

# Regional Offset Management Plan

Warkworth Mine, NSW

Hunter Valley Operations, NSW



This document has been prepared in conjunction with Integrated Design Solutions and utilising reports prepared by Cumberland Ecology and DnA Environmental prepared for the Warkworth Extension Project 2010.

---

<b>Document Title</b>	<b>Version</b>	<b>Date effective</b>	<b>Comment</b>
Regional Offset Management Plan	1	14 April 2014	Draft submitted for approval.
	2	24 June 2014	Final draft in response to regulator comments

---

# Contents page

<b>1</b>	<b>Introduction</b>	<b>1</b>
1.1	Background	1
1.1.1	Hunter Valley South	1
1.1.2	Warkworth Mine	1
1.1.3	Approval Conditions	1
1.2	Offset Security	3
1.3	Function of the Offset Management Plan	3
1.3.1	Structure	3
1.3.2	Information Management	4
1.3.3	Key Project Stakeholders and Roles	6
1.3.4	Review and Reporting	6
<b>2</b>	<b>Biodiversity Areas</b>	<b>7</b>
2.1	Location and description	7
2.2	Land-use history	11
2.3	Landform and Geology	11
2.4	Vegetation Communities	11
2.4.1	Goulburn River Biodiversity Area	11
2.4.2	Bowditch Biodiversity Area	12
2.5	Habitat	15
2.5.1	Swift Parrot	15
2.5.2	Regent Honeyeater	16
2.6	Baseline biodiversity condition assessment	16
2.6.1	Rapid Condition Assessment	16
2.6.2	Fauna Baseline	19
2.7	Management Zones	20
2.7.1	Management Zone A – Foothills and escarpments	20
2.7.2	Management Zone B – Valley floor and floodplain	20
2.7.3	Management Zone C - Derived Native Grasslands	20
2.7.4	Management Zone D - Riparian Zone	20
2.7.5	Management Zone E - Agriculture	20
<b>3</b>	<b>Conservation Objectives, Key Performance Indicators and Completion Criteria</b>	<b>25</b>
3.1	Conservation Objectives	25
3.2	Key Performance Indicators	25
3.3	Completion Criteria	26
<b>4</b>	<b>Conservation Management Strategies</b>	<b>27</b>
4.1	Controlled Activities	27
4.2	Weed Control	27
4.2.1	Management Objective	28
4.2.2	Method	28

4.2.3	Implementation and Reporting	30
4.2.4	Performance and completion criteria	30
4.3	Pest Animal Control	30
4.3.1	Management Objective	31
4.3.2	Method	31
4.3.3	Implementation and Reporting	31
4.3.4	Performance and completion criteria	31
4.4	Strategic Grazing	31
4.4.1	Management Objective	32
4.4.2	Method	32
4.4.3	Implementation and Reporting	33
4.4.4	Performance and completion criteria	34
4.5	Revegetation	34
4.5.1	Management Objective	34
4.5.2	Method	34
	Assisted natural regeneration	34
	Replanting and Seed Collection	34
	Regrowth management	35
4.5.3	Implementation and Reporting	35
4.5.4	Performance and completion criteria	36
4.6	Infrastructure Maintenance/Improvement	36
4.6.1	Management Objective	36
4.6.2	Method	36
4.6.3	Implementation and Reporting	36
4.6.3	Performance and completion criteria	37
4.7	Fire Management	37
4.7.1	Management Objective	37
4.7.2	Method	38
4.7.3	Implementation and Reporting	38
4.7.4	Performance and completion criteria	38
4.8	Erosion Control	38
4.8.1	Management Objective	38
4.8.2	Method	39
4.8.3	Implementation and reporting	39
4.8.4	Performance and completion criteria	39
4.9	Cultural Heritage	39
<b>5</b>	<b>Monitoring Programme</b>	<b>40</b>
5.1	Monitoring Approach and Frequency	40
5.2	Landscape Monitoring	40
5.3	Habitat Restoration and Bird Assemblage Monitoring	41
5.3.1	Habitat Restoration Monitoring	41

5.3.1.1	Field Methods	41
5.3.1.2	Photo Reference Points	42
5.3.2	Bird Assemblage Monitoring	43
5.3.2.1	Field Methods	43
5.4	Rapid Condition Assessment	43
5.5	Adaptive Management Monitoring	44
<b>6</b>	<b>Conclusion</b>	<b>45</b>
<b>7</b>	<b>References</b>	<b>48</b>
	<b>Appendix A - Approval Conditions Relating to Offsets</b>	<b>50</b>
	<b>Appendix B - Fauna baseline (2012)</b>	<b>54</b>
	<b>Appendix C - Rapid Condition Assessment results November 2013</b>	<b>58</b>
	<b>Appendix D - Habitat Restoration Monitoring – Field Methods</b>	<b>60</b>
	<b>Appendix E - Adaptive Management Monitoring – Field Methods</b>	<b>62</b>

# Abbreviations

---

BA	Biodiversity Area
CEEC	Critically Endangered Ecological Community
DoE	Australian Government Department of the Environment
DPI	NSW Department of Planning and Infrastructure
EEC	Endangered Ecological Community
EP&A Act	NSW <i>Environmental Planning and Assessment Act 1979</i>
EPBC Act	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>
Ha	Hectare
HLLS	Hunter Local Land Services
HVO	Hunter Valley Operations
Km	Kilometre
LGA	Local Government Area
MNES	Matter of National Environmental Significance
MTO	Mount Thorley Operations
MTW	Mount Thorley Warkworth
MZ	Management Zone
NSW	New South Wales
OEH	NSW Office of Environment and Heritage
OMP	Offset Management Plan
RCA	Rapid Condition Assessment
TSC Act	NSW <i>Threatened Species Conservation Act 1995</i>
WML	Warkworth Mining Limited

---

# 1 Introduction

Coal & Allied Operations Limited (Coal & Allied), which is managed by Rio Tinto Coal Australia (RTCA), has prepared this Regional Offset Management Plan (OMP) to guide the long term protection and management of the regional offset areas, located in the Goulburn River and Bowditch Biodiversity Areas (BAs). This OMP has been prepared to satisfy the consent requirements for the New South Wales (NSW) Hunter Valley Operations (HVO) South Project Approval (PA 06\_0261) and the Warkworth Mine Commonwealth approval EPBC 2002/629.

