang Creek and property 18 contains approximately 1.5km of riparian vegetation along Sportsmans Hollow Creek.

The creeks are likely to form a refuge for many species as they supplies permanent fresh water, which could be of particular merit if the climate changes and warms.

Several threatened species including large raptors such as the Barking Owl (*Ninox connivens*), Square-tailed Kite (*Lophoictina isura*) and Little Eagle (*Hieraaetus morphnoides*) are known to prefer to nest along permanent creek lines and these riparian corridors on the offset properties are likely to provide habitat for these species. The adjacent grasslands and open forests on both properties are likely to provide good foraging habitat for these species. Many species of microchiropteran bats are also likely to forage over and around the creeks, and to drink from them. This includes threatened bat species.

3.5.4 Aquatic Habitat

The farm dams and creek-lines on properties 9E, 9W and 18 are subject to seasonal flooding. Their fringing vegetation might provide foraging habitat and refuge for water birds and amphibians.

3.5.5 Shelter or Breeding Habitat for Cave-Dependant Fauna

Habitat assessments indicated that the offset properties do not support any significant areas of caves, which limits the available roosting or breeding habitat for cave-dependant species. However, buildings within the offset properties may provide suitable artificial roosting habitat for some microchiropteran bats, particularly the Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*) and the Large-eared Bat (*Chalinolobus dwyeri*). All three offset properties contain small caves and rock ledges which may provide potential denning habitat for the Spotted-tailed Quoll (*Dasyurus maculata*).

3.5.6 Summary of Habitat for Threatened Species

Based upon current data the proposed offset properties contain significant habitats for a broad range of threatened fauna. **Table 3.11** below shows the availability of habitat for each threatened species, as well as the number of NSW National Parks and Wildlife Atlas data records (OEH, 2011). These records are sightings since 1980 for each target species within a 20km radius of each offset property. The number of records within a 20km radius indicate how likely a threatened species is to occur on the offset property itself (i.e. if a species is

very common in the area surrounding the property, it is very likely to exist on the property as well, provided the habitat for that species exists). Species that have been found on the offset properties are shown in **bold**.

The offset properties contain 9 of the 11 bat species impacted by the Preferred Project, two of which are threatened species (*Chalinolobus dwyeri* and *Miniopterus orianae oceanensis*). Additionally the offset properties contain two bat species that have not been detected in the impact area.

The offset properties contain 100 of 170 bird species recorded on the impact site, which is nearly 60% and an additional five species that were not recorded on the impact site. Four of those species (Brown Treecreeper, Varied Sittella, Speckled Warbler and Scarlet Robin) recorded on the offsets are listed as vulnerable under the TSC Act and two (Rainbow Bee-eater and Satin Flycatcher) are listed as migratory species under the EPBC Act. Of the species not detected during the survey and listed as vulnerable under the TSC Act, another six bird species are likely and another nine species are possible to occur on the offset properties. An additional migratory species listed under the EPBC Act possibly occurs on the offset properties as well. A quarter of all threatened bird species detected on the impact site has been found on the offset properties, with significantly less survey effort. It is highly likely that additional species would be recorded with further surveys.

A full list of fauna species present on the offset and impact sites, including likelihood of occurrence within the offset properties, can be found in **Appendix B. Appendix C** contains the results of the Anabat surveys.

Table 3.11 Number of Recorded Threatened Species within a 20km radius of each Offset Property (NPWS Atlas Data as at Nov 2011)

				Property 9E		Property 9W		Property 17		Property 18	
Common Name	**Scientific Name**	**TSC**	**EPBC**	**#**	**H**	**#**	**H**	**#**	**H**	**#**	**H**
Amphibians											
Giant Barred Frog	*Mixophyes iteratus*	V			H		H		H	2	H
Birds											
Barking Owl	*Ninox connivens*	V			H	1	H	2	FH	2	H
Black-breasted Buzzard	*Hamirostra melanosternon*	V			H		H		H	1	H
Black-chinned Honeyeater (eastern subspecies)	*Melithrephtus gularis gularis*	V			H		H		H	31	H
Brown Treecreeper	***Climacteris picumnus***	**V**		**1**	**H**	**3**	**H**	**5**	**H**	**190**	**H**
Diamond Firetail	*Stagonopleura guttata*	V			H		H		H	66	H
Flame Robin	*Petroica phoenicea*	V			H		H		H	1	H
Gang-gang Cockatoo	*Callocephalon fimbriatum*	V			H		H		H	14	H
Gilbert's Whistler	*Pachycephala inornata*	V			H		H		H		H
Glossy Block-Cockatoo	*Calyptorhynchus lathami*	V			H		H	4	H	36	H
Grey-crowned Babbler (eastern subspecies)	*Pomatostomus temporalis temporalis*	V			H		H		H	25	H
Hooded Robin	*Melanodryas cucullata*	V			H		H	1	H	30	H
Little Eagle	*Hieraaetus morphnoides*	V			H		H	1	FH	15	H

Table 3.11 Number of Recorded Threatened Species within a 20km radius of each Offset Property (NPWS Atlas Data as at Nov 2011)

				Property 9E		Property 9W		Property 17		Property 18	
Common Name	**Scientific Name**	**TSC**	**EPBC**	**#**	**H**	**#**	**H**	**#**	**H**	**#**	**H**
Little Lorikeet*	*Glossopsitta pusilla*	V		1	H	3	H	1	H	19	H
Masked Owl	*Tyto novaehollandiae*	V			H	1	H		H	1	H
Painted Honeyeater	*Grantiella picta*	V			H		H		H	14	H
Powerful Owl	*Ninox strenua*	V			H		H	7	FH	18	H
Rainbow Bee-eater	***Merops ornatus***		**M**		**H**		**H**		**FH**		**FH**
Regent Honeyeater	*Anthochaera phrygia*	E	E, M	1	H	1	H	7	H	58	H
Satin Flycatcher	***Myiagra cyanoleuca***		**M**		**H**		**H**		**H**		**H**
Scarlet Robin	***Petroica boodang***	**V**			**H**		**H**	**8**	**H**	**7**	**H**
Speckled Warbler	***Pyrrholaemus sagittatus***	**V**			**H**	**1**	**H**	**1**	**H**	**199**	**H**
Spotted Harrier	*Circus assimilis*	V			H		H	3	H	3	H
Square-tailed Kite	*Lophoictina isura*	V			H		H		FH	7	H
Swift Parrot	*Lathamus discolor*	E	E, M		FH		FH		FH	3	FH
Turquoise Parrot	*Neophema pulchella*	V			H		H	1	H	22	H
Varied Sittella	***Daphoenositta chrysoptera***	**V**			**H**		**H**		**H**	**27**	**H**
White-fronted Chat	*Epthianura albifrons*	V			H		H		H	1	H
White-throated Needletail	*Hirundapus caudacutus*		M		FH		FH		FH		FH

Table 3.11 Number of Recorded Threatened Species within a 20km radius of each Offset Property (NPWS Atlas Data as at Nov 2011)

				Property 9E		Property 9W		Property 17		Property 18	
Common Name	**Scientific Name**	**TSC**	**EPBC**	**#**	**H**	**#**	**H**	**#**	**H**	**#**	**H**
Mammals											
Brush-tailed Rock-wallaby	*Petrogale penicillata*	E	V	1	N	1	N	1	N	2	N
Eastern Bentwing Bat	***Miniopterus schreibersii***	**V**		**2**	**FH**	**4**	**FH**	**2**	**FH**	**2**	**FH**
Greater Long-eared Bat	*Nyctophilus timoriensis (South-eastern form)*	V			H		H		H	4	H
Koala	*Phascolarctos cinereus*	V		9	H	29	H	30	H	4	H
Large-eared Bat	***Chalinolobus dwyeri***	**V**	**V**		**FH**	**1**	**FH**		**FH**	**3**	**FH**
Little Pied Bat	*Chalinolobus picatus*	V			H		H		H		H
Spotted-tailed Quoll	*Dasyurus maculata*	E	E		H		H	3	FH	2	H
Squirrel Glider	*Petaurus norfolcensis*	V			H		H		H	16	H
Yellow Sheath-tailed Bat	*Saccolaimus flaviventris*	V			H	1	H		H		H
Reptiles											
Little Whip Snake	*Suta flagellum*	V			H		H		H	1	H
Plants											
	Acacia ausfeldii	V			H		H	5	H	12	H

Table 3.11 Number of Recorded Threatened Species within a 20km radius of each Offset Property (NPWS Atlas Data as at Nov 2011)

				Property 9E		Property 9W		Property 17		Property 18	
Common Name	**Scientific Name**	**TSC**	**EPBC**	**#**	**H**	**#**	**H**	**#**	**H**	**#**	**H**
Pine Donkey Orchid	*Diuris tricolor*	V			H		H		H	1	H
Capertee Stringybark	*Eucalyptus cannonii*	V	V	2	H	2	H	5	H	3	H
-	*Ozothamnus tesselatus*	V	V		H		H		H		H
Scant Pomaderris	*Pomaderris queenslandica*	E			H		H	20	H		H
Silky Swainson-pea	*Swainsona sericea*	V			H		H		H	2	H

Key :

E = Endangered

V = Vulnerable

M = Migratory

H = Habitat present for this species (i.e. for foraging, nesting, breeding, roosting)

FH = Foraging habitat only

BH = Breeding habitat only

N = No habitat

Bold = Species found on Offset Properties

3.6 Summary of the Strategic Benefits of the Offset Properties

The proposed offset properties contain significant areas of forest and woodland habitat, and also habitat areas of grassland that can be regenerated to wooded habitats in the longer term. The proposed offset package currently affords habitat to a wide variety of threatened fauna, and more species will almost certainly be identified with further survey and greater access to wider areas of each property.

Land on all properties is feasible and well situated to permit long term conservation and several of the properties will complement nearby conservation areas or blocks of forest/woodland habitat.

The conservation of *Box Gum Woodland and Derived Native Grassland* is consistent with the principles and objectives within the Draft National Recovery Plan for Box Gum Woodland and Derived Native Grasslands (NSW DECCW 2010) (**Section 4.3**).

The conservation of the Swift Parrot is consistent with the principles and objectives of the Swift Parrot Recovery Plan (Swift Parrot Recovery Team 2001) (**Section 4.4**).

The conservation of the Regent Honeyeater is consistent with the principles and objectives of the Regent Honeyeater Recovery Plan (Menkhorst, Schedvin et al. 1999) (**Section 4.5**).

The conservation of the Greater Long-eared Bat is consistent with the principles and objectives of the Greater Long-eared Bat Recovery Plan (SEWPaC 2011c) (**Section 4.6**).

Land selected for inclusion in the biodiversity offset package has been selected based upon various criteria. In general terms, the offset properties were selected because:

- The offset properties contain at least nine of the 11 bat species impacted by the Preferred Project, two of which are threatened species (*Chalinolobus dwyeri* and *Miniopterus orianae oceanensis*). Additionally, the offset properties contain two bat species that have not been detected in the impact area (*Mormopterus ridei* and *Vespadelus darlingtoni*);

- The offset properties contain at least 60% of the bird species recorded on the impact site, including four threatened bird species under the TSC Act and two migratory species under the EPBC Act. This is likely to be an underestimate of the diversity of the offset properties considering the far greater survey effort for the impact area. Additionally the offset properties contain five bird species that have not been detected in the impact area;

- The offset properties contain at least 30% of the plant species recorded on the impact site; They contain appropriate vegetation communities in good condition, comparable to or in better condition than the vegetation proposed to be cleared for the Preferred Project;

- They contain extensive areas of high quality habitat for threatened fauna species thought to be impacted by the Preferred Project;
- Broad areas of the vegetation can be feasibly regenerated and improved to provide additional woodland and forest in the medium term;
- They will build onto existing conservation areas (Goulburn River National Park, Munghorn Gap Nature Reserve and Avisford Nature Reserve) and/or land that contains significant native vegetation;
- They include permanent streams, including the upper reaches of Pyramul Creek and Sportsmans Hollow Creek, that form high quality habitat for wildlife;
- They can be used to form new, or improve existing, habitat corridors; particularly:
    - East-West link between Cope State Forest and Goulburn River National Park by joining with similar quantities of lands that have been acquired by MCM and other mines (Figure 3.2);
    - Extension of the southern tip of Avisford Nature Reserve; and
    - Conservation and improvement of a large block of forested land that is large enough to provide substantial habitat for threatened species in its own right;
    - Conservation and improvement of existing riparian corridors along Pyramul Creek and Sportsmans Hollow Creek;
- The offset area within the Project Boundary acts as a buffer between the mine and Munghorn Gap Nature Reserve in the short term and creates a permanent link to the rehabilitated mining area in the long term;
- They are freehold land that is free of other mining tenements; and
- The offset lands will be protected by an appropriate mechanism such as a planning or conservation agreement, rezoning or transferral to National Parks estate, if acceptable for OEH.

The Biodiversity Offset Strategy has been devised to comply with the current principles for offsetting set out by DSEWPC (DEWR, 2007) and by OEH (DECC (NSW), 2008). This is discussed in detail in **Chapter 4**.

3.7 Properties within the Predicted Zone of Impact

An area of approximately 1,200 ha is predicted to be impacted from noise and/or dust by the MCM Stage 2. An estimated 230 ha of this area contains native vegetation, which may be included in the offset strategy. Combined with MCM Stage 1 offsets, Stage 1 zones of noise/dust impact and other mine's offsets, this forms a large corridor connecting Cope State Forest, Goulburn River National Park and Munghorn Gap Nature Reserve (**Figure 3.2**).

3.8 Rehabilitation and Offset Management Plan

The proposed offsets are to be conserved in perpetuity and conservation management will be guided by a ROMP that is to be prepared for the Preferred Project. The ROMP will include:

- Description of impacts and offset properties;
- Environmental gains:
  - Rehabilitation of mine areas after mining has ceased;
  - Management of land that contains and/or can be regenerated to provide *Box Gum Woodland and Derived Native Grassland*;
  - Regeneration and management of land that contains other non-EEC native vegetation;
  - Active management of weeds and feral animals to improve quality of vegetation and habitat;
  - Creation of corridors to improve connectivity between existing remnant areas; and
  - Management and improvement of land that includes habitat for all relevant threatened flora and fauna species that could be impacted by the Preferred Project;
- Detailed and measureable management actions;
- Adaptive management approach to implementation, monitoring and accountability of ROMP;
- Ensure that offset management objectives are compliant with existing recovery plans for C/EECs and threatened species (**Sections 4.3 to 4.6**); and
- Offset Protection Mechanisms such as change in land tenure, Voluntary Conservation Agreements, monitoring and reporting.

The ROMP will consider the Federal Offset Management Plan Guidelines (DEWR, 2007).

The implementation of the plan will be funded by the proponent for the life of the Preferred Project.

Chapter 4

Compliance With Offset Principles & Recovery Plans

4.1 OEH Offset Principles

The proposed offsets clearly can be established and comply with the basic principles of the OEH interim principles for offsetting (DECCW 2010). This is shown within the table below.