This plan outlines management actions and a monitoring programme that has been formulated based on the existing condition of the Offset Areas and the conservation objectives. **Figure 1** provides a location of the BAs and their proximity to Warkworth Mine and HVO.

## 1.1 Background

### 1.1.1 Hunter Valley South

Coal & Allied was granted Project Approval by the NSW Minister for Planning for the Hunter Valley Operations (HVO) South Coal Project on 24 March 2009 and last modified on 31 October 2012. The approval was granted under the provisions of the *Environmental Planning and Assessment Act 1979* (EP&A Act), reference NSW PA 06\_0261. The approval granted permission to clear 48 hectares (ha) of remnant native vegetation and 92ha of regrowth. To offset this impact 140ha of Narrow-leaved Ironbark Woodland is to be protected in perpetuity. The offset area to satisfy this condition is located within the Goulburn River BA.

### 1.1.2 Warkworth Mine

Warkworth Mine is owned by Warkworth Mining Limited (WML) and has two Commonwealth and one NSW approval to construct and operate an open cut coal mine, including two mine extensions. In 2004 the Warkworth Mine and the adjoining Mount Thorley Operations (MTO) were integrated and operate as Mount Thorley Warkworth (MTW) for mining purposes. The MTW coal mine is operated and managed by Coal & Allied, as part of RTCA within the Rio Tinto group.

The Commonwealth Minister for the Environment, under provisions of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), has issued two approvals the first in February 2004 (EPBC 2002/629) and the second in August 2012 (EPBC 2009/5081).

The EPBC 2002/629 approval was last modified in December 2013 due to the recent NSW Land and Environment Court appeal and subsequent disapproval of the NSW approval of the Warkworth Extension Project. The EPBC 2002/629 approval requires WML to offset the impact upon Matters of National Environmental Significance (MNES) by protecting and managing no less than 1,586ha of habitat for the Regent Honeyeater (*Anthochaera phrygia*) and Swift Parrot (*Lathamus discolor*). At least 1,586ha of the Goulburn River and Bowditch BAs is to be secured as an Offset Area, with a legally binding mechanism for enduring protection.

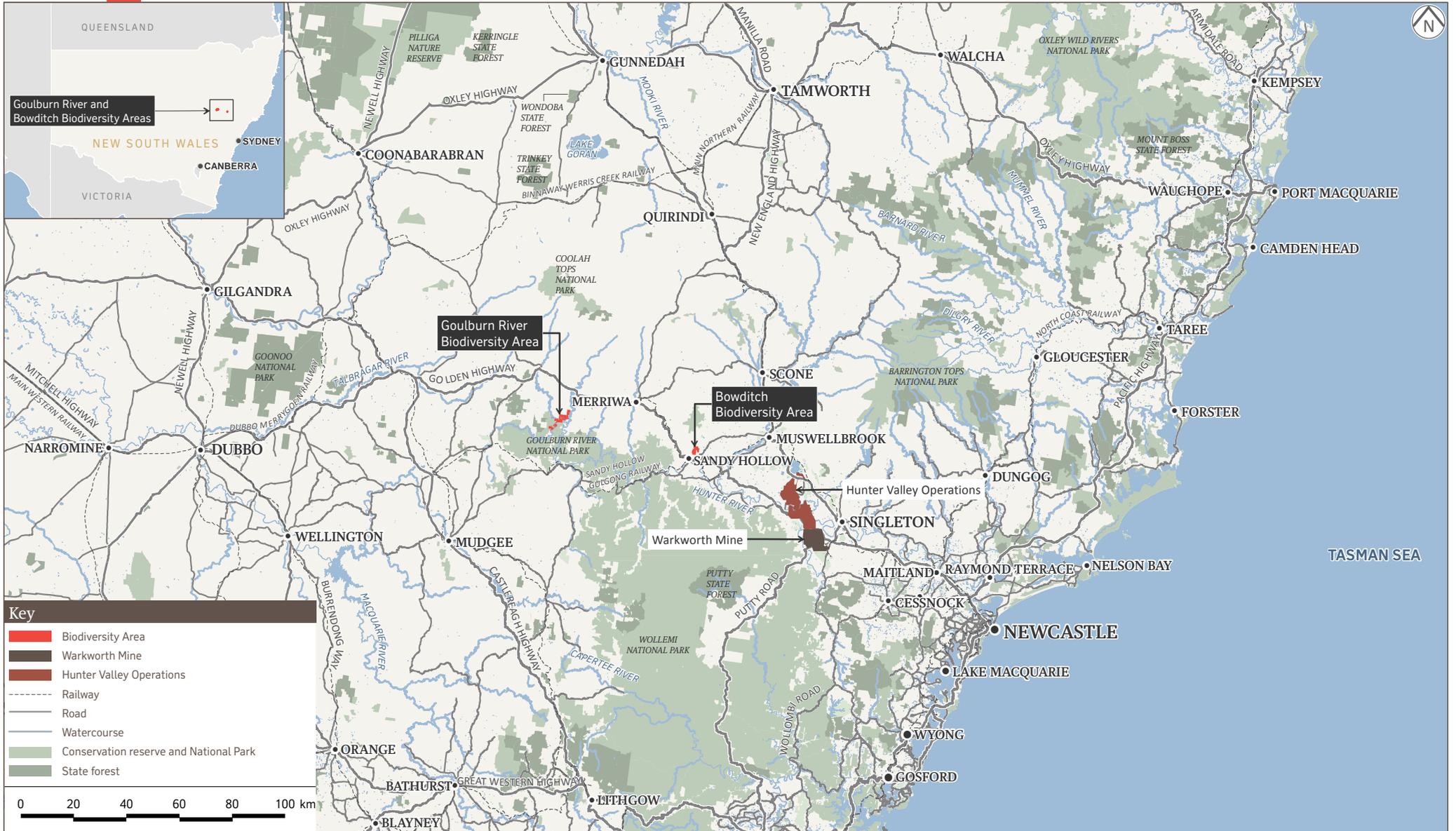
### 1.1.3 Approval Conditions

The relevant offset conditions for EPBC 2002/629 and NSW PA 06\_0261 Approval are shown in **Appendix A** with cross references to the relevant chapters within the Regional OMP to track compliance. **Table 1** lists the relevant Approval Conditions that the Regional OMP aims to satisfy and the links to the online versions of the Approvals, as conditions can vary and the version at **Appendix A** may not be current.