Table 4.1 Compliance with NSW OEH Interim Offset Principles

	DECC Biodiversity Offset Principles	Justification
1	Impacts must be avoided first by using prevention and mitigation measures.	Changes to the Stage 2 Preferred Project to minimise impact include: • Modification to Open Cut 4 (OC4) footprint to achieve avoidance of impacts to C/EEC; • Construction of one Northern Out-Of-Pit (OOP) in lieu of two southern OOP emplacement areas to reduce impact to C/EEC • Avoidance of 2.7 km of Murragamba Creek • Modification to the OC4 haul road to avoid C/EEC • Development of a ROM coal transfer conveyor to minimise noise and dust impacts Total reduction in impacts to C/EEC = 33.56 ha Total reduction in impacts to 16 Aboriginal heritage sites (4 additional low significance sites impacted) By including longwall methods, the area required for open cut mining methods is minimized therefore reducing environmental impacts.
2	All regulatory requirements must be met.	An environmental assessment including an ecological impact assessment was undertaken in accordance with regulatory requirements.

Table 4.1 Compliance with NSW OEH Interim Offset Principles

	DECC Biodiversity Offset Principles	Justification
3	Offsets must never reward ongoing poor performance.	MCM will implement best practice environmental management to progressively rehabilitate mined and non-mined degraded areas, including re-established and enhancing C/EECs and threatened species habitat.
4	Offsets will complement other government programs	The proposed offsets will increase the amount of native vegetation and habitat in the area by specifically: • Increasing the amount of C/EEC Box Gum Woodland and non C/EEC native vegetation; • Improving the connectivity between Goulburn River National Park, Munghorn Gap Nature Reserve and Cope State Forest by adding offsets to existing Stage 1 offsets and surrounding mine's offsets; • Creating a southern extension of Avisford Nature Reserve; • Increasing the amount of protected native vegetation in the area in the long-term This offset package also complements the objectives of the National Recovery Plan for White Box, Yellow Box Blakley's Red Gum Grassy Woodland and Derived Native Grassland (NSW DECCW, 2010).
5	Offsets must be underpinned by sound ecological principles.	Ecological impacts have been assessed and quantified in accordance with impact assessment guidelines (Ecovision, 2008), which form the basis for the proposed offset measures. Implementation of leading practice rehabilitation will re-establish ecological function, biodiversity and threatened species habitat in the long-term.
6	Offsets should aim to result in a net improvement in biodiversity over time.	The offset strategy will increase the amount of native vegetation and associated habitat to that presently existing in the area which will result in a net improvement in biodiversity values in the long-term. Rehabilitation and revegetation of mined and existing degraded non-mined areas will increase habitat connectivity between surrounding conservation reserves. At mine closure, greater than three times as much native vegetation and potential habitat to that adversely impacted will be re-established, protected and conserved.

Table 4.1 Compliance with NSW OEH Interim Offset Principles

	DECC Biodiversity Offset Principles	Justification
7	Offsets must be enduring and they must offset the impact of the development for the period that the impact occurs.	MCM will ensure offset areas are conserved and protected in the long-term either by dedication of offset areas to the National Estate, through Voluntary Conservation Agreements, land rezoning or other appropriate strategy.
8	Offsets should be agreed prior to the impact occurring.	MCM has committed to providing offsets prior to adverse impacts on C/EECs occurring. MCM anticipates that the Minister's approval for Stage 2 will require it to formalise the offset strategy prior to impacts on native vegetation and threatened species occurring.
9	Offsets must be quantifiable and the impacts and benefits must be reliably estimated.	Ecological impacts have been assessed and quantified in accordance with impact assessment guidelines (Ecovision, 2008). The type and quantity of vegetation cleared and rehabilitated (including revegetation and enhancement) will be reported annually. The success of threatened species habitat re-establishment and enhancement will be monitored and reported annually.

Table 4.1 Compliance with NSW OEH Interim Offset Principles

	DECC Biodiversity Offset Principles	Justification
10	Offsets must be targeted.	The offset strategy is targeted to achieve: • Improvement and long-term conservation of like-for-like C/EECs. • Improvement and long-term conservation of native vegetation types adversely impacted through rehabilitation and regeneration. • Improvement and long-term conservation of existing remnant native vegetation not impacted by the mine. • Improvement in habitat connectivity between the Munghorn Gap Nature Reserve, Cope State Forest and the Goulburn River National Park. In addition, the offset strategy aims to: • Reinstate and enhance habitat for local threatened species, such as: Bush Stone-curlew; Masked Owl; Regent Honeyeater; Painted Honeyeater; Black-chinned Honeyeater (eastern subspecies); Speckled Warbler; Swift Parrot; Glossy Black-cockatoo; Spotted-tailed Quoll and Squirrel Glider. • Reinstate and enhance habitat for declining woodland bird species, such as: Hooded Robin; Diamond Firetails; Brown Treecreeper; and Grey-crowned Babblers.
11	Offsets must be located appropriately.	The offset strategy focuses on reinstating, enhancing, conserving and protecting native vegetation, including C/EECs, and associated habitat values local to the area. This includes: • Enhancing and conserving remnant native vegetation and biodiversity values adjacent to existing conservation areas. • Conserving large patches of existing remnant native vegetation in surrounding areas to maintain long-term habitat connectivity and biodiversity values in the district. • Rehabilitating mined and degraded non-mined areas to increase and improve the overall extent of native vegetation, habitat connectivity and biodiversity values in the area in the long-term.

Table 4.1 Compliance with NSW OEH Interim Offset Principles

	DECC Biodiversity Offset Principles	Justification
12	Offsets must be supplementary.	The offset strategy includes a suite of comprehensive impact avoidance, remediation and rehabilitation measures that will result in increased and improved biodiversity values for the site in the long-term.
13	Offsets and their actions must be enforceable through development consent conditions, licence conditions, conservation agreements or a contract.	MCM anticipates that the Ministers approval for Stage 2 will include a condition that reinforces its commitment to implement the offset strategy.

4.2 Compliance with the Federal Draft Environmental Offset Policy

The proposed offsets clearly can be established and comply with the basic principles of the Commonwealth Draft Policy for offsets (DEWR, 2007). This is shown within the table below.

Table 4.2 Compliance with the Federal Draft Environmental Offset Policy

	Draft Environmental Offset Policy Principles	Justification
1	Environmental offsets should be targeted to the matter protected by the EPBC Act that is being impacted.	The Offset Strategy will target the woodland and forest communities, including C/EECs, that are to be impacted by the Preferred Project. These will include EPBC listed fauna species such as the Swift Parrot and the Regent Honeyeater.
2	A flexible approach should be taken to the design and use of environmental offsets to achieve long-term and certain conservation outcomes which are cost effective for proponents.	The Offset Strategy is long-term and cost effective because some of the properties are already owned by the proponent and can be subject to ongoing conservation management.
3	Environmental offsets should deliver a real conservation outcome.	The Offset Strategy will deliver a real outcome in that it will immediately conserve grassland, woodland and forest areas, including endangered ecological communities and habitats for threatened species. This outcome will improve with time as the woodland areas mature and habitats regrow as a result of active management.
4	Environmental offsets should be developed as a package of actions, which may include both direct and indirect offsets.	The Offset Strategy comprises a package of measures aimed at maintaining or improving grassland, woodland and open forest habitats on and around the Moolarben mining lease, and promoting connectivity of habitats.
5	As a minimum, environmental offsets should be commensurate with the magnitude of the impacts of the development and ideally deliver outcomes that are 'like for like'.	The Offset Strategy will deliver an increased area of woodland and open forest at a ratio of 3.9:1 for each hectare of woodland, grassland and forest that is to be cleared.
6	Environmental offsets should be located within the same general area as the development activity.	The offset areas are located in the same locality as the area of the proposed mining activity. Rehabilitation, which comprises part of the offset package, will take place on the site of the proposed mining activity in the long term.

Table 4.2 Compliance with the Federal Draft Environmental Offset Policy

	Draft Environmental Offset Policy Principles	Justification
7	Environmental offsets should be delivered in a timely manner and be long lasting.	It is the intention of MCM that the offset areas be protected and form long lasting biodiversity offsets.
8	Environmental offsets should be enforceable, monitored and audited.	The Offset Strategy will be enforceable via auditing conditions of consent. The performance of the Offset Strategy through time will be subject to monitoring.

4.3 Compliance with Recovery Plan for Box Gum Woodland

The proposed offsets clearly can be established and comply with the principles of the Recovery Objectives for Box Gum Woodland. This is shown within the table below.

Table 4.3 Analysis of ROMP Objectives Against Recovery Objectives for Box Gum Woodland

Recovery Objectives	Response
The overall objective of this recovery plan is to promote the recovery and prevent the extinction of the critically endangered ecological community, known as Box-Gum Grassy Woodland. *The specific objective to be achieved within the life-span of this recovery plan is to minimise the risk of extinction of the ecological community through:*	The ROMP aims to protect areas of existing Box Gum Grassy Woodland on the offset properties and to recover areas of Derived Native Grassland to woodland.
• *achieving no net loss in extent and condition of the ecological community throughout its geographic distribution;*	The ROMP will prescribe measures that will *protect and restore* Box Gum Grassy Woodland such that in the long term, there will be a ratio of 5:1 hectares of Box Gum Woodland conserved to every hectare of Box Gum Woodland that will be removed by the Project.
• *increasing protection of sites in good condition;*	The ROMP will prescribe measures for the protection of good quality Box Gum Woodland and diverse Derived Native Grassland within the offset properties.
• *increasing landscape functionality of the ecological community through*	The ROMP aims to restore areas of Derived Native Grassland to woodland. One of the ROMP

Table 4.3 Analysis of ROMP Objectives Against Recovery Objectives for Box Gum Woodland

Recovery Objectives	Response
management and restoration of degraded sites;	objectives is also to rest and recover areas of low diversity native grasslands to return them to diverse Derived Native Grassland and subsequently restored to woodland.
• *increasing transitional areas around remnants and linkages between remnants; and*	The ROMP aims to establish vegetated corridors and increase existing patch sizes to improve the landscape connectivity.
• *bringing about enduring changes in participating land manager attitudes and behaviours towards environmental protection and sustainable land management practices to increase extent, integrity and function of Box-Gum Grassy Woodland.*	The ROMP will involve land managers in the management of the offset properties to allow adaptive management to ensure proposed environmental outcomes and sustainable land management.
This objective will be achieved across the geographic distribution of Box-Gum Grassy Woodland and within five years of the adoption of this recovery plan.	Not applicable to this analysis.

Recovery objectives from NSW DECCW (2010).

4.4 Compliance with Recovery Plan for Swift Parrot

The proposed offsets clearly can be established and comply with the principles of the Recovery Objectives for Swift Parrot. This is shown within the table below.

Table 4.4 Analysis of ROMP Objectives Against Recovery Objectives for Swift Parrot

Recovery Objectives	Response
To change the conservation status of the swift parrot from endangered to vulnerable within 10 years.	Not applicable as the recovery plan was initiated in 2001. However, the ROMP will generally be consistent with the intent of this objective, which is to provide lasting protection for the species to reduce its risk of extinction.
To achieve a demonstrable sustained improvement in the quality of swift parrot habitat to increase carrying capacity.	The ROMP will aim to increase and improve the existing area of habitat for Swift Parrot in the offset properties. The ROMP will prescribe regular

Table 4.4 Analysis of ROMP Objectives Against Recovery Objectives for Swift Parrot

Recovery Objectives	Response
	monitoring to assess and quantify the improvement in Swift Parrot habitat.

Recovery objectives from Swift Parrot Recovery Team (2001).

4.5 Compliance with Recovery Plan for Regent Honeyeater

The proposed offsets clearly can be established and comply with the principles of the Recovery Objectives for Regent Honeyeater. This is shown within the table below.

Table 4.5 Analysis of ROMP Objectives Against Recovery Objectives for Regent Honeyeater

Recovery Objectives	Response
1. To ensure that the species persists in the wild.	The ROMP will aim to assist the conservation of the species in the wild by protecting and improving habitat for the species in a well documented part of its range.
2. To achieve a down-listing from nationally endangered to vulnerable by stabilising the population decline and securing habitat extent and quality in the main areas of occupancy.	The ROMP will aim to assist the conservation of the species in the wild by protecting and improving habitat for the species in a well documented part of its range.
3. Achieve increasing reporting rates (5% per annum) in areas previously used regularly, eg Munghorn Gap (NSW), Bendigo, north-east Melbourne and the Eildon area (VIC).	Not applicable.

Recovery objectives from Menkhorst et al. (1999)

4.6 Compliance with Recovery Plan for Greater Long-eared Bat

The proposed offsets clearly can be established and comply with the principles of the Recovery Objectives for the Greater Long-eared Bat. This is shown within the table below.

Recovery objectives	Response
Increase understanding of the basic ecology of the species to determine:	The species will be monitored in the offset properties and this will provide additional

Recovery objectives	Response
• *habitat requirements;* • *roost and maternity site selection; and* • *threatening processes.*	information about habitat utilisation, including potential roosting or breeding. Revegetation of the offset properties will provide information about how the species recovers from historic habitat clearance, which is a key threatening process.
Clarify the current distribution and abundance of the species.	Monitoring will provide further information about the distribution of the species in the locality.

Recovery objectives from SEWPaC (2011c)

Chapter 5

Conclusions

5.1 Ecological Merits of Offset Strategy

The Biodiversity Offset Strategy will result in a net gain in forest and woodland vegetation by adding over 2,100 ha of existing forest and woodland to conservation tenure and by regenerating 850 ha of grassland to forest and woodland. It provides an opportunity to regenerate degraded vegetation, improve the resilience and quality of existing native vegetation and provide permanent conservation for threatened species and ecological communities. Such conservation outcomes will be available from the outset of the Preferred Project and will improve with time and with active conservation management.

The field surveys to date have clearly verified that the proposed offsets support many of the threatened species predicted to be impacted by the project. It is also clear that many more species are likely to be found with additional survey effort.

The protection and regeneration of these areas will ensure that the Biodiversity Offset Strategy exceeds the 3:1 target offset ratio for native vegetation (at 3.9:1) and the 5:1 offset requirement for C/EECs. Accordingly, it is considered that this Biodiversity Offset Strategy meets the DP&I's requirements for offsetting development impacts.

The Biodiversity Offset Strategy's key features are:

- Offsets consisting of three strategically located properties, two link to other areas of forest and woodland, the other links to riparian corridors and is large enough to form a conservation offset in its own right;
- All three offset properties are freehold land outside of coal mining tenements;
- They contain appropriate vegetation communities in good condition, comparable to or in better condition than the vegetation proposed to be cleared for the Preferred Project;
- They contain habitat for threatened species that are predicted to be impacted by the Preferred Project – the quality of such habitat will be improved by management such as livestock removal;

- They contain a large diversity of good quality micro-habitats (such as creeks, dams, gullies and ridges), which provide potential habitat for threatened fauna species;
- One of the properties, "Dun Dun", is large enough to be a conservation reserve in its own right. It could be used as a nucleus for future offsets for other projects; and
- Potential to increase environmental value by appropriate management on all three properties.
- The offset properties contain at least nine of the 16 bat species potentially impacted by the development, two of which are threatened species (*Chalinolobus dwyeri* and *Miniopterus orianae oceanensis*). Additionally the offset properties contain two bat species (*Mormopterus ridei* and *Vespadelus darlingtoni*) that have not been detected in the impact area; and
- The offset properties contain at least 100 of 170 bird species recorded on the impact site (nearly 60%), including five threatened bird species. This is likely to be an underestimate of the diversity of the offset properties considering the far greater survey effort for the impact area. Additionally the offset properties contain five bird species that have not been detected in the impact area.
- The offset properties contain a total of 267 flora species. Of the 440 flora species recorded on the impact site, 136 were also found on the offset properties, which is 31%.

The proposed offset package will add substantially to flora and fauna habitats within the region and, when combined with the proposed rehabilitation of forest and woodland on the mine site of 1,545 hectares progressively over the 24 year mine life, will create a significant increase in habitats for threatened species.

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Appendix A

Flora Species List

Table A.1 Flora Species List (Presence and Cover Abundance) on Impact Area and Offset Properties

					Impact	Property 9E								Property 9W									17	Property 18								
Family	Scientific Name	Common Name	TSC	EPBC	EIA *	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Acanthaceae	*Brunoniella pumilio*	Dwarf Blue Trumpet			P																											
Adiantaceae	*Cheilanthes austrotenuifolia*	Rock Fern					P			P																						
Adiantaceae	*Cheilanthes distans*	Bristly Cloak Fern			P																											
Adiantaceae	*Cheilanthes sieberi*																P	P		P			P									P
Adiantaceae	*Cheilanthes sieberi subsp. sieberi*	Poison Rock Fern			P	P		P	P			P	P		P										P	P	P	P	P	P	P	
Adiantaceae	*Pellaea falcata*	Sickle Fern			P																											
Amaranthaceae	*Alternanthera denticulata*	Lesser Joyweed			P																											
Amaranthaceae	*Alternanthera pungens*				P																											
Amaranthaceae	*Alternanthera sp. A*				P																											
Anthericaceae	*Caesia parviflora*				P																											
Anthericaceae	*Dichopogon fimbriatus*	Nodding Chocolate Lily			P										P																P	
Anthericaceae	*Laxmannia gracilis*	Slender Wire Lily			P																									P		
Anthericaceae	*Thysanotus juncifolius*				P																											
Anthericaceae	*Thysanotus patersonii*				P																											
Anthericaceae	*Thysanotus tuberosus*	Fringed Lily			P																											
Anthericaceae	*Tricoryne elatior*	Yellow Rush Lily			P																											
Apiaceae	*Actinotus helianthi*	Flannel Flower			P																											
Apiaceae	*Apium prostratum var.*	Sea Celery			P																											
Apiaceae	*Centella asiatica*	Swamp Pennywort			P																											
Apiaceae	*Ciclospermum leptophyllum*	Slender Celery			P																											
Apiaceae	*Daucus glochidiatus*	Native Carrot			P																											
Apiaceae	*Eryngium rostratum*				P																											
Apiaceae	*Hydrocotyle laxiflora*	Stinking Pennywort			P			P			P		P	P	P		P	P		P		P							P			
Apiaceae	*Hydrocotyle tripartita*	Pennywort																					P									
Apiaceae	*Hydrocotyle sp.*											P													P							
Apiaceae	*Platysace ericoides*	Heathy Platysace			P																											
Apiaceae	*Xanthosia sp.*																						P									
Asphodelaceae	*Bulbine bulbosa*	Native Leek			P																											
Aspleniaceae	*Asplenium flabellifolium*	Necklace Fern			P																											
Aspleniaceae	*Pleurosorus rutifolius*	Bristly Cloak Fern			P																											
Asteraceae	*Arctotheca calendula*	Capeweed			P																											
Asteraceae	*Bidens sp.*																								P				P		P	

Table A.1 Flora Species List (Presence and Cover Abundance) on Impact Area and Offset Properties

					Impact	Property 9E								Property 9W									17	Property 18								
Family	Scientific Name	Common Name	TSC	EPBC	EIA *	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Asteraceae	*Brachyscome multifida*	Cut-leaved Daisy			P																											
Asteraceae	*Bracteantha viscosa*	Sticky Everlasting			P																											
Asteraceae	*Calocephalus citreus*	Lemon Beauty-heads			P																											
Asteraceae	*Calotis cuneifolia*	Purple Burr Daisy			P																											
Asteraceae	*Calotis lappulacea*	Yellow Burr Daisy			P																							P		P		
Asteraceae	*Calotis sp.*																							P	P						P	
Asteraceae	*Carthamus lanatus*	Saffron Thistle			P		P										P															
Asteraceae	*Cassinia aculeata*	Dolly Bush			P																											
Asteraceae	*Cassinia arcuata*	Sifton Bush			P									P			P	P	P	P												
Asteraceae	*Cassinia cunninghamii*	Cunninghams Everlasting			P																											
Asteraceae	*Cassinia quinquefaria*				P		P																P	P	P	P			P	P	P	
Asteraceae	*Cassinia sp.*					P		P				P																				
Asteraceae	*Chondrilla juncea*	Skeleton Weed												P																		
Asteraceae	*Chrysocephalum apiculatum*	Common Everlasting			P																				P					P	P	
Asteraceae	*Cirsium vulgare*	Spear Thistle			P		P				P			P	P		P			P		P			P							
Asteraceae	*Conyza albida*	Fleabane			P																				P					P	P	
Asteraceae	*Conyza bonariensis*	Flax-leaf Fleabane			P																											P
Asteraceae	*Cotula australis*	Common Cotula			P																											
Asteraceae	*Cotula coronopifolia*	Waterbuttons			P																											
Asteraceae	*Cymbonotus lawsonianus*	Bears-ear			P	P		P			P	P		P	P					P												
Asteraceae	*Euchiton gymnocephalus*				P																											
Asteraceae	*Euchiton involucratus*	Star Cudweed			P																											
Asteraceae	*Euchiton sphaericus*	Cudweed			P	P	P				P			P	P	P	P			P			P									
Asteraceae	*Gamochaeta americana*	Cudweed			P																											
Asteraceae	*Glossogyne tannensis*	Cobbler's Tack			P																											
Asteraceae	*Gnaphalium americum*	A Cudweed																														P
Asteraceae	*Gnaphalium sp. A*																								P				P	P	P	
Asteraceae	*Hedypnois glabra*				P																											
Asteraceae	*Hypochaeris glabra*	Smooth Catsear			P															P												P
Asteraceae	*Hypochaeris radicata*	Flatweed			P	P						P	P		P						P	P							P	P		P
Asteraceae	*Lactuca serriola*	Prickly Lettuce			P																											
Asteraceae	*Microseris lanceolata*	Murnong			P																											
Asteraceae	*Minuria leptophylla*				P																											

Table A.1 Flora Species List (Presence and Cover Abundance) on Impact Area and Offset Properties

					Impact	Property 9E								Property 9W									17	Property 18								
Family	Scientific Name	Common Name	TSC	EPBC	EIA *	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Asteraceae	*Olearia elliptica*													P				P														
Asteraceae	*Olearia microphylla*				P																											
Asteraceae	*Olearia viscidula*	Wallaby Weed																					P									
Asteraceae	*Ozothamnus diosmifolius*	Ball Everlasting			P																											
Asteraceae	*Podolepis jaceoides*	Showy Copper-wire Daisy			P																											
Asteraceae	*Podolepis neglecta*				P																											
Asteraceae	*Podolepis sp.*																								P							
Asteraceae	*Senecio diaschides*	Wolly Ragwort			P																											
Asteraceae	*Senecio hispidulus*	Grey Groundsel			P																											
Asteraceae	*Senecio lautus*								P																				P			
Asteraceae	*Senecio prenanthoides*	Cape Ivy			P																											
Asteraceae	*Senecio quadridentatus*	Cotton Fireweed			P											P																
Asteraceae	*Senecio sp.*																P															
Asteraceae	*Sigesbeckia orientalis subsp. orientalis*	Indian Weed			P																											
Asteraceae	*Solenogyne bellioides*				P										P																	
Asteraceae	*Solenogyne dominii*				P																											
Asteraceae	*Solenogyne sp.A*																											P	P			
Asteraceae	*Solenogyne sp. B*													P								P										
Asteraceae	*Sonchus oleraceus*	Common Sow-thistle			P							P			P							P										
Asteraceae	*Taraxacum officinale*	Dandelion			P																	P										
Asteraceae	*Tolpis umbellata*				P																											
Asteraceae	*Triptilodiscus pygmaeus*				P																											
Asteraceae	*Vitladinia sp.*				P			P							P																	
Asteraceae	*Vittadinia cuneata*				P																							P				
Asteraceae	*Vittadinia dissecta*				P																											
Asteraceae	*Vittadinia muelleri*				P																											
Asteraceae	*Vittadinia pustulata*				P																											
Asteraceae	*Vittadinia sulcata*				P																											
Asteraceae	*Vittadinia sp.*																								P							
Asteraceae	*Xerochrysum sp.*							P				P	P																		P	
Blechnaceae	*Doodia aspera*	Rasp Fern			P																											
Boraginaceae	*Cynoglossum australe*				P									P									P									

Table A.1 Flora Species List (Presence and Cover Abundance) on Impact Area and Offset Properties

					Impact	Property 9E								Property 9W									17	Property 18								
Family	Scientific Name	Common Name	TSC	EPBC	EIA *	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Boraginaceae	*Echium plantagineum*	Patterson's Curse			P																											
Brassicaceae	*Lepidium africanum*				P																											
Brassicaceae	*Lepidium bonariense*				P																											
Brassicaceae	*Lepidium sp.*																							P								
Brassicaceae	*Sisymbrium erysimoides*				P																											P
Brassicaceae	*Sisymbrium irio*				P																											
Cactaceae	*Opuntia stricta*	Prickly Pear			P																				P							
Campanulaceae	*Wahlenbergia communis*	Tufted Bluebell			P								P															P	P	P	P	
Campanulaceae	*Wahlenbergia gracilis*	Australian Bluebell			P				P	P		P	P		P																	
Campanulaceae	*Wahlenbergia luteola*	Bluebell			P																											
Campanulaceae	*Wahlenbergia sp. A*				P			P			P																					
Campanulaceae	*Wahlenbergia sp. B*	a Bluebell															P			P												
Campanulaceae	*Wahlenbergia stricta*				P											P	P	P	P	P	P		P									P
Caryophyllaceae	*Cerastium glomeratum*	Mouse-ear Chickweed			P												P															
Caryophyllaceae	*Paronychia brasiliana*	Brazilian Witlow												P			P			P		P										
Caryophyllaceae	*Petrorhagia nanteuilii*	Proliferous Pink			P												P			P												P
Caryophyllaceae	*Polycarpon tetraphyllum*	Four-leaved Allseed																											P			
Caryophyllaceae	*Silene gallica*	French Catchfly			P												P															P
Caryophyllaceae	*Spergularia marina*				P																											
Caryophyllaceae	*Stellaria media*	Common Chickweed																				P										
Caryophyllaceae	*Stellaria pungens*				P				P																							
Caryophyllaceae	*Stellaria sp. D*				P																											
Casuarinaceae	*Casuarina cunninghamiana*	River Oak																				P										
Casuarinaceae	*Allocasuarina gymnanthera*				P																											
Casuarinaceae	*Allocasuarina luehmannii*	bulloak			P																											
Casuarinaceae	*Allocasuarina verticillata*	Drooping She-oak			P																						P					
Chenopodiaceae	*Chenopodium sp.*					P	P																									
Chenopodiaceae	*Einadia hastata*	Berry Saltbush / Saloop																						P								
Chenopodiaceae	*Einadia nutans*	Climbing Saltbush			P																											
Chenopodiaceae	*Einadia nutans subsp. nutans*	Climbing Saltbush																				P										
Chenopodiaceae	*Einadia polygonoides*				P																											
Chenopodiaceae	*Einadia trigonos*	Fishweed			P							P																				
Chenopodiaceae	*Einadia sp.*																							P								

Table A.1 Flora Species List (Presence and Cover Abundance) on Impact Area and Offset Properties

					Impact	Property 9E								Property 9W									17	Property 18								
Family	Scientific Name	Common Name	TSC	EPBC	EIA *	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Chenopodiaceae	*Enchylaena tomentosa*	Ruby Saltbush			P																											
Clusiaceae	*Hypericum gramineum*	Small St Johns Wort			P	P	P					P	P	P	P		P			P			P							P	P	
Clusiaceae	*Hypericum perforatum*	St Johns Wort			P																	P										
Clusiaceae	*Hypericum sp.*										P																					
Colchicaceae	*Wurmbea biglandulosa*				P																											
Convolvulaceae	*Convolvulus erubescens*	Blushing Bindweed			P										P																	
Convolvulaceae	*Dichondra repens*	Kidney Weed			P			P				P		P								P					P	P	P			
Convolvulaceae	*Dichondra sp. A sensu Harden*																					P										
Crassulaceae	*Crassula sieberiana*	Australian Stonecrop			P																											
Cupressaceae	*Callitris endlicheri*	Black Cypress Pine			P																											
Cupressaceae	*Callitris glaucophylla*	White Cypress Pine																							P							
Cyperaceae	*Bolboschoenus sp.*																													P	P	
Cyperaceae	*Carex appressa*	Tall Sedge			P									P			P					P										
Cyperaceae	*Carex inversa*	Knob Sedge			P												P					P								P	P	
Cyperaceae	*Cyperus fulvus*	Sticky Sedge			P																											
Cyperaceae	*Cyperus gracilis*				P																											
Cyperaceae	*Cyperus lucidus*	Leafy Flat Sedge			P																											
Cyperaceae	*Cyperus sanguinolentus*				P																											
Cyperaceae	*Eleocharis gracilis*				P																											
Cyperaceae	*Fimbristylis dichotoma*	Common Fringe-rush			P																											P
Cyperaceae	*Gahnia aspera*	Saw Sedge			P																											
Cyperaceae	*Isolepis inundata*	Swamp Club-rush			P																											
Cyperaceae	*Lepidosperma laterale*	Variable Sword-sedge			P													P														
Cyperaceae	*Schoenus apogon*	Fluke Bog-rush			P												P		P	P												
Cyperaceae	*Schoenus ericetorum*				P																											
Cyperaceae	*Schoenus moorei*				P																											
Cyperaceae	*Scleria polycarpa*						P																									
Dennstaedtiacea	*Pteridium esculentum*	Bracken			P																											
Dilleniaceae	*Hibbertia acicularis*	Prickly Guinea Flower			P																											
Dilleniaceae	*Hibbertia circumdans*				P																											
Dilleniaceae	*Hibbertia linearis*				P																											
Dilleniaceae	*Hibbertia obtusifolia*	Grey Guinea Flower			P				P	P						P		P	P	P	P				P			P				
Dilleniaceae	*Hibbertia riparia*				P																						P					

Table A.1 Flora Species List (Presence and Cover Abundance) on Impact Area and Offset Properties