# Location of the Biodiversity Areas

Regional Offset Management Plan

Figure 1



**Table 1 Relevant Approval Conditions for the Regional Offset Management Plan**

Approval	Offset Area (ha)	Internet link to full approval conditions
HVO South Project NSW PA 06_0261	140	<a href="https://majorprojects.affinitylive.com/public/74c7d15c53beebcc8dc944cadd23fdb0/12.%20HVO%20South%20Mod%204%20-%20Consolidated%20Approval.PDF">https://majorprojects.affinitylive.com/public/74c7d15c53beebcc8dc944cadd23fdb0/12.%20HVO%20South%20Mod%204%20-%20Consolidated%20Approval.PDF</a> Last modified October 2012
Warkworth Extension Project EPBC 2002/629	1,586	<a href="http://www.environment.gov.au/epbc/notices/assessments/2002/629/2002-629-variation-approval-conditions-2.pdf">http://www.environment.gov.au/epbc/notices/assessments/2002/629/2002-629-variation-approval-conditions-2.pdf</a> Last modified December 2013

## 1.2 Offset Security

The 140ha HVO South Offset Area is required to be secured using the conservation agreement provisions under Section 69B Part 4 Division 12 of the NSW *National Parks and Wildlife Act 1974*. The mechanism to secure the EPBC Offset Areas within the Goulburn and Bowditch BAs is not specified only it must be legally binding.

This Regional OMP proposes a total Offset Area of 1,726ha (140ha and 1,586ha for NSW and Commonwealth regulator respectively). Once the Regional OMP is approved, the Offset Area will be surveyed and a final area provided to the Commonwealth Department of Environment (DoE) and DPI.

The NSW government is currently developing an improved mechanism to secure Offset Areas in NSW associated with its 'Biobanking' policy. Coal & Allied will endeavour to secure the Offset Area under this mechanism by the end of 2014.

## 1.3 Function of the Offset Management Plan

This Regional OMP will provide the management framework for the Offset Areas and BAs with the aim to protect and enhance biodiversity values through the implementation of conservation management strategies.

The Goulburn River and Bowditch BAs are to be leased. The presence of a Leaseholder will ensure security for the Offset Areas, providing a deterrent to illegal activities, including clearing for firewood or hunting. In addition, they can respond quickly to emergency events such as bushfires. The conditions of the lease agreement will ensure that the Leaseholder adhere to and implement the Regional OMP. The Leaseholder responsibilities will encompass the day to day management of the properties, including grassland monitoring, livestock management and implementation of on-ground works.

### 1.3.1 Structure

For the Regional OMP to be successful it needs to define the Offset Areas, provide clear conservation objectives, detail the conservation management strategies and measure success. To that end the Regional OMP comprises the following chapters:

- Biodiversity Areas: This chapter describes the BAs and baseline condition of the vegetation communities and fauna habitats within the Offset Area;
- Conservation Objectives, Key Performance Indicators and Completion Criteria: This chapter outlines the conservation objectives for the Regional OMP as well as the biodiversity values, nested conservation values and key performance indicators that have guided the development of conservation management strategies and the monitoring programme;
- Conservation Management Strategies: This chapter outlines primary management strategies used to improve the extent, connectivity and condition of the vegetation community;
- Monitoring: This chapter details the data collection to measure short, medium and long term impacts of the conservation management strategies. These assessments will provide quantitative data to guide adaptive management,

monitor long term trends in biodiversity values and attainment of Key Performance Indicators; and

- Conclusion: This chapter describes the risk matrix to cross check activities against key risks to ensure the Regional OMP is comprehensive.

### 1.3.2 Information Management

Successful implementation of the Regional OMP will rely upon the sharing of skills, knowledge and resources, as well as careful monitoring of activities.

The sharing of information will be facilitated through the online Biodiversity Offsets Portal. This Portal has been designed to centralise and share information among authorised users and will include spatial data, an image library, reports and other non-spatial data as well as project management information such as stakeholder details and safety information. The Portal will greatly improve communication among stakeholders, transparency of management and monitoring activities and will ensure data security and integrity (e.g. preventing risks of data loss due to staff turnover and minimising the risk of using superseded information). Ultimately, this will result in improved decision making and adaptive management that is responsive to seasonal conditions and current operational challenges.