					Impact	Property 9E								Property 9W									17	Property 18									
Family	Scientific Name	Common Name	TSC	EPBC	EIA *	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Dilleniaceae	*Hibbertia sp.*							P				P	P										P									
Droseraceae	*Drosera auriculata*	Sundew			P																											
Droseraceae	*Drosera burmanni*				P																											
Ericaceae	*Acrotriche rigida*				P																											
Ericaceae	*Acrotriche serrulata*	Honeypots																							P	P			P	P	P	
Ericaceae	*Astroloma humifusum*	Cranberry Heath			P																											
Ericaceae	*Brachyloma daphnoides*				P																								P			
Ericaceae	*Leucopogon biflorus*				P																											
Ericaceae	*Leucopogon microphyllus*	Small-leaved Whitebeard			P																											
Ericaceae	*Leucopogon muticus*				P																											
Ericaceae	*Leucopogon setiger*				P																											
Ericaceae	*Leucopogon virgatus*				P																											
Ericaceae	*Lissanthe strigosa*	Peach Heath			P		P	P					P	P			P	P													P	
Ericaceae	*Lissanthe strigosa subsp. Subulata*																						P									
Ericaceae	*Melichrus erubescens*	Ruby Urn Heath			P																											
Ericaceae	*Melichrus urceolatus*	Urn-heath			P				P	P						P		P	P		p											
Ericaceae	*Melichrus sp.*																						P									
Ericaceae	*Monotoca scoparia*	Prickly Broom-heath			P																											
Ericaceae	*Styphelia sp.*							P																								
Ericaceae	*Styphelia triflora*				P											P							P									
Eriocaulaceae	*Eriocaulon scariosum*				P																											
Euphorbiaceae	*Chamaesyce drummondii*	Caustic Weed			P							P								P												
Euphorbiaceae	*Euphorbia peplus*	Petty Spurge																				P										
Fabaceae	*Acacia acinacea*	Gold-dust Wattle			P																											
Fabaceae	*Acacia brownii*				P																											
Fabaceae	*Acacia buxifolia*	Box-leaf Wattle														P		P	P				P									
Fabaceae	*Acacia dealbata*																	A														
Fabaceae	*Acacia decora*	Western golden wattle			P			P						P	P									P						P	P	
Fabaceae	*Acacia difformis*	Drooping Wattle			P																											
Fabaceae	*Acacia doratoxylon*	Currawang			P																											
Fabaceae	*Acacia gladiiformis*	Sword Wattle			P																											
Fabaceae	*Acacia gunnii*	Ploughshare Wattle			P		P																									

Table A.1 Flora Species List (Presence and Cover Abundance) on Impact Area and Offset Properties

					Impact	Property 9E								Property 9W									17	Property 18								
Family	Scientific Name	Common Name	TSC	EPBC	EIA *	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Fabaceae	*Acacia hakeoides*	Hakea Wattle			P																											
Fabaceae	*Acacia implexa*	Hickory			P																				P					P	P	
Fabaceae	*Acacia lanigera*	Woolly Wattle			P																											
Fabaceae	*Acacia leucolobia*				P																											
Fabaceae	*Acacia linearifolia*	Narrow-leaved Wattle			P											P					P					P	P		P			
Fabaceae	*Acacia penninervis*	Mountain Hickory			P																								P			
Fabaceae	*Acacia polybotrya*	Western Silver Wattle			P																											
Fabaceae	*Acacia sertiformis*				P																											
Fabaceae	*Acacia sp. A*																	P														
Fabaceae	*Acacia sp. B*							P							P													P				
Fabaceae	*Acacia spectabilis*	Mudgee Wattle			P																											
Fabaceae	*Acacia subulata*	Awl-leaved Wattle			P																											
Fabaceae	*Acacia triptera*	Spurwing Wattle			P											P																
Fabaceae	*Acacia verniciflua*	Varnish Wattle			P																											
Fabaceae	*Acacia vestita*																	P														
Fabaceae	*Aotus subglauca var. filiformis*				P																											
Fabaceae	*Bossiaea buxifolia*				P																											
Fabaceae	*Bossiaea obcordata*	Spiny Bossiaea			P																											
Fabaceae	*Bossiaea rhombifolia subsp. concolor*				P																											
Fabaceae	*Daviesia acicularis*				P																											
Fabaceae	*Daviesia genistifolia*				P																											
Fabaceae	*Daviesia sp.*											P	P		P														P			
Fabaceae	*Daviesia ulicifolia*	Gorse Bitter Pea			P																											
Fabaceae	*Desmodium brachypodum*	Large Tick-trefoil			P																											
Fabaceae	*Desmodium varians*	Tick Trefoil			P	P	P	P				P		P	P		P	P		P			P									
Fabaceae	*Dillwynia elegans*				P																											
Fabaceae	*Dillwynia juniperina*																	P														
Fabaceae	*Dillwynia parvifolia*															P		P	P													
Fabaceae	*Glycine canescens*	Silky Glycine			P																											
Fabaceae	*Glycine clandestina*	Twining Glycine			P										P										P	P			P	P	P	
Fabaceae	*Glycine microphylla*							P				P			P								P								P	
Fabaceae	*Glycine tabacina*	Twining Glycine			P									P	P								P	P	P				P	P		

Table A.1 Flora Species List (Presence and Cover Abundance) on Impact Area and Offset Properties

					Impact	Property 9E								Property 9W									17	Property 18								
Family	Scientific Name	Common Name	TSC	EPBC	EIA *	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Fabaceae	*Gompholobium huegelii*	Pale Wedge Pea			P																											
Fabaceae	*Hardenbergia violacea*	False Sarsparilla			P					P						P					P		P								P	
Fabaceae	*Hovea heterophylla*				P																											
Fabaceae	*Hovea lanceolata*				P																											
Fabaceae	*Hovea linearis*				P																											
Fabaceae	*Indigofera adesmiifolia*				P																											
Fabaceae	*Indigofera australis*	Native Indigo			P										P						P											
Fabaceae	*Jacksonia scoparia*	Dogwood			P																											
Fabaceae	*Kennedia rubicunda*	Dusky Coral Pea			P																											
Fabaceae	*Medicago arabica*	Spotted Burr Medic			P																											
Fabaceae	*Medicago laciniata*	Cut-leaved Medic			P																											
Fabaceae	*Medicago polymorpha*	Burr Medic			P																											
Fabaceae	*Neptunia gracilis*				P																											
Fabaceae	*Oxylobium pulteneae*	Wiry Shaggy Pea			P																											
Fabaceae	*Podolobium ilicifolium*	Prickly Shaggy Pea			P																											
Fabaceae	*Pultenaea foliolosa*	Graceful Bush Pea			P																											
Fabaceae	*Pultenaea microphylla*				P																		P								P	
Fabaceae	*Pultenaea spinosa*				P																											
Fabaceae	*Pultenaea sp.*																									P						
Fabaceae	*Swainsona galegifolia*	Smooth Darling Pea			P									P					P		A		P									
Fabaceae	*Swainsona reticulata*				P																											
Fabaceae	*Templetonia stenophylla*				P																											
Fabaceae	*Trifolium arvense*	Haresfoot Clover			P												P			P												P
Fabaceae	*Trifolium campestre*	Hop Clover															P															P
Fabaceae	*Trifolium dubium*	Yellow Suckling Clover																														P
Fabaceae	*Trifolium ornithopodioides*	Birds Foot Trefoil																				P										
Fabaceae	*Trifolium repens*																P															
Fabaceae	*Trifolium subterraneum*				P																											
Fabaceae	*Trifolium sp.*					P					P																					
Fabaceae	*Zornia dyctiocarpa*	Zornia			P																											
Gentianaceae	*Centaurium spicatum*						P				P																	P				
Gentianaceae	*Centaurium tenuiflorum*				P															P					P					P	P	
Gentianaceae	*Sebaea ovata*	Flintwood			P																											

Table A.1 Flora Species List (Presence and Cover Abundance) on Impact Area and Offset Properties

					Impact	Property 9E								Property 9W									17	Property 18								
Family	Scientific Name	Common Name	TSC	EPBC	EIA *	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Geraniaceae	*Erodium crinitum*	Storksbill			P																											
Geraniaceae	*Geranium homeanum*														P																	
Geraniaceae	*Geranium retrorsum*	Common Cranesbill			P																											
Geraniaceae	*Geranium solanderi*	Cutleaf Cranesbill			P	P	P	P				P			P					P			P		P							
Geraniaceae	*Geranium sp. A*													P			P					P										
Geraniaceae	*Geranium sp. B*							P					P																			
Goodeniaceae	*Dampiera lanceolata var.*	Grooved Dampiera			P																											
Goodeniaceae	*Goodenia ?hederacea*	Forest Goodenia						P				P																				
Goodeniaceae	*Goodenia hederacea*	Forest Goodenia			P				P				P			P		P	P		P		P									
Goodeniaceae	*Goodenia heterophylla*				P																											
Goodeniaceae	*Goodenia macbarronii*	Narrow Goodenia			P																											
Goodeniaceae	*Goodenia pinnatifida*				P																											
Goodeniaceae	*Goodenia sp.*									P															P						P	
Haloragaceae	*Gonocarpus elatus*				P																											
Haloragaceae	*Gonocarpus tetragynus*	Poverty Raspwort			P					P						P		P														
Haloragaceae	*Gonocarpus sp.*										P																	P				
Haloragaceae	*Haloragis heterophylla*	Rough Raspwort			P																											
Haloragaceae	*Myriophyllum gracile var.*	Slender Water-milfoil			P																											
Iridaceae	*Patersonia sericea*	Wild Iris			P											P		P														
Iridaceae	*Sisyrinchium sp.*	Scourweed															P															
Juncaceae	*Juncus articulatus*	Jointed Rush			P																											
Juncaceae	*Juncus bufonius*	Toad Rush					P																									
Juncaceae	*Juncus filicaulis*				P																											
Juncaceae	*Juncus homalocaulis*				P																											
Juncaceae	*Juncus planifolius*	Broad Rush			P																											
Juncaceae	*Juncus radula*																P			P												
Juncaceae	*Juncus sp. A*												P		P																	
Juncaceae	*Juncus subsecundus*	Finger Rush			P		P																								P	
Juncaceae	*Juncus usitatus*	Common Rush			P																											
Juncaceae	*Luzula meridionalis*				P																											
Lamiaceae	*Ajuga australis*	Austral Bugle			P										P																	
Lamiaceae	*Marrubium vulgare*				P									P																		
Lamiaceae	*Mentha diemenica*	Slender Mint			P																											

Table A.1 Flora Species List (Presence and Cover Abundance) on Impact Area and Offset Properties

					Impact	Property 9E								Property 9W									17	Property 18								
Family	Scientific Name	Common Name	TSC	EPBC	EIA *	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Lamiaceae	*Prostanthera howelliae*				P																											
Lamiaceae	*Scutellaria humilis*	Dwarf Skullcap												P						P												
Lauraceae	*Cassytha glabella*	Devils Twine			P																											
Lauraceae	*Cassytha pubescens*	Common Devil's Twine			P																											
Lentibulariaceae	*Utricularia dichotoma*				P																											
Linaceae	*Linum marginale*	Native Flax			P																											
Lobeliaceae	*Isotoma axillaris*	Rock Isotome			P																											
Lobeliaceae	*Isotoma fluviatilis*	Swamp Isotome			P																											
Lobeliaceae	*Isotoma sp.*																											P				
Lomandraceae	*Lomandra confertifolia*				P																											
Lomandraceae	*Lomandra filiformis subsp. coriacea*	Wattle Mat-rush			P									P		P	P	P		P												
Lomandraceae	*Lomandra filiformis subsp. filiformis*	Wattle Mat-rush			P	P	P		P	P					P				P				P									
Lomandraceae	*Lomandra glauca*	Pale Mat-rush			P			P				P	P																			
Lomandraceae	*Lomandra leucocephala*	Woolly Mat-rush			P																											
Lomandraceae	*Lomandra longifolia*	Spiky-headed Mat-rush			P																				P					P	P	
Lomandraceae	*Lomandra multiflora subsp. multiflora*	Many-flowered Mat-rush			P		P	P	P	P					P	P					P		P	P	P	P					P	
Loranthaceae	*Amyema cambagei*																					P										
Loranthaceae	*Amyema miquelii*	Mistletoe			P																											
Loranthaceae	*Amyema miraculosum subsp. boormanii*				P																											
Loranthaceae	*Amyema ?pendulum*																		P													
Loranthaceae	*Amyema quandang var.*				P																											
Loranthaceae	*Amyema sp. A*						P																									
Iridaceae	*Sisrynichum sp. A*				P																											
Malvaceae	*Modiola caroliniana*	Red-flowered Mallow					P															P										
Malvaceae	*Sida corrugata*	Ridged Sida			P																											
Malvaceae	*Sida cunninghamii*	Paddy's Lucerne			P																											
Myoporaceae	*Eremophila debilis*	Winter Apple			P																											
Myrtaceae	*Angophora floribunda*	Rough-barked Apple			P																								P			
Myrtaceae	*Babingtonia cunninghamii*				P																											

Table A.1 Flora Species List (Presence and Cover Abundance) on Impact Area and Offset Properties

					Impact	Property 9E								Property 9W								17	Property 18								
Family	Scientific Name	Common Name	TSC	EPBC	EIA *	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Myrtaceae	*Babingtonia densifolia*				P																											
Myrtaceae	*Calothamnus sp.*					P																										
Myrtaceae	*Calytrix tetragona*	Fringe Myrtle			P																					P	P					
Myrtaceae	*Eucalyptus agglomerata*	Blue-leaved Stringybark			P																											
Myrtaceae	*Eucalyptus albens*	White Box			P	P		P															P								P	
Myrtaceae	*Eucalyptus blakelyi*	Blakely's Red Gum			P							P		P				A							P		P	P	P	P		
Myrtaceae	*Eucalyptus bridgesiana*	Apple Box												P				P	A													
Myrtaceae	*Eucalyptus cannonii*	Cannons Stringybark	V	V	P																											
Myrtaceae	*Eucalyptus crebra*	Narrow-leaved Ironbark			P																			P		P	P				P	
Myrtaceae	*Eucalyptus dawsonii*	Slaty Gum			P																											
Myrtaceae	*Eucalyptus dealbata*	Tumbledown Red Gum			P																											
Myrtaceae	*Eucalyptus dives*	Broad-leaved Peppermint							P	P			P			P																
Myrtaceae	*Eucalyptus dwyeri*	Dwyer's Red Gum			P																											
Myrtaceae	*Eucalyptus fibrosa*	Broad Leaved Ironbark			P																											
Myrtaceae	*Eucalyptus macrorhyncha*	Red Stringybark			P			P	P	P			P	A		P		A	P				P									
Myrtaceae	*Eucalyptus macrorhyncha X*				P																											
Myrtaceae	*Eucalyptus melliodora*	Yellow Box			P		P					P		P	P										P					P		
Myrtaceae	*Eucalyptus microcarpa*	Grey Box																					P									
Myrtaceae	*Eucalyptus moluccana*	Grey Box			P																											
Myrtaceae	*Eucalyptus polyanthemos*	Red Box							P	P			P		P	P			P													
Myrtaceae	*Eucalyptus punctata*	Grey Gum			P																											
Myrtaceae	*Eucalyptus racemosa ssp*	Inland Scribbly Gum														P			P		P											
Myrtaceae	*Eucalyptus rossii*	Inland Scribbly Gum			P			P					P											P								
Myrtaceae	*Eucalyptus sideroxylon*	Red Ironbark			P																											
Myrtaceae	*Eucalyptus sparsifolia*	Narrow-leaved			P																											
Myrtaceae	*Eucalyptus tereticornis*	Forest Red Gum																												P		
Myrtaceae	*Kunzea ambigua*	Tick Bush																								P	P					
Myrtaceae	*Kunzea parvifolia*	Violet Kunzea			P																											
Myrtaceae	*Kunzea sp. Mt Kaputar*				P																											
Myrtaceae	*Leptospermum continentale*				P																											
Myrtaceae	*Leptospermum parvifolium*	Small-leaved Tea-tree			P																											
Myrtaceae	*Leptospermum polygalifolium*	Lemon Scented Tea-tree			P																											
Myrtaceae	*Melaleuca thymifolia*	Thyme Honey Myrtle			P																											