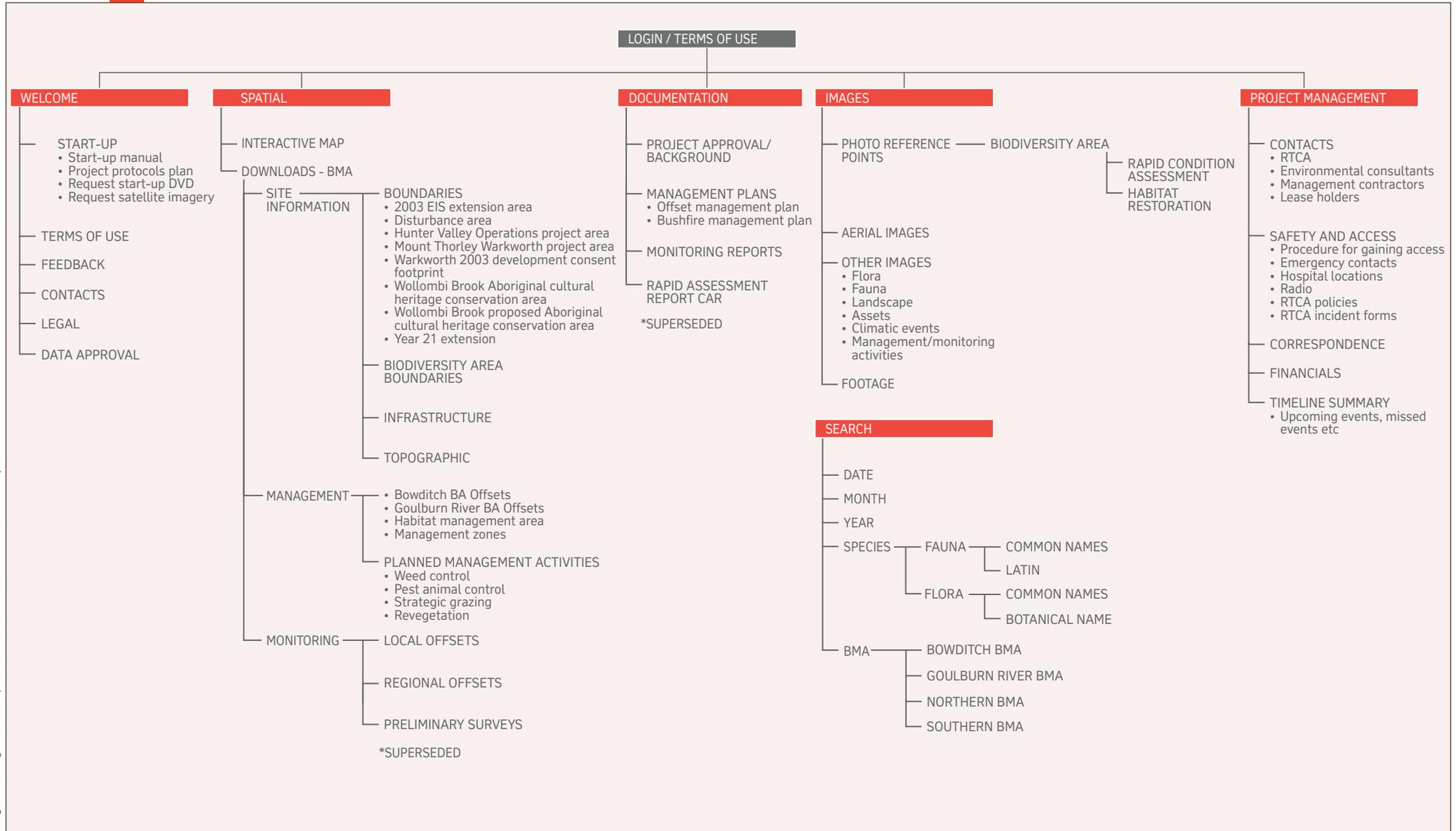
The Portal will also provide access to an Interactive Map that will allow users to visualise data in a geo-spatial context, assisting in data interpretation. This data will include aerial imagery, site information (e.g. cadastral, site access, topographic, infrastructure, geology) and data relating to management and monitoring activities. The Interactive Map will allow users to query information, turn layers on and off, mark up and print maps. This is an easy to use but powerful tool that does not require knowledge of Geographic Information Systems on the part of the user.

The following **Figure 2** provides an outline of the Portal and elements of the database that will form an important component in the overall planning, management and compliance of the Offset Areas.

Portal Structure

Regional Offset Management Plan

Figure 2



### 1.3.3 Key Project Stakeholders and Roles

The key project stakeholders are identified by their roles in **Table 2**.

**Table 2 Key Stakeholders Roles and Responsibilities**

<b>Roles</b>	<b>Responsible Entity</b>	<b>Details</b>
NSW Regulator: Administers Project Approval (PA 06_0261). Approves the Regional OMP and receives annual reports.	Department of Planning & Infrastructure (DPI)	Singleton Office Compliance (Mining) Mining & Industry Projects Department of Planning & Infrastructure <a href="http://www.planning.nsw.gov.au">http://www.planning.nsw.gov.au</a>
Commonwealth Regulator: Approval Conditions for EPBC Act – approval reference EPBC 2002/629. The Minister is to approve the Regional OMP.	Australian Government Department of the Environment	PostApproval@environment.gov.au
Project Proponent and land owner: Prepare and implement the Regional OMP and complete reporting.	RTCA	Principal Advisor - Offsets info@rtca.riotinto.com.au 1300 727 745
Leaseholder: Day to day management of the Biodiversity Areas, adhere to the Regional OMP and prepare quarterly reports.	Appointed by RTCA	
Biodiversity Auditor: Monitor improvement in condition of the biodiversity values.	RTCA	RTCA will engage suitably qualified person/s.

### 1.3.4 Review and Reporting

The Regional OMP will be reviewed in 2017 to update information on the condition of the habitats across the Offset Areas and refine conservation management strategies. The document may be updated on an irregular basis to amend changes to contact details, agency names or other secondary information.

Annual reports will be the critical tool to review the performance of the Regional OMP and adapt conservation management strategies. The reports will include a summary of monitoring data and management highlights.

The Annual reports will be prepared and submitted to DoE and DPI (as part of the Annual Environmental Report) and will include the following information as a minimum:

- Name and contact details of the Landholder and/or Leaseholder;
- List of conservation management activities undertaken, detailing scope of works, skill and expertise of the responsible entity/ies completing the works and performance;
- Monitoring results - all data will be correctly labelled with date, location and GPS points;
- An assessment of progress in attaining the conservation objectives against the key performance indicators;
- An assessment of any new risks or potential threats to the Offset Areas and actions to be undertaken to manage these threats and/or risks; and
- Where the proponent is proposing that the completion criteria have been achieved and the report is being submitted as the final report, the proponent must provide evidence that all conservation objectives and have been achieved in full.

## 2 Biodiversity Areas

The Regional OMP includes two BAs, namely the Goulburn River and Bowditch BAs, which are both located in the upper Hunter Valley close to the townships of Merriwa and Sandy Hollow respectively.

The BAs have previously been described in a series of reports to determine their suitability to offset the impact of Warkworth Mine extensions. Information from the following reports have been used to prepare this chapter.

- Cumberland Ecology (2013) Warkworth Biodiversity Areas – Baseline Fauna Investigations. Report prepared for Rio Tinto Coal Australia Pty Limited.
- DNA Environmental (2011) Biodiversity Management Plan for Warkworth Biodiversity Areas. Report prepared for Warkworth Mining Limited.
- Cumberland Ecology (2011) Additional strategic offsets for Warkworth extension: Bowditch, O'Brien & Hunt. Letter report to Rio Tinto Coal Australia Pty Limited.
- Cumberland Ecology (2009) Summary of initial site inspections of potential offsite offsets for the Warkworth extension. Letter report to Rio Tinto Coal Australia Pty Limited.

### 2.1 Location and description

The Goulburn River BA is approximately 1,539ha in total area. The property is known locally as 'The Rivers' and includes the convergence of the Munmurra and Goulburn Rivers. It is located west of the township of Merriwa, approximately 100km to the north west of the Warkworth Mine and HVO. It sits on the boundary between the Upper Hunter and Mid-Western Regional Local Government Areas (LGAs) but is wholly within the Hunter Local Land Services region (HLLS). The majority of the Goulburn River BA is located within the Brigalow Belt South Bioregion and the southern portion extends approximately 500m into the Sydney Basin Bioregion.

The Goulburn River BA includes Offset Areas for extension projects for two mines (HVO and Warkworth), which are required by two separate regulators. The Offset Area for:

- HVO South Project is required to satisfy the NSW regulator; and
- Warkworth Extension Project is required by the Commonwealth regulator.

The Bowditch BA is 607ha in area and located 3km north of Sandy Hollow and approximately 55km northwest of the Warkworth Mine. The property falls within the Muswellbrook LGA and within the HLLS in the Sydney Basin Bioregion.

**Table 3** and **Table 4** provide a summary of the location of the BAs and Offset Area details respectively.

**Table 3 Biodiversity Areas location details**

BA	Bioregion	Local Land Services Region	Local Government Area	Land Owner	Area (ha)	Location
Goulburn River	Brigalow Belt South / Sydney Basin	Hunter	Upper Hunter / Mid-Western	Warkworth Mining Limited	1,539	'The Rivers' 30km west of Merriwa, via Dulhunty Road, Comialla Road and Golden Hwy.
Bowditch	Sydney Basin	Hunter	Muswellbrook	Warkworth Mining Limited	607	3km north of Sandy Hollow, 3450 Wybong Road, via Golden Hwy.

**Table 4 Biodiversity Areas details of Offset Areas**

Biodiversity Area	HVO South Offset Area (ha)	Warkworth Offset Area (ha)	Non-offset Area (ha)	Total (ha)
Goulburn River	140	1,066	333	1,539
Bowditch		520	87	607
<b>Total</b>	<b>140</b>	<b>1,586</b>	<b>420</b>	<b>2,146</b>

The BAs strategically sit within a system of existing conservation reserves that protects the sandstone-based links between the Sydney, Hunter and Central West regions of NSW (DEC 2006) including Goulburn River National Park, Wollemi National Park, Yengo National Park, Putty State Forest, Manobalai Nature Reserve and Munmurra Nature Reserve. Their protection and enhancement will help facilitate the movement of fauna across the landscape and extend broad areas of suitable habitats for threatened fauna species.

The location of these BAs, their proximity to conservation reserves and the offset areas within each BA are shown in **Figure 3** and **Figure 4**.



**Photo: Sandstone rock formation at Goulburn River BA**



# Offset Areas within the Bowditch Biodiversity Area

Regional Offset Management Plan

Figure 4



## 2.2 Land-use history

The Goulburn River BA property was first purchased in the 1840s and in the earlier times supported numerous (at least four) families. Most of the river flat areas have been historically cleared for grazing. There are several sites of European and aboriginal cultural heritage, including Dulhuntly hut and grinding grooves.

Bowditch BA site has been generally cleared along the valley floors (approximately 10% of the property) for grazing. The vegetation of the lower foothills and upper sandstone escarpments has been left relatively free from agricultural disturbance.

## 2.3 Landform and Geology

The geology and geomorphology of the region is layered sedimentary rock that has weathered to produce a dissected landscape dominated by many deep eroded valleys, steep hills and cliffs with frequent outcrops of sandstone and conglomerate, escarpments, plateaus and narrow gorges. The Goulburn River BA consists of gently sloping foothills that grade into sandstone escarpments and ridge tops that surround the lower-lying river flats of the permanently flowing Goulburn and Munmurra Rivers. The Bowditch BA consists of numerous arms of low-lying valley floor habitat surrounded by steep sandstone hills and escarpments.

## 2.4 Vegetation Communities

Vegetation communities were broadly assessed during preliminary investigations by Cumberland Ecology (2009, 2011) and DnA Environmental (2011).

### 2.4.1 Goulburn River Biodiversity Area

The upper slopes and ridges typically contain two intergrading communities dominated by *Eucalyptus crebra* (Narrow-leaved Ironbark) - *E. sparsifolia* (Narrow-leaved Stringybark) and *Eucalyptus crebra* - *Eucalyptus punctata* var. *punctata* (Grey Gum). Other species that commonly occur within these communities depending upon location include *Callitris endlicheri* (Black Cypress Pine), *Allocasuarina luehmannii* (Bull-oak) and *Corymbia trachyphloia* (Brown Bloodwood).