Table A.1 Flora Species List (Presence and Cover Abundance) on Impact Area and Offset Properties

					Impact	Property 9E								Property 9W									17	Property 18								
Family	Scientific Name	Common Name	TSC	EPBC	EIA *	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Orchidaceae	*Acianthus fornicatus*	Pixie Caps			P																											
Orchidaceae	*Caladenia caerulea*	Blue Finger Orchid			P																											
Orchidaceae	*Caladenia fuscata*	Dusky Fingers			P																											
Orchidaceae	*Caladenia gracilis*	Musky Caladenia			P																											
Orchidaceae	*Diuris goonooensis*	Western Donkey Orchid			P																											
Orchidaceae	*Diuris sulphurea*	Tiger Orchid			P																											
Orchidaceae	*Eriochilus cucullatus*	Parson's Bands			P																											
Orchidaceae	*Glossodia major*	Wax Lip Orchid			P																											
Orchidaceae	*Microtis parviflora*	Slender Onion Orchid			P																											P
Orchidaceae	*Microtis unifolia*	Common Onion Orchid																										P				
Orchidaceae	*Pterostylis bicolor*	King Greenhood			P																											
Orchidaceae	*Pterostylis nutans*	Nodding Greenhood			P																											
Orchidaceae	*Pterostylis sp.*								P																							
Orchidaceae	*Thelymitra pauciflora*	Slender Sun Orchid			P																											
Oxalidaceae	*Oxalis chnoodes*				P																											P
Oxalidaceae	*Oxalis exilis*				P	P																										
Oxalidaceae	*Oxalis perennans*				P		P	P				P			P											P						
Oxalidaceae	*Oxalis ?perennans*													P						P		P										
Oxalidaceae	*Oxalis sp.*										P																			P		
Philydraceae	*Philydrum lanuginosum*	Woolly Frogmouth			P																											
Phormiaceae	*Dianella caerulea*	Blue Flax Lily			P																											
Phormiaceae	*Dianella longifolia*				P																									P		
Phormiaceae	*Dianella revoluta*	Blueberry Lily			P			P							P	P							P									
Phormiaceae	*Stypandra glauca*	Nodding Blue Lily								P								P			P											
Phyllanthaceae	*Phyllanthus hirtellus*															P		P			P											
Phyllanthaceae	*Phyllanthus occidentalis*				P																											
Phyllanthaceae	*Poranthera corymbosa*				P																											
Phyllanthaceae	*Poranthera microphylla*				P			P				P			P			P	P		P		P									
Picrodendraceae	*Pseudanthus divaricatissimus*	Oval-leafed Pseudanthus			P																											
Pittosporaceae	*Billardiera scandens*	Hairy Apple Berry			P																											
Pittosporaceae	*Bursaria spinosa*	Blackthorn			P							P											P									
Pittosporaceae	*Cheiranthera linearis*	Finger Flower			P																											
Plantaginaceae	*Plantago debilis*	Slender Plantain			P			P						P	P																	

Table A.1 Flora Species List (Presence and Cover Abundance) on Impact Area and Offset Properties

					Impact	Property 9E								Property 9W									17	Property 18								
Family	Scientific Name	Common Name	TSC	EPBC	EIA *	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Plantaginaceae	*Plantago gaudichaudii*				P			P				P																				
Plantaginaceae	*Plantago hispida*				P																											
Plantaginaceae	*Plantago lanceolata*	Ribwort			P																											
Plantaginaceae	*Plantago sp.*											P																				
Plantaginaceae	*Plantago varia*				P																											
Poaceae	*Agrostis capillaris*	Browntop Bent																														P
Poaceae	*Aira elegantissima*	Delicate Hairgrass			P																											
Poaceae	*Aristida benthamii*	Three-awned Spear					P																									
Poaceae	*Aristida calycina*	Wire Grass			P																											
Poaceae	*Aristida ramosa*	Wire Grass			P							P								P												
Poaceae	*Aristida sp.*														P														P	P		
Poaceae	*Aristida warburgii*	Wire Grass			P																											
Poaceae	*Aristida ?vagans*	a Three-awned																														P
Poaceae	*Aristida vagans*	Three-awned Speargrass												P			P	P		P					P		P	P			P	
Poaceae	*Arundinella nepalensis*	Reed Grass			P																								P			
Poaceae	*Austrodanthonia bipartita*	Wallaby Grass			P																											
Poaceae	*Austrodanthonia caespitosa*				P																											
Poaceae	*Austrodanthonia carphoides*	Short Wallaby Grass					P																					P				
Poaceae	*Austrodanthonia eriantha*				P												P	P		P												
Poaceae	*Austrodanthonia penicillata*	Slender Wallaby Grass					P																									
Poaceae	*Austrodanthonia pilosa*	Smooth-flower Wallaby			P																											
Poaceae	*Austrodanthonia racemosa*	Wallaby Grass			P		P		P	P														P	P			P			P	
Poaceae	*Austrodanthonia richardsonii*	Wallaby Grass			P																											
Poaceae	*Austrodanthonia setacea*	Smallflower Wallaby			P																											
Poaceae	*Austrodanthonia sp.*	Wallaby Grass			P	P		P					P		P								P			P	P	P		P		
Poaceae	*Austrodanthonia tenuior*	Wallaby Grass			P																											
Poaceae	*Austrostipa densiflora*				P																											
Poaceae	*Austrostipa laevis*																						P									
Poaceae	*Austrostpia ?scabra*											P																				
Poaceae	*Austrostipa scabra*	Speargrass			P									P		P				P				P	P	P	P	P		P	P	P
Poaceae	*Austrostipa sp. A*				P																											
Poaceae	*Austrostipa sp. B*					P		P				P		P	P								P									
Poaceae	*Bothriochloa decipiens*	Redleg Grass			P						P			P			P			P												

Table A.1 Flora Species List (Presence and Cover Abundance) on Impact Area and Offset Properties

					Impact	Property 9E								Property 9W									17	Property 18								
Family	Scientific Name	Common Name	TSC	EPBC	EIA *	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Poaceae	*Bothriochloa ?macra*	Redleg Grass																														P
Poaceae	*Bothriochloa macra*				P		P																					P				
Poaceae	*Bothriochloa sp.*					P							P		P															P		
Poaceae	*Briza minor*	Shivery Grass			P							P					P															P
Poaceae	*Bromus hordeaceus*	Soft Brome			P												P					P										P
Poaceae	*Bromus molliformis*	Soft Brome				P																										
Poaceae	*Bromus sp.*																							P								
Poaceae	*Chloris truncata*	Windmill Grass			P																											
Poaceae	*Chloris ventricosa*	Tall Chloris			P																											
Poaceae	*Cymbopogon refractus*	Barbwire Grass			P																									P		
Poaceae	*Cynodon dactylon*	Common Couch			P																											
Poaceae	*Dactyloctenium australe*	Durban Grass			P																											
Poaceae	*Danthonia sp.*							P				P																				
Poaceae	*Deyeuxia sp.*								P																							
Poaceae	*Dichelachne micrantha*	Short-hair Plume Grass			P													P	P													P
Poaceae	*Dichelachne rara*				P																											
Poaceae	*Dichelachne sp.*																											P			P	
Poaceae	*Digitaria breviglumis*				P																											
Poaceae	*Digitaria brownii*	Cotton Panic Grass			P																											
Poaceae	*Digitaria divaricatissima*	Umbrella Grass			P																											
Poaceae	*Digitaria sp.*											P			P																	
Poaceae	*Digitaria violascens*				P																											
Poaceae	*Echinopogon caespitosus*	Bushy Hedgehog-grass			P			P				P	P		P			P					P						P			
Poaceae	*Echinopogon cheelii*	Longflower Hedgehog			P																											
Poaceae	*Echinopogon ovatus*	Forest Hedgehog Grass			P																											
Poaceae	*Echinopogon sp.*																														P	
Poaceae	*Eleusine indica*	Crowsfoot Grass			P																											
Poaceae	*Elymus scaber*				P																											
Poaceae	*Enneapogon gracilis*	Slender Bottle-washers			P																											
Poaceae	*Enneapogon sp.*																											P				
Poaceae	*Entolasia marginata*	Bordered Panic			P																											
Poaceae	*Entolasia stricta*	Wiry Panic			P																											
Poaceae	*Eragrostis brownii*	Brown's Lovegrass			P																							P				

Table A.1 Flora Species List (Presence and Cover Abundance) on Impact Area and Offset Properties

					Impact	Property 9E								Property 9W									17	Property 18								
Family	Scientific Name	Common Name	TSC	EPBC	EIA *	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Poaceae	*Eragrostis leptostachya*	Paddock Lovegrass			P	P	P				P														P							
Poaceae	*Eragrostis sp. A*	Lovegrass			P																											
Poaceae	*Eragrostis sp. B*																P			P												
Poaceae	*Eriochloa pseudoacrotricha*	Early Spring Grass			P																											
Poaceae	*Eulalia aurea*	Silky Browntop			P																											
Poaceae	*Hordeum hystrix*	Mediterranean Barley			P																											
Poaceae	*Hordeum leporinum*	Barley Grass			P																											
Poaceae	*Imperata cylindrica*	Blady Grass			P																											
Poaceae	*Joycea pallida*	Silvertop Wallaby Grass			P		P	P	P	P			P		P	P		P	P		P		P									
Poaceae	*Lachnagrostis filiformis*						P																	P								
Poaceae	*Lolium rigidum*	Stiff Ryegrass			P																				P							P
Poaceae	*Melinus repens*	Red Natal Grass			P																											
Poaceae	*Microlaena stipoides*	Weeping Grass			P	P					P			P	P		P			P		P		P		P	P	P	P		P	P
Poaceae	*Nassella neesiana*	Chilian Needlegrass												P								P										
Poaceae	*Nassella trichotoma*													P																		
Poaceae	*Panicum decompositum*	Native Millet			P																											
Poaceae	*Panicum effusum*	Hairy Panic			P	P																P										P
Poaceae	*Panicum simile*	Two Colour Panic			P																											
Poaceae	*Paspalum dilatatum*	Paspalum			P																											
Poaceae	*Phragmites australis*	Common Reed			P																											
Poaceae	*Poa labillardieri*	Tussock Grass			P																											
Poaceae	*Poa meionectes*				P																											
Poaceae	*Poa sieberiana*	Tussock Grass			P	P			P	P																						
Poaceae	*Poa sp. A*														P																	
Poaceae	*Poa sp. B*																P	P			P	P										
Poaceae	*Poa sp. C*																															
Poaceae	*Setaria gracilis*	Slender Pigeon Grass			P																											
Poaceae	*Setaria sp.*																							P								
Poaceae	*Sorghum leiocladum*	Johnson Grass			P																											
Poaceae	*Sporobolus creber*	Slender Rat's Tail Grass			P																											P
Poaceae	*Sporobolus sp.*																											P				
Poaceae	*Tetrarrhena juncea*				P																											
Poaceae	*Themeda australis*	Kangaroo Grass			P												P															

Table A.1 Flora Species List (Presence and Cover Abundance) on Impact Area and Offset Properties

					Impact	Property 9E								Property 9W									17	Property 18								
Family	Scientific Name	Common Name	TSC	EPBC	EIA *	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Poaceae	*Themeda avenacea*				P																											
Poaceae	*Themeda sp.*																													P		
Poaceae	*Vulpia bromoides*	Squirrel Tail Fescue			P												P			P												P
Poaceae	*Vulpia myuros*	Rat's Tail Fescue			P												P															
Polygonaceae	*Acetosella vulgaris*	Sheep Sorrel			P	P	P				P						P			P				P								P
Polygonaceae	*Persicaria hydropiper*	Water Pepper																				P										
Polygonaceae	*Rumex brownii*	Clustered Dock			P	P	P					P		P	P		P					P			P							P
Polygonaceae	*Rumex conglomeratus*	Swamp Dock			P																											
Polygonaceae	*Rumex crispus*	Curled Dock			P																	P										
Primulaceae	*Anagallis arvensis*	Blue Pimpernel			P										P							P										
Proteaceae	*Banksia marginata*	Silver Banksia			P																											
Proteaceae	*Grevillea ramosissima*	Fan Grevillea			P																											
Proteaceae	*Grevillea sericea*	Pink Spider Flower			P																											
Proteaceae	*Grevillea triternata*				P																											
Proteaceae	*Hakea dactyloides*	Broad-leaved Hakea			P																											
Proteaceae	*Isopogon dawsonii*	Nepean Conebush			P																											
Proteaceae	*Isopogon petiolaris*				P																											
Proteaceae	*Persoonia curvifolia*				P																											
Proteaceae	*Persoonia linearis*	Narrow-leaved Geebung			P																P					P			P			
Proteaceae	*Persoonia myrtilloides subsp. cunninghamii*				P																											
Proteaceae	*Persoonia pinifolia*	Pine-leaved Geebung																					P									
Ranunculaceae	*Clematis glycinoides*	Headache Vine			P																											
Ranunculaceae	*Ranunculus inundatus*	River Buttercup			P																											
Rhaminaceae	*Cryptandra amara var.*				P																											
Rhaminaceae	*Pomaderris elliptica var.*				P																											
Rhamnaceae	*Cryptandra spinescens*				P																											
Rosaceae	*Acaena echinata*													P			P			P		P										
Rosaceae	*Acaena novae-zelandiae*	Bidgee-widgee				P																										
Rosaceae	*Acaena ovina*	Sheeps Burr			P																		P									
Rosaceae	*Rosa rubiginosa*	Sweet Briar			P												P					P										
Rosaceae	*Rubus discolor*				P																											
Rosaceae	*Rubus fruiticosus*	Blackberry										P			P							P										

Table A.1 Flora Species List (Presence and Cover Abundance) on Impact Area and Offset Properties