The vegetation of the lower foothills forms four different intergrading communities with composition depending upon slope, geology and aspect. These communities include *Angophora floribunda* (Rough-barked Apple) woodland, *E. crebra* woodland *Eucalyptus dawsonii* (Slaty Gum) open woodland and *E. albens* (White Box) woodland. The *E. albens* woodland corresponds to the State and Commonwealth listed (Critically) Endangered Ecological Community (C/EEC) Box Gum Grassy Woodland.

Box Gum Grassy Woodland and Derived Native Grasslands also occurs on the river flats and valley floor with canopy species, where present, including *E. albens*, *E. melliodora* (Yellow Box) and *E. blakelyi* (Blakely's Red Gum). Most of the river flat areas have been historically cleared for grazing. Other remnant vegetation is present in some areas of the valley floor include communities dominated by *E. tereticornis* (Forest Red Gum) and *A. floribunda*. Large *Casuarina cunninghamiana* (River Oak) trees line some river bank portions. Regeneration of the canopy species was common in parts of the valley floor.

The vegetation communities at the Goulburn River BA are mapped in **Figure 5** and a breakdown of the area of each vegetation community is shown in **Table 5**

Two threatened flora species have been recorded within the Goulburn River BA and adjacent land. These are:

- *Pomaderris queenslandica*; and
- Tiger Orchid (*Cymbidium canaliculatum*).

*Pomaderris queenslandica* is listed as Endangered under the TSC Act. Tiger Orchid (*Cymbidium canaliculatum*) (*Cymbidium canaliculatum* in the Hunter Catchment) is listed as an endangered population under the TSC Act. There is potential habitat within the Goulburn River BA for a number of other threatened flora species previously recorded in the locality. These include *Homoranthus darwinioides* and *Kennedia retrorsa*.

**Table 5 Vegetation Communities at the Goulburn River Biodiversity Area**

Vegetation Community	Warkworth Offset Area (ha)	HVO Offset Area (ha)	Non Offset Area (ha)	Total
White Box Woodland (NSW EEC, C'wlth CEEC)	340			340
Narrow-leaved Ironbark Woodland	566	140		706
Slaty Gum Open Forest	69			69
River Oak Forest	25			25
Regenerating Blakely's Red Gum Shrubland	41			41
Rough-barked Apple Open Forest	25			25
Low quality Derived Native Grassland			232	232
Agriculture			101	101
<b>Total</b>	<b>1,066</b>	<b>140</b>	<b>333</b>	<b>1,539</b>

### 2.4.2 Bowditch Biodiversity Area

The upper slopes and ridges are dominated by Stringybarks, *E. crebra* and *Corymbia eximia* (Yellow Bloodwood). In these areas *Allocasuarina littoralis* (Black She-oak) is very common in the shrub layer. On the midslopes two different communities occur, dominated by either Stringybark and Scribbly Gum or an *E. crebra* and Wattle open woodland.

The flat valley floor has been historically cleared for grazing and these areas account for approximately 10% of the Offset Area. There is evidence of widespread native canopy regeneration, particularly in the northern valleys of the property, amidst scattered *Eucalyptus tereticornis* and *Angophora floribunda* old-growth trees. The ground stratum is comprised predominantly of native grasslands and a midstory and shrub layer is typically absent. Some areas of this low-lying valley floor community retain water, particularly along the drainage lines, and form temporary swamps during wetter periods such that the ground cover is dominated by sedges and rushes.

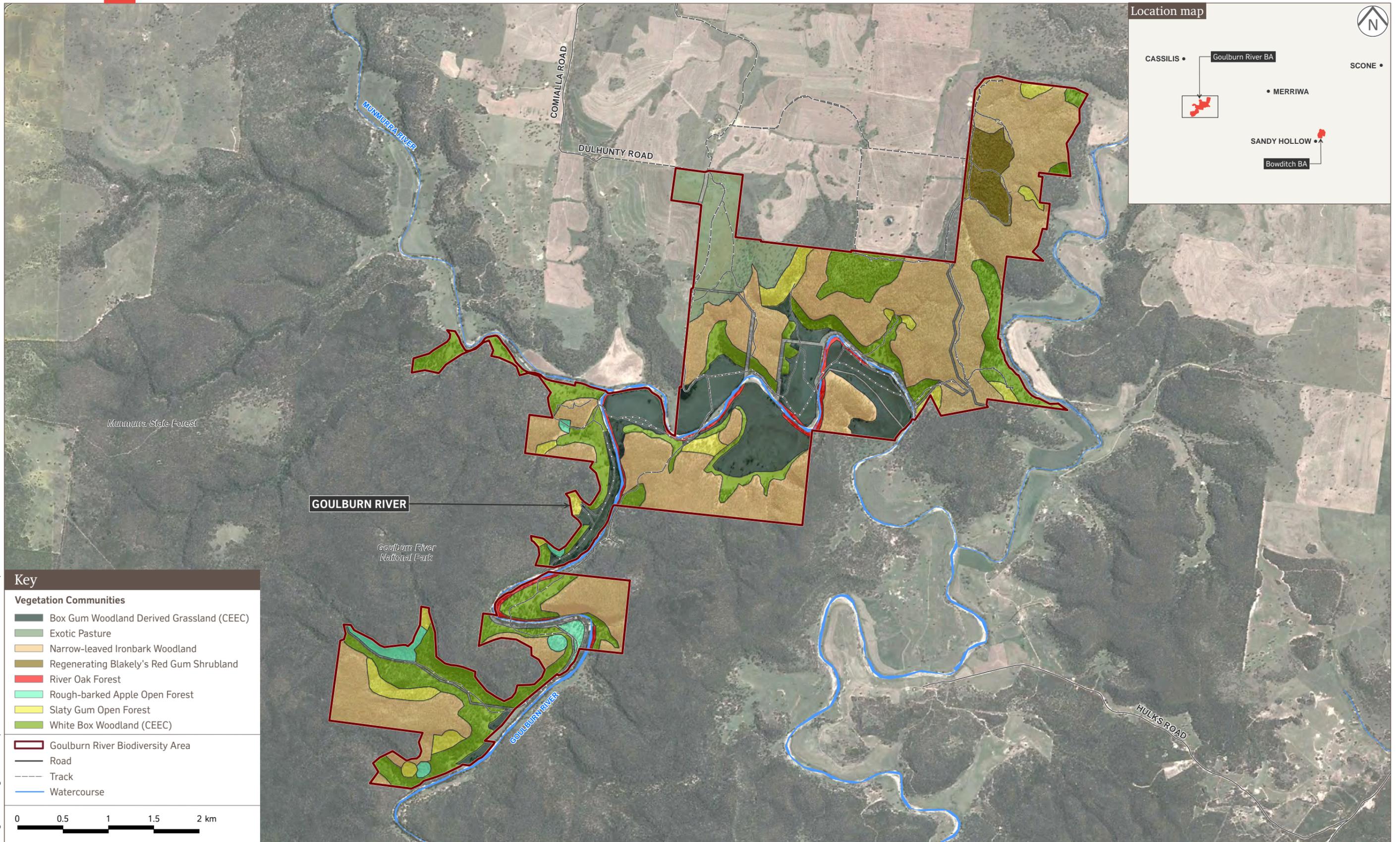
The vegetation communities at the Bowditch BA are mapped in **Figure 6** and a breakdown of the area of each vegetation community is shown in **Table 6**.

**Table 6 Vegetation Communities at the Bowditch Biodiversity Area**

Vegetation Community	Warkworth Offset Area (ha)	Non-Offset Area (ha)	Total (ha)
Narrow-leaved Ironbark Woodland	137	47	184
Narrow-leaved Ironbark/Currawang Woodland and Shrubland	38	31	69
Red Gum/Smooth-barked Apple/Narrow-leaved Ironbark Woodland	61		61
Yellow Bloodwood/Ironbark/ Scrub She-oak	3		3
Scribbly Gum/Yellow Bloodwood Woodland	257		257
Hunter Lowland Red Gum Forest	22	7	29
Dry Rainforest		2	2
Derived Native Grassland	2		2
<b>Total</b>	<b>520</b>	<b>87</b>	<b>607</b>

Vegetation Communities at the Goulburn River Biodiversity Area  
Regional Offset Management Plan

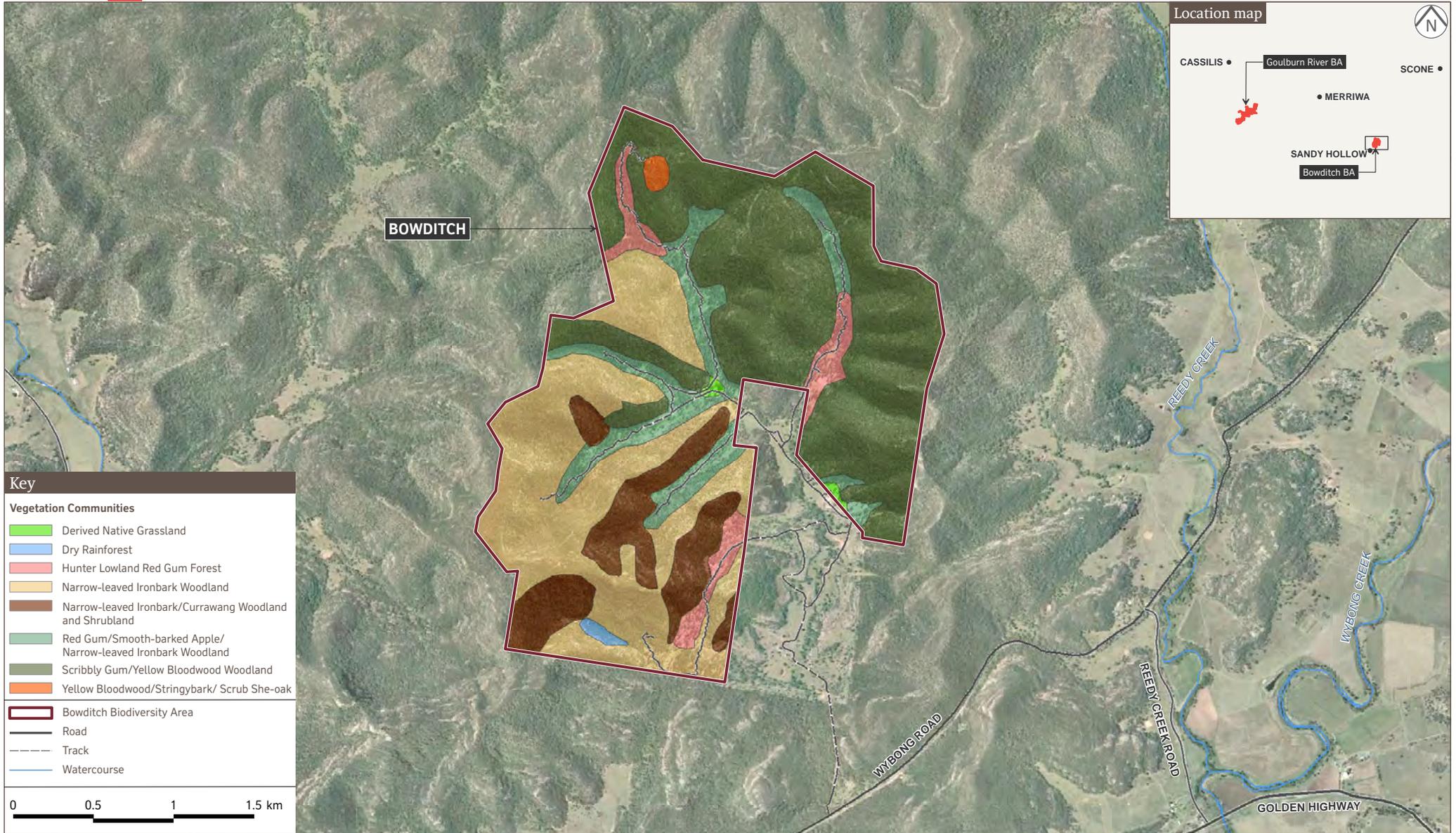
Figure 5



Vegetation Communities at the Bowditch Biodiversity Area

Regional Offset Management Plan

Figure 6



## 2.5 Habitat

The BAs sit within a system of reserves that protects the sandstone-based links between the Sydney, Hunter and Central West regions of NSW. The BAs support a wide range of fauna habitat features, including various forest and woodland communities with mixed age trees, grassland, waterbodies, hollow-bearing trees, rocky outcrops, forage resources and ground debris. These features provide suitable forage, shelter, breeding or roosting habitat for a range of fauna species.

The Warkworth Mine Approval Conditions require that the Offset Areas are protected and provide suitable habitat values for the Swift Parrot and Regent Honeyeater. Surveys of the BAs indicate that the vegetation communities present would meet their habitat requirements. Cumberland Ecology completed fauna surveys in 2012 and a summary of their assessment of potential for threatened or migratory and Marine species to occur at the BAs is provided at **Appendix B**. Both the Goulburn River and Bowditch BAs were assessed as moderate habitat for both the Swift Parrot and Regent Honeyeater.

### 2.5.1 Swift Parrot

The Swift Parrot is a predominantly nectarivorous, migratory species endemic to south eastern Australia (Birds Australia 2011). The species breeds in Tasmania and migrates to the mainland in winter, where it is most commonly found in dry, open eucalypt forests and woodlands containing Grey Box, White Box and Yellow Gum (Garnett and Crowley 2000; OEH 2012). The species is reliant on Box-Ironbark communities for winter foraging and movement is strongly associated with the availability of lerps and winter-flowering eucalypt species. Swift Parrots often occur in urban areas, including farmland with remnant patches of eucalypt woodland (DEC (NSW) 2005; Saunders and Heinsohn 2008).