					Impact	Property 9E								Property 9W									17	Property 18								
Family	Scientific Name	Common Name	TSC	EPBC	EIA *	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Rosaceae	*Rubus parvifolius*	Native Raspberry			P																											
Rubiaceae	*Asperula conferta*	Common Woodruff			P			P				P	P	P	P		P					P										
Rubiaceae	*Galium gaudichaudii*	Rough Bedstraw			P																											
Rubiaceae	*Galium migrans*				P																											
Rubiaceae	*Galium sp.*								P																							
Rubiaceae	*Galium propinquum*	Maori Bedstraw			P																											
Rubiaceae	*Opercularia diphylla*				P																											
Rubiaceae	*Opercularia hispida*				P																											
Rubiaceae	*Opercularia varia*	Variable Stinkweed							P																							
Rubiaceae	*Pomax umbellata*	Pomax			P											P										P	P	P				
Rubiaceae	*Richardia stellaris*				P																											
Rutaceae	*Correa reflexa*	Native Fuschia			P																											
Rutaceae	*Phebalium glandulosum*				P																											
Rutaceae	*Phebalium squamulosum*	Scaly Phebalium			P																											
Rutaceae	*Philotheca salsolifolia*				P																											
Santalaceae	*Choretrum pauciflorum*	Dwarf Sour Bush			P																											
Santalaceae	*Exocarpos cupressiformis*	Native Cherry			P																			P								
Santalaceae	*Exocarpos strictus*	Pale Ballart			P																											
Santalaceae	*Exocarpos sp.*																						P									
Santalaceae	*Santalum lanceolatum*	Mother-in-law's Tongue			P																											
Sapindaceae	*Dodonaea boroniifolia*	Fern-leaf Hop-bush			P																											
Sapindaceae	*Dodonaea sinuolata*				P																											
Sapindaceae	*Dodonaea triangularis*				P																											
Sapindaceae	*Dodonaea viscosa*	Sticky Hop Bush			P			P							P																	
Scrophulariaceae	*Gratiola pedunculata*				P																											
Scrophulariaceae	*Linaria pelisseriana*	Pelisser's Toadflax			P																											
Scrophulariaceae	*Parentucellia latifolia*	Red Bartsia			P																											
Scrophulariaceae	*Veronica calycina*																				P											
Scrophulariaceae	*Veronica plebia*	Creeping Speedwell			P	P	P	P				P			P																	
Scrophulariaceae	*Veronica sp.*																							P								
Solanaceae	*Solanum brownii*				P																											
Solanaceae	*Solanum campanulatum*				P																											
Solanaceae	*Solanum cinereum*	Narrawa Burr			P																											

Table A.1 Flora Species List (Presence and Cover Abundance) on Impact Area and Offset Properties

					Impact	Property 9E								Property 9W									17	Property 18								
Family	Scientific Name	Common Name	TSC	EPBC	EIA *	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Solanaceae	*Solanum prinophyllum*	Forest Nightshade																						P	P							
Stackhousiaceae	*Stackhousia monogyna*	Creamy Candles			P																				P		P		P			
Stackhousiaceae	*Stackhousia viminea*				P																											
Sterculiaceae	*Brachychiton populneus*	Kurrajong			P			P				P	P																			
Sylidiaceae	*Stylidium eglandulosum*				P																											
Thymelaeaceae	*Pimelea curviflora var. sericea*				P																											
Thymelaeaceae	*Pimelea linifolia*	Slender Rice Flower			P																											
Thymelaeaceae	*Pimelea sp.*							P																								
Typhaceae	*Typha domingensis*				P																											
Urticaceae	*Urtica incisa*	Stinging Nettle			P							P		P								P										
Verbenaceae	*Verbena bonariensis*	Purpletop			P																											
Violaceae	*Hymenanthera dentata*	Tree Violet			P																	P										
Violaceae	*Viola betonicifolia*						P					P																				
Xanthorrhoeacea	*Xanthorrhoea johnsonii*				P																											
Xyridaceae	*Xyris complanata*	Feathered Yellow-eye			P																											
Zamiaceae	*Macrozamia secunda*				P																											
Zamiaceae	*Macrozamia sp.*																						P									

Notes: * Species surveyed in Impact Area (EIA by Ecovision, 2008)

P = Present in Quadrat

A = Adjacent (indicates species recorded adjacent to quadrat in similar plant community)

Appendix B

Fauna Species List

Table B.1 Fauna Species List (Presence and Likelihood of Occurrence) on Impact Area and Offset Properties

Scientific Name	Common Name	Exotic	TSC	EPBC	Impact *	9E		9W		18		Notes
						Survey	Likelihood of Occurrence	Survey	Likelihood of Occurrence	Survey	Likelihood of Occurrence	
Amphibians												
Crinia signifera	Common Eastern				P		Likely		Likely		Likely	
Limnodynastes dumerilii	Eastern Banjo Frog				P		Likely		Likely		Likely	
Limnodynastes ornatus	Ornate Burrowing Frog				P		Unlikely		Unlikely		Unlikely	
Limnodynastes peronii	Striped Marsh Frog				P		Possible		Possible		Possible	
Limnodynastes	Spotted Grass Frog				P		Likely		Likely		Likely	
Limnodynastes	Northern Banjo Frog				P		Extremely unlikely		Extremely unlikely		Extremely unlikely	
Litoria caerulea	Green Tree Frog				P		Unlikely		Unlikely		Unlikely	
Litoria dentata	Bleating Tree Frog				P		Extremely unlikely		Extremely unlikely		Extremely unlikely	
Litoria fallax	Eastern Dwarf Tree Frog				P		Unlikely		Unlikely		Unlikely	
Litoria latopalmata	Broad-palmed Frog				P		Likely		Likely		Likely	
Litoria lesueuri	Leseur's Tree Frog				P		Extremely unlikely		Extremely unlikely		Extremely unlikely	
Litoria peronii	Peron's Tree Frog				P		Likely		Likely		Likely	
Litoria verreauxii	Verreaux's Tree Frog				P		Possible		Possible		Possible	
Neobatrachus sudelli	Painted Burrowing Frog				P		Possible		Possible		Possible	
Pseudophryne bibronii	Brown Toadlet				P		Likely		Likely		Likely	
Uperoleia laevigata	Smooth Toadlet				P		Likely		Likely		Likely	
Uperoleia tyleri	Tyler's Toadlet				P		Unlikely		Unlikely		Unlikely	
Birds												
Dromaius novaehollandiae	Emu				P		Unlikely		Unlikely	P	Uncommon	
Coturnix pectoralis	Stubble Quail				P		Likely		Likely		Likely	
Coturnix ypsilophora	Brown Quail				P		Likely		Likely		Likely	
Cygnus atratus	Black Swan				P		Unlikely		Unlikely		Unlikely	
Chenonetta jubata	Australian Wood Duck				P	P	Common	P	Common	P	Common	
Anas gracilis	Grey Teal				P		Likely		Possible	P	Uncommon	
Anas superciliosa	Pacific Black Duck				P	P	Common		Likely	P	Common	
Aythya australis	Hardhead				P	P	Uncommon		Likely		Likely	
Tachybaptus	Australasian Grebe				P	P	Uncommon		Likely	P	Uncommon	
Phaps chalcoptera	Common Bronzewing				P	P	Common	P	Uncommon	P	Uncommon	
Phaps elegans	Brush Bronzewing				P		Unlikely		Unlikely		Unlikely	
Ocyphaps lophotes	Crested Pigeon				P	P	Common		Likely	P	Common	

Table B.1 Fauna Species List (Presence and Likelihood of Occurrence) on Impact Area and Offset Properties

Scientific Name	Common Name	Exotic	TSC	EPBC	Impact *	9E		9W		18		Notes
						Survey	Likelihood of Occurrence	Survey	Likelihood of Occurrence	Survey	Likelihood of Occurrence	
Geopelia striata	Peaceful Dove				P	P	Uncommon		Likely	P	Uncommon	
Geopelia humeralis	Bar-shouldered Dove				P		Unlikely		Unlikely		Possible	
Leucosarcia picata	Wonga Pigeon				P		Unlikely		Unlikely		Possible	Called *Leucosarcia melanoleuca* in EIA
Podargus strigoides	Tawny Frogmouth				P		Likely		Likely		Likely	
Eurostopodus mystacalis	White-throated Nightjar				P		Likely		Likely		Likely	
Aegotheles cristatus	Australian Owlet-nightjar				P		Likely		Likely		Likely	
Hirundapus caudacutus	White-throated			M	P		Likely		Likely		Likely	
Anhinga novaehollandiae	Australasian Darter				P		Possible		Possible		Possible	Called *Anhinga melanogaster* in EIA
Microcarbo melanoleucos	Little Pied Cormorant						Likely		Likely	P	Uncommon	
Phalacrocorax carbo	Great Cormorant				P		Unlikely		Unlikely		Unlikely	
Phalacrocorax sulcirostris	Little Black Cormorant				P		Unlikely		Unlikely		Unlikely	
Phalacrocorax varius	Pied Cormorant				P		Unlikely		Unlikely		Unlikely	
Pelecanus conspicillatus	Australian Pelican				P		Unlikely		Unlikely		Unlikely	
Ardea pacifica	White-necked Heron				P		Likely		Likely		Likely	
Ardea modesta	Eastern Great Egret						Likely		Likely		Likely	
Ardea ibis	Cattle Egret			M	P		Likely		Likely		Likely	
Egretta novaehollandiae	White-faced Heron				P	P	Likely		Likely	P	Uncommon	
Nycticorax caledonicus	Nankeen Night-Heron						Likely		Likely		Likely	In the area, suitable habitat and possible sighting.
Threskiornis spinicollis	Straw-necked Ibis				P		Likely		Possible	P	Uncommon	
Elanus axillaris	Black-shouldered Kite				P		Likely		Likely		Likely	
Lophoictinia isura	Square-tailed Kite		V		P		Likely		Likely		Likely	
Haliastur sphenurus	Whistling Kite				P		Likely		Likely		Likely	
Accipiter fasciatus	Brown Goshawk				P	P	Uncommon		Likely		Likely	
Accipiter cirrhocephalus	Collared Sparrowhawk				P		Likely		Likely		Likely	
Circus assimilis	Spotted Harrier		V		P		Possible		Possible		Possible	
Aquila audax	Wedge-tailed Eagle				P	P	Common	P	Common	P	Uncommon	
Hieraaetus morphnoides	Little Eagle		V		P		Likely		Likely		Likely	
Falco cenchroides	Nankeen Kestrel				P	P	Common		Likely	P	Uncommon	
Falco berigora	Brown Falcon				P		Likely	P	Uncommon	P	Uncommon	
Falco longipennis	Australian Hobby				P	P	Uncommon		Likely		Likely	
Falco peregrinus	Peregrine Falcon				P		Likely		Likely		Likely	

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						Survey	Likelihood of Occurrence	Survey	Likelihood of Occurrence	Survey	Likelihood of Occurrence	
Porphyrio porphyrio	Purple Swamphen				P		Likely		Likely		Likely	
Gallinula tenebrosa	Dusky Moorhen				P		Likely		Likely		Likely	
Fulica atra	Eurasian Coot				P		Unlikely		Unlikely		Unlikely	
Himantopus himantopus	Black-winged Stilt				P		Unlikely		Unlikely		Unlikely	
Elseyornis melanops	Black-fronted Dotterel				P		Likely		Possible	P	Uncommon	
Vanellus miles	Masked Lapwing				P		Likely		Likely	P	Uncommon	
Turnix varius	Painted Button-quail				P		Likely		Likely		Likely	
Calyptorhynchus lathami	Glossy Black-Cockatoo		V		P		Possible		Possible		Likely	
Calyptorhynchus funereus	Yellow-tailed Black-				P		Likely		Likely		Likely	
Callocephalon fimbriatum	Gang-gang Cockatoo		V		P		Possible		Possible		Unlikely	
Eolophus roseicapillus	Galah				P	P	Common	P	Common	P	Common	
Cacatua sanguinea	Little Corella				P		Possible		Possible		Possible	
Cacatua galerita	Sulphur-crested				P		Likely		Likely	P	Common	
Glossopsitta concinna	Musk Lorikeet				P	P	Uncommon		Likely	P	Uncommon	
Glossopsitta pusilla	Little Lorikeet		V		P		Likely		Likely		Likely	
Alisterus scapularis	Australian King-Parrot				P	P	Uncommon	P	Uncommon	P	Uncommon	
Platycercus elegans	Crimson Rosella				P	P	Common	P	Common		Unlikley	
Platycercus eximius	Eastern Rosella				P	P	Common	P	Common	P	Common	
Lathamus discolor	Swift Parrot		E	E, M	P		Possible		Possible		Possible	
Psephotus haematonotus	Red-rumped Parrot				P		Likely	P	Uncommon	P	Common	
Neophema pulchella	Turquoise Parrot		V				Possible		Unlikely		Possible	
Eudynamys orientalis	Eastern Koel				P		Possible		Possible		Possible	Called *Eudynamys scopopacea* in EIA
Scythrops novaehollandiae	Channel-billed Cuckoo				P		Likely		Likely	P	Uncommon	
Chalcites basalis	Horsfield's Bronze-				P		Likely		Likely	P	Uncommon	Called *Chrysococcyx basalis* in EIA
Chalcites osculans	Black-eared Cuckoo						Possible		Possible		Possible	Has been recorded for area.
Chalcites lucidus	Shining Bronze-Cuckoo					P	Common	P	Common	P	Common	Should also be on development site.
Cacomantis pallidus	Pallid Cuckoo				P		Likely	P	Uncommon	P	Common	Called *Cuculus pallidus* in EIA
Cacomantis flabelliformis	Fan-tailed Cuckoo				P	P	Common	P	Common		Likely	Called *Cuculus flabelliformis* in EIA
Cacomantis variolosus	Brush Cuckoo				P		Likely		Likely		Likely	Called *Cuculus variolosus* in EIA
Ninox strenua	Powerful Owl		V		P		Unlikely		Unlikely		Unlikely	
Ninox connivens	Barking Owl		V				Possible		Possible		Possible	
Ninox novaeseelandiae	Southern Boobook				P		Likely		Likely		Likely	
Tyto javanica	Eastern Barn Owl				P		Likely		Likely		Likely	Called *Tyto alba* in EIA

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						Survey	Likelihood of Occurrence	Survey	Likelihood of Occurrence	Survey	Likelihood of Occurrence	
Ceyx azureus	Azure Kingfisher					P	Uncommon		Possible		Possible	Along streams with pools.
Dacelo novaeguineae	Laughing Kookaburra				P	P	Common	P	Common	P	Common	
Todiramphus sanctus	Sacred Kingfisher				P	P	Common		Likely	P	Common	
Merops ornatus	Rainbow Bee-eater			M	P	P	Uncommon		Likely		Likely	
Eurystomus orientalis	Dollarbird				P	P	Uncommon		Likely		Likely	
Menura novaehollandiae	Superb Lyrebird				P		Unlikely		Unlikely		Possible	
Cormobates leucophaea	White-throated				P	P	Common	P	Common	P	Common	
Climacteris picumnus	Brown Treecreeper		V		P	P	Common	P	Uncommon	P	Uncommon	
Malurus cyaneus	Superb Fairy-wren				P	P	Common	P	Common	P	Common	
Malurus melanocephalus	Red-backed Fairy-wren				P		Extremely unlikely		Extremely unlikely		Extremely unlikely	300 km SW of recognized range.
Malurus lamberti	Variegated Fairy-wren				P		Likely		Likely		Likely	
Origma solitaria	Rockwarbler				P		Unlikely		Unlikely		Unlikely	
Sericornis frontalis	White-browed				P	P	Uncommon	P	Uncommon		Likely	
Hylacola pyrrhopygia	Chestnut-rumped				P		Likely		Likely		Likely	
Chthonicola sagittata	Speckled Warbler		V		P	P	Common	P	Common	P	Common	
Smicrornis brevirostris	Weebill				P	P	Common	P	Common	P	Common	
Gerygone fusca	Western Gerygone				P	P	Uncommon	P	Uncommon	P	Common	
Gerygone albogularis	White-throated				P	P	Common	P	Common	P	Common	Called *Gerygone olivacea* in EIA
Acanthiza lineata	Striated Thornbill				P	P	Common	P	Common	P	Common	
Acanthiza nana	Yellow Thornbill				P	P	Common	P	Common	P	Common	
Acanthiza chrysorrhoa	Yellow-rumped Thornbill				P	P	Common	P	Common	P	Common	
Acanthiza reguloides	Buff-rumped Thornbill				P	P	Common	P	Common	P	Common	
Acanthiza pusilla	Brown Thornbill				P	P	Common	P	Common		Likely	
Aphelocephala leucopsis	Southern Whiteface				P		Likely	P	Uncommon		Likely	
Pardalotus punctatus	Spotted Pardalote				P	P	Common	P	Common	P	Common	
Pardalotus striatus	Striated Pardalote				P	P	Common	P	Common	P	Common	
Acanthorhynchus	Eastern Spinebill				P	P	Common	P	Common	P	Common	
Lichenostomus chrysops	Yellow-faced				P	P	Common	P	Common	P	Common	
Lichenostomus virescens	Singing Honeyeater				P		Possible		Possible		Possible	
Lichenostomus leucotis	White-eared Honeyeater				P	P	Common	P	Common	P	Common	
Lichenostomus melanops	Yellow-tufted				P		Possible		Possible		Possible	
Lichenostomus fuscus	Fuscous Honeyeater				P		Likely		Likely		Likely	
Lichenostomus penicillatus	White-plumed				P	P	Common		Likely	P	Common	

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Scientific Name	Common Name	Exotic	TSC	EPBC	Impact *	9E		9W		18		Notes
						Survey	Likelihood of Occurrence	Survey	Likelihood of Occurrence	Survey	Likelihood of Occurrence	
Manorina melanocephala	Noisy Miner				P	P	Common	P	Common	P	Common	
Acanthagenys rufogularis	Spiny-cheeked				P		Possible		Possible		Likely	
Anthochaera phrygia	Regent Honeyeater		CE	E, M			Possible		Possible		Possible	
Anthochaera carunculata	Red Wattlebird				P	P	Common	P	Common	P	Common	
Epthianura albifrons	White-fronted Chat		V		P		Unlikely		Unlikely		Possible	
Myzomela sanguinolenta	Scarlet Honeyeater				P		Likely		Likely		Likely	
Lichmera indistincta	Brown Honeyeater				P		Unlikely		Unlikely		Unlikely	
Phylidonyris	New Holland				P		Possible		Possible		Possible	
Melithreptus gularis	Black-chinned		V		P		Possible		Possible		Possible	
Melithreptus brevirostris	Brown-headed				P	P	Common	P	Common	P	Common	
Melithreptus lunatus	White-naped				P	P	Common	P	Common		Possible	
Entomyzon cyanotis	Blue-faced Honeyeater				P		Unlikely		Unlikely		Possible	
Philemon corniculatus	Noisy Friarbird				P	P	Common	P	Common	P	Common	
Philemon citreogularis	Little Friarbird				P		Likely		Likely		Likely	
Plectorhyncha lanceolata	Striped Honeyeater				P	P	Uncommon	P	Uncommon	P	Common	
Grantiella picta	Painted Honeyeater		V		P		Possible		Possible		Possible	
Pomatostomus temporalis	Grey-crowned Babbler		V		P		Unlikely		Unlikely		Unlikely	
Pomatostomus	White-browed Babbler				P		Possible		Possible		Possible	
Cinclosoma punctatum	Spotted Quail-thrush				P	P	Uncommon		Likely	P	Uncommon	
Psophodes olivaceus	Eastern Whipbird				P		Unlikely		Unlikely		Unlikely	
Daphoenositta chrysoptera	Varied Sittella		V		P	P	Uncommon	P	Uncommon	P	Uncommon	
Coracina novaehollandiae	Black-faced Cuckoo-shrike				P	P	Common		Likley	P	Common	
Coracina papuensis	White-bellied Cuckoo-shrike				P		Likely		Likely	P	Uncommon	
Coracina tenuirostris	Cicadabird				P		Likely		Likely	P	Common	
Lalage sueurii	White-winged Triller				P		Likely	P	Uncommon	P	Common	
Lalage leucomela	Varied Triller				P		Extremely unlikely		Extremely unlikely		Extremely unlikely	300 km SW of recognized range.
Falcunculus frontatus	Crested Shrike-tit				P	P	Uncommon		Likely	P	Uncommon	
Pachycephala inornata	Gilbert's Whistler		V		P		Unlikely		Unlikely		Unlikely	
Pachycephala pectoralis	Golden Whistler				P		Likely		Likely		Likely	
Pachycephala rufiventris	Rufous Whistler				P	P	Common	P	Common	P	Common	
Colluricincla harmonica	Grey Shrike-thrush				P	P	Common	P	Common	P	Common	

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						Survey	Likelihood of Occurrence	Survey	Likelihood of Occurrence	Survey	Likelihood of Occurrence	
Oriolus sagittatus	Olive-backed Oriole				P	P	Common	P	Common	P	Common	
Artamus personatus	Masked Woodswallow				P		Possible		Possible		Possible	
Artamus superciliosus	White-browed				P	P	Uncommon	P	Uncommon		Likely	
Artamus cinereus	Black-faced				P		Unlikley		Unlikley		Unlikley	
Artamus cyanopterus	Dusky Woodswallow				P	P	Uncommon		Likely		Likely	
Cracticus torquatus	Grey Butcherbird				P	P	Common		Likely	P	Common	
Cracticus nigrogularis	Pied Butcherbird				P	P	Common	P	Common	P	Common	
Cracticus tibicen	Australian Magpie				P	P	Common	P	Common	P	Common	Called *Gymnorhina tibicen* in EIA
Strepera graculina	Pied Currawong				P	P	Common	P	Common	P	Common	
Rhipidura rufifrons	Rufous Fantail			M	P		Possible		Possible		Possible	
Rhipidura albiscapa	Grey Fantail				P	P	Common	P	Common	P	Common	Called *Rhipidura fuliginosa* in EIA
Rhipidura leucophrys	Willie Wagtail				P	P	Common	P	Common	P	Common	
Corvus coronoides	Australian Raven				P	P	Common	P	Common	P	Common	
Corvus mellori	Little Raven						Possible		Possible	P	Common	
Myiagra rubecula	Leaden Flycatcher					P	Common	P	Common	P	Common	Far more common than S. Flycatcher in this area.
Myiagra cyanoleuca	Satin Flycatcher			M	P		Likely	P	Uncommon		Unlikely	
Myiagra inquieta	Restless Flycatcher				P		Likely		Likely		Likely	
Grallina cyanoleuca	Magpie-lark				P	P	Common	P	Common	P	Common	
Corcorax melanorhamphos	White-winged Chough				P	P	Common	P	Common	P	Common	
Microeca fascinans	Jacky Winter				P	P	Common	P	Uncommon	P	Common	
Petroica boodang	Scarlet Robin		V		P	P	Uncommon	P	Uncommon		Likley	Called *Petroica multicolor* in EIA
Petroica goodenovii	Red-capped Robin				P	P	Uncommon	P	Uncommon		Likely	
Petroica phoenicea	Flame Robin		V				Likely		Likely		Likely	More likely in winter.
Melanodryas cucullata	Hooded Robin		V		P		Likley		Likley		Likley	
Eopsaltria australis	Eastern Yellow Robin				P	P	Common	P	Common	P	Common	
Acrocephalus australis	Australian Reed-Warbler				P		Likely		Unlikely		Unlikely	Called *Acrocephalus stentoreus* in EIA
Cincloramphus mathewsi	Rufous Songlark				P	P	Common	P	Uncommon	P	Common	
Cincloramphus cruralis	Brown Songlark				P		Likley		Unlikely	P	Uncommon	
Zosterops lateralis	Silvereye				P		Likley	P	Common		Likely	
Cheramoeca leucosterna	White-backed Swallow				P		Possible		Possible		Possible	
Hirundo neoxena	Welcome Swallow				P	P	Common		Likley	P	Common	
Petrochelidon ariel	Fairy Martin				P	P	Common		Likley		Likley	Called *Hirundo ariel* in EIA

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Petrochelidon nigricans	Tree Martin				P	P	Common		Likley		Likley	Called *Hirundo nigricans* in EIA
Zoothera lunulata	Bassian Thrush				P		Unlikely		Unlikely		Unlikely	
Turdus merula	Common Blackbird	*			P	P	Uncommon		Likley		Likley	
Sturnus vulgaris	Common Starling	*			P	P	Common		Likley	P	Common	
Dicaeum hirundinaceum	Mistletoebird				P	P	Common	P	Common	P	Common	
Taeniopygia bichenovii	Double-barred Finch				P		Likley		Likley		Likley	
Neochmia temporalis	Red-browed Finch				P	P	Common	P	Common		Likley	
Stagonopleura guttata	Diamond Firetail		V		P		Likley		Likley		Likley	
Passer domesticus	House Sparrow	*			P		Likley		Likley		Likley	
Anthus novaeseelandiae	Australasian Pipit				P	P	Uncommon		Likley	P	Uncommon	
Mammals - Bats												
Saccolaimus flaviventris	Yellow-bellied Sheath-		V		P		Possible		Possible		Possible	
Mormopterus ridei							Likely	P	Present	P	Present	
Mormopterus sp. 3	Inland Freetail Bat				P		Likely		Likely		Likely	
Mormopterus sp. 4	Southern Freetail Bat				P	P	Present	P	Present	P	Present	
Tadarida australis	White-striped Freetail				P	P	Present	P	Present	P	Present	
Pteropus scapulatus	Little Red Flying-fox				P		Likely		Likely		Likely	
Chalinolobus dwyeri	Large-eared Pied Bat		V	V	P		Likely		Likely	P	Present	
Chalinolobus gouldii	Gould's Wattled Bat				P	P	Present	P	Present	P	Present	
Chalinolobus morio	Chocolate Wattled Bat				P		Likely	P	Present	P	Present	
Chalinolobus picatus	Little Pied Bat		V		P		Possible		Possible		Possible	
Miniopterus orianae	Eastern Bent-wing Bat		V		P	P	Present	P	Present	P	Present	Same as *Miniopterus schreibersii*
Nyctophilus geoffroyi	Lesser Long-eared Bat				P		Possible		Possible		Possible	
Nyctophilus gouldi	Gould's Long-eared Bat				P		Possible		Possible		Possible	
Nyctophilus sp.					P	P	Present	P	Present	P	Present	
Nyctophilus timoriensis	Greater Long-eared Bat		V	V	P		Possible		Possible		Possible	Identification to genus only with call ID
Scotorepens balstoni	Inland Broad-nosed Bat				P		Likely	P	Present		Likely	
Scotorepens orion	Eastern Broad-nosed				P		Likely		Likely		Likely	
Vespadelus darlingtoni	Large Forest Bat					P	Present	P	Present	P	Present	
Vespadelus regulus	Southern Forest Bat						Possible		Likely		Likely	
Vespadelus vulturnus	Little Forest Bat				P	P	Present	P	Present	P	Present	

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Mammals - Other												
Acrobates pygmaeus	Feathertail Glider				P		Likely		Likely		Likely	
Capra hircus	Goat	*			P		Likely	P	Present		Likely	
Canis familiaris	Dog (Feral)				P		Likely		Likely		Likely	
Vulpes vulpes	Fox	*			P		Likely	P	Present		Likely	Scats found
Dama dama	Fallow Deer	*			P		Possible		Possible		Possible	
Antechinus flavipes	Yellow-footed				P		Likely		Likely		Likely	
Dasyurus maculata	Spotted-tailed Quoll		E	E			Possible		Possible		Possible	
Sminthopsis murina	Common Dunnart				P		Likely		Likely		Likely	
Felis catus	Feral Cat	*			P		Likely		Likely		Likely	
Lepus capensis	Brown Hare	*			P		Likely		Likely		Likely	
Oryctolagus cuniculus	Rabbit	*			P		Likely	P	Common	P	Common	
Macropus giganteus	Eastern Grey Kangaroo				P		Likely	P	Present		Likely	
Macropus robustus	Common Wallaroo				P		Likely		Likely		Likely	
Macropus rufogriseus	Red-necked Wallaby				P		Likely		Likely		Likely	
Petrogale penicillata	Brush-tailed Rock-		E	V			Possible		Possible		Possible	
Wallabia bicolor	Swamp Wallaby				P		Likely	P	Present		Likely	
Mus musculus	House Mouse				P		Likely		Likely		Likely	
Ornithorhynchus anatinus	Platypus					P	Present		Possible		Possible	
Petaurus breviceps	Sugar Glider				P		Likely		Likely		Likely	
Petaurus norfolcensis	Squirrel Glider		V		P		Possible		Possible		Possible	
Trichosurus vulpecula	Common Brushtail				P		Likely		Likely		Likely	
Phascolarctos cinereus	Koala		V				Possible		Likely		Possible	
Pseudocheirus peregrinus	Common Ringtail				P		Likely		Likely		Likely	
Sus scrofa	Pig	*			P		Likely	P	Present		Likely	
Tachyglossus aculeatus	Short-beaked Echidna				P		Likely		Likely		Likely	
Vombatus ursinus	Common Wombat				P		Likely		Likely		Likely	Burrows found
Fish												
Anguilla australis	Short-finned Eel				P		Likely		Likely		Likely	

Table B.1 Fauna Species List (Presence and Likelihood of Occurrence) on Impact Area and Offset Properties

Scientific Name	Common Name	Exotic	TSC	EPBC	Impact *	9E		9W		18		Notes
						Survey	Likelihood of Occurrence	Survey	Likelihood of Occurrence	Survey	Likelihood of Occurrence	
Reptiles												
Amphibolurus nobbi	Nobbi				P		Likely		Likely		Likely	
Physignathus lesueurii	Eastern Water Dragon					P	Present		Likely		Likely	
Pogona barbata	Eastern Bearded Dragon				P		Likely		Likely		Likely	
Tympanocryptis diemensis	Mountain Dragon				P		Likely		Likely		Likely	
Chelodina longicollis	Eastern Long-necked				P	P	Present	P	Present		Likely	
Demansia psammophis	Yellow-faced Whip				P		Likely		Likely		Likely	
Furina diadema	Red-naped Snake				P		Likely		Likely		Likely	
Pseudechis porphyriacus	Red-bellied Black Snake				P		Likely		Likely		Likely	
Pseudonaja textilis	Eastern Brown Snake				P		Likely		Likely		Likely	
Suta dwyeri	Dwyer's Black-headed				P		Likely		Likely		Likely	
Vermicella annulata	Bandy Bandy				P		Likely		Likely		Likely	
Diplodactylus vittatus	Wood Gecko				P		Likely		Likely		Likely	
Oedura lesueurii	Lesueur's Velvet Gecko				P		Likely		Likely		Likely	
Phyllurus platurus	Southern Leaf-tailed				P		Likely		Likely		Likely	
Underwoodisaurus milii	Thick-tailed Gecko				P		Likely		Likely		Likely	
Pygopus lepidopodus	Common Scaly-foot				P		Likely		Likely		Likely	
Ualis burtonis	Burton's Snake-lizard				P		Likely		Likely		Likely	
Anomalopus leukartii	Two-clawed Worm Skink				P		Likely		Likely		Likely	
Carlia foliorum	Littrer Skink				P		Likely		Likely		Likely	
Carlia tetradactyla	Southern Rainbow Skink				P		Likely		Likely		Likely	
Ctenotus robustus	Striped Skink				P		Likely		Likely		Likely	
Ctenotus taeniolatus	Copper-tailed Skink				P		Likely		Likely		Likely	
Egernia cunninghami	Cunningham's Skink				P		Likely		Likely		Likely	
Egernia whitii	White's Skink				P		Likely		Likely		Likely	
Eulamprus tenuis	Yellow-bellied Skink				P		Likely		Likely		Likely	
Lampropholis delicata	Grass Skink				P		Likely		Likely		Likely	
Lerista bouganvilli	South-eastern Slider				P		Likely		Likely		Likely	
Morethia boulengeri	Boulenger's Skink				P		Likely		Likely		Likely	
Trachydosaurus rugosus	Shingle-back				P		Likely		Likely		Likely	
Ttliqua scincoides	Eastern Blue-tongued				P		Likely		Likely		Likely	
Ramphotyphlops	Blind Snake				P		Likely		Likely		Likely	

Table B.1 Fauna Species List (Presence and Likelihood of Occurrence) on Impact Area and Offset Properties

Scientific Name	Common Name	Exotic	TSC	EPBC	Impact *	9E		9W		18		Notes
						Survey	Likelihood of Occurrence	Survey	Likelihood of Occurrence	Survey	Likelihood of Occurrence	
Ramphotyphlops proximus	Blind Snake				P		Likely		Likely		Likely	
Varanus varius	Lace Monitor				P		Likely	P	Present		Likely	

Notes: * Species surveyed in Impact Area (EIA by Ecovision, 2008)

P = Present

Appendix C

Bat Calls

Anabat Data Analysis Summary

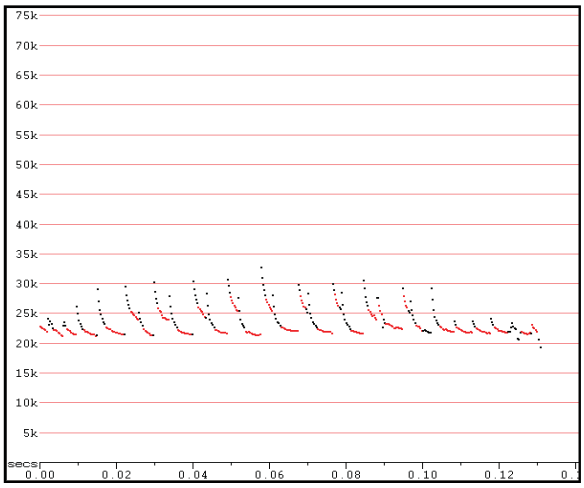
Client: Cumberland Ecology **Balance Job no.:** CUMB1108

Project name/location: Hargraves and Ulan, 6-10 November 2011 2011

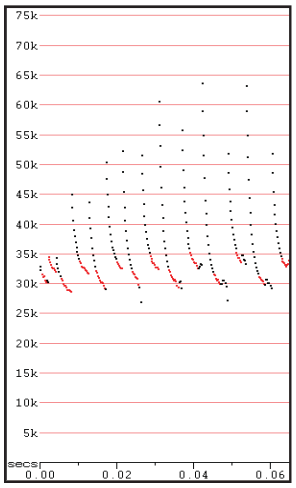
Sample calls extracted from the survey data.

Scale: 10 msec per tick; time between pulses removed (AnalookW F7 compressed mode)

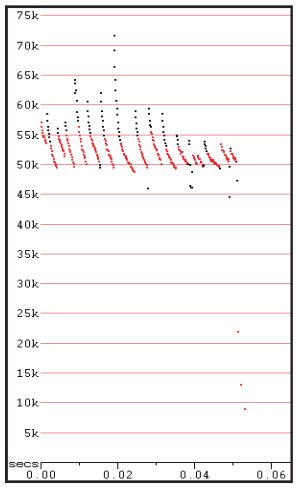
Species positively identified



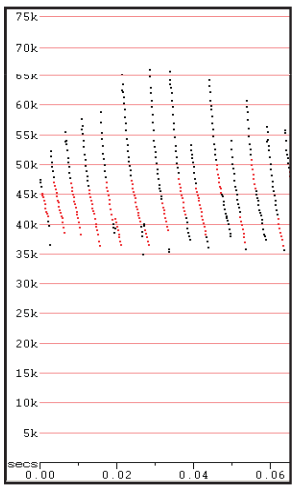
Chalinolobus dwyeri



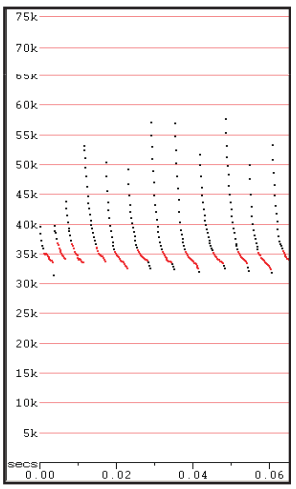
Chalinolobus gouldii



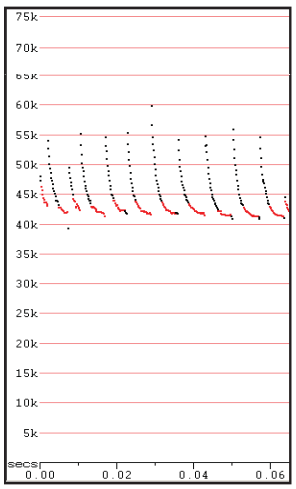
Chalinolobus morio



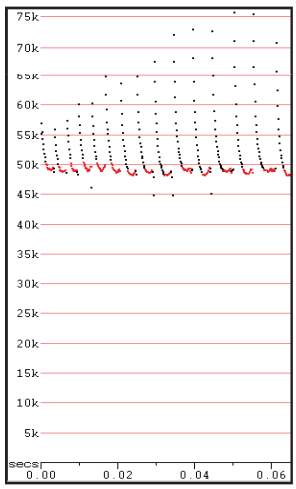
Nyctophilus species



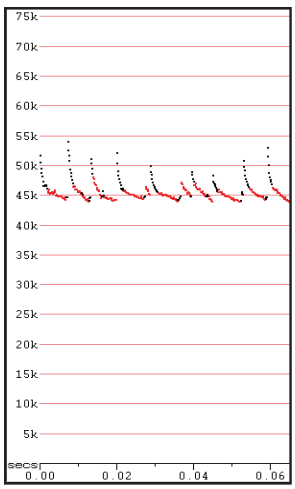
Scotorepens balstoni



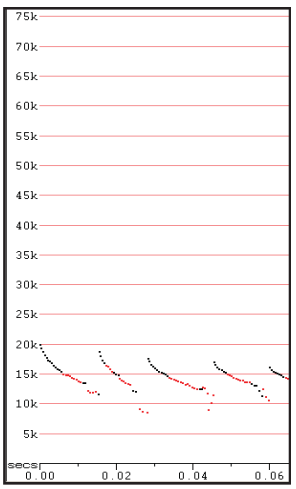
Vespadelus darlingtoni



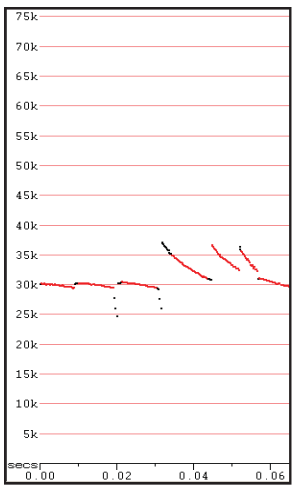
Vespadelus vulturnus



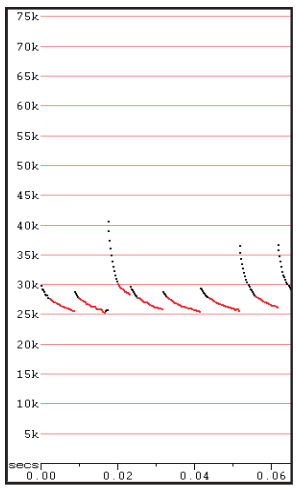
Miniopterus o. oceanensis



Austronomus australis



Mormopterus ridei



Mormopterus 'species 4'

Anabat Data Analysis Summary

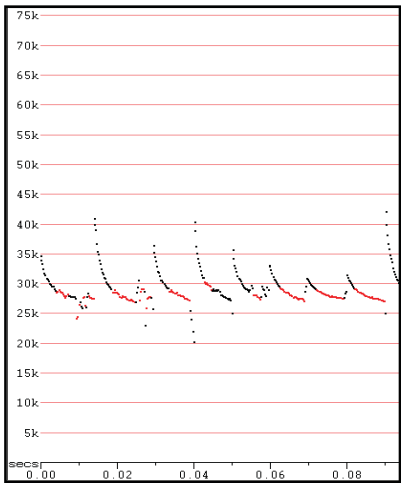
Client: Cumberland Ecology **Balance Job no.:** CUMB1108

Project name/location: Hargraves and Ulan, 6-10 November 2011 2011

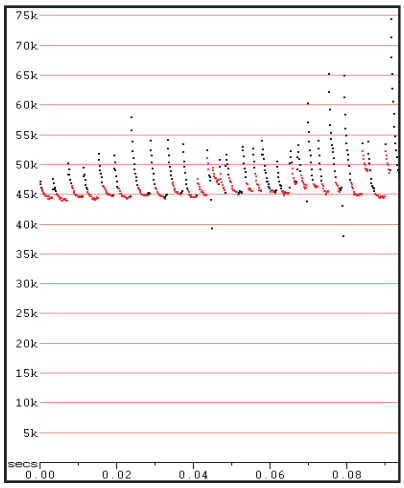
Sample calls extracted from the survey data.

Scale: 10 msec per tick; time between pulses removed (AnalookW F7 compressed mode)

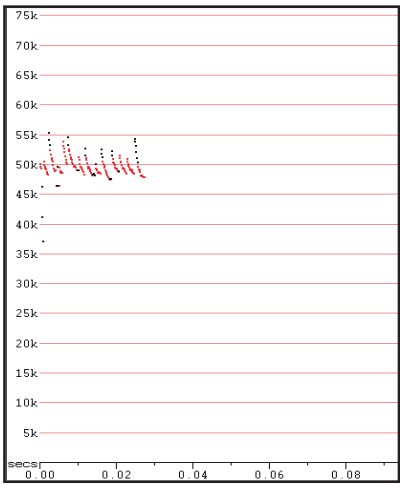
Calls NOT positively identified



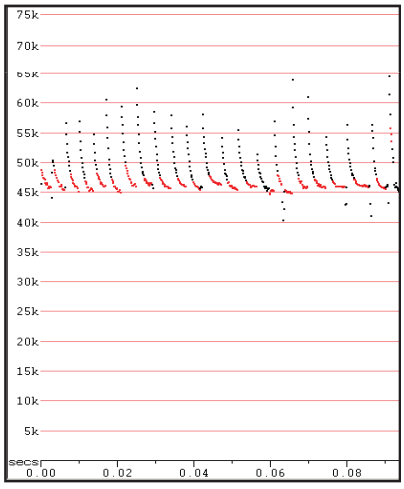
C. gouldii or *Mormopterus* spp



Vespadelus sp (probably *V. regulus*)



V. vulturnus or *C. morio*



Vespadelus spp or *M. o. oceanensis*

Appendix D

Rapid Vegetation Assessment of Secondary Grassland in Project Area

Table D.1 Rapid Vegetation Assessment of Secondary Grassland in Project Area

Scientific Name	EPBC Listed*	EPBC Important**	1	2	3	4	5	6	7	8	9	10	11
Calocephalus citreus	√	√								P			
Calotis lappulacea	√	√	P										
Carex appressa				P			P			P	P		P
Carex inversa	√									P			
Cheilanthes sieberi	√		P		P								
Crassula sieberiana	√		P										
Daucus glochidiatus	√	√	P										
Dichondra repens	√		P										
Templetonia	√	√	P										
Eryngium ovinum	√	√								P			
Euchiton sphaericus	√		P		P								
Fimbristylis					P								
Gahnia radula			P				P	P					
Geranium solanderi	√											P	
Glycine tabacina	√	√	P									P	
Gonocarpus	√											P	
Goodenia sp.	√												P
Haloragis					P						P	P	P
Hydrocotyle laxiflora	√		P										
Hypericum	√	√					P					P	P
Juncus subsecundus	√				P	P	P	P		P		P	P
Laxmannia gracilis	√	√	P										
Isotoma fluviatilis					P								
Lomandra multiflora	√		P										
Microtis unifolia	√	√			P								
Oxalis perennans	√						P				P		
Plantago varia	√	√		P									
Rumex brownii	√	√	P	P		P	P	P		P	P		
Schoenus apogon	√						P					P	P
Senecio lautus			P										
Stackhousia viminea	√												P
Tricoryne elatior	√	√	P										
Wahlenbergia	√				P	P							

Table D.1 Rapid Vegetation Assessment of Secondary Grassland in Project Area

Scientific Name	EPBC Listed*	EPBC Important**	1	2	3	4	5	6	7	8	9	10	11
Total Number of Species Recorded			**15**	**3**	**8**	**3**	**7**	**3**	**0**	**6**	**4**	**7**	**7**
Number of Listed Species Present *			**12**	**2**	**5**	**3**	**5**	**2**	**0**	**5**	**2**	**6**	**5**
Number of Important Species Present**			**7**	**0**	**1**	**1**	**2**	**1**	**0**	**3**	**1**	**2**	**1**

* Species listed under the EPBC Act as forming part of the *White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland C/EEC*

** Species listed under the EPBC Act as **Important Species** for *White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland C/EEC*