Both Goulburn River and Bowditch BAs support forage habitat for Swift Parrots in the form of winter flowering mature and regenerating eucalypt species that also support lerps and a high proportion of mistletoes. For example, at Goulburn River suitable habitat areas include River She-oak mistletoes, valley eucalypt woodland and Box-Ironbark woodland on the slopes (Debus 2009; Debus 2011) while Bowditch BA offers Red Gum and Ironbark communities.

The Swift Parrot is considered to have the potential to occur in the Offset Areas, infrequently visiting to forage during winter migrations. The species may occur occasionally and in low numbers but is unlikely to visit these regions regularly every year. There are no Atlas records for the species within the locality of any of the Offset Areas (OEH 2011).

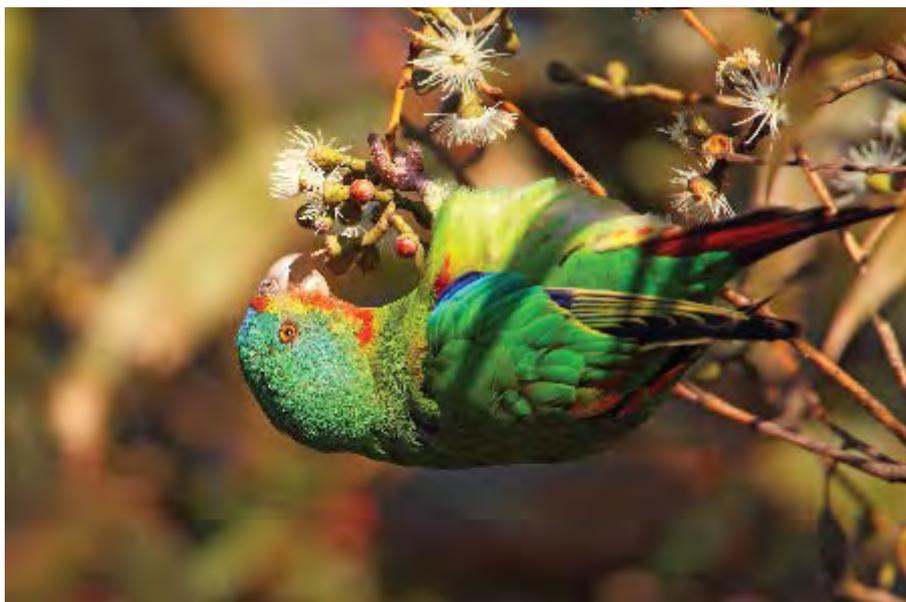


Photo: Swift Parrot (Chris Tzaros)

## 2.5.2 Regent Honeyeater

The Regent Honeyeater is a winter migrant endemic to south eastern Australia where it is widespread but sparsely scattered, and strongly associated with the western slopes of the Great Dividing Range (Garnett and Crowley 2000). The species is also known to forage and breed in Box-Ironbark woodland in the Hunter Valley region. It is found in temperate eucalypt forests and woodlands but prefers Box-Ironbark associations and River Oak riparian forest in wet, fertile sites along creek lines and river valleys (DEC (NSW) 2006).

The Regent Honeyeater is strongly nomadic and follows blossoming trees and mistletoe (Franklin, Menkhorst *et al.* 1989; NSW Scientific Committee 2004). Numbers fluctuate greatly between years and sites, and movement outside of breeding season is poorly understood. Only 1,500 individuals are thought to make up the single subpopulation of this species. Regent Honeyeaters forage in the canopy tops of mature feed trees, but roost in saplings (Oliver, 1998). This suggests that the species requires a more extensive area of habitat than other similar nectarivorous species.

Both Goulburn River and Bowditch BAs are within the known distributional range for the Regent Honeyeater and offer suitable breeding and winter forage resources in the form of mature flowering eucalypt trees, mistletoe, shrubland and River Oak forest. For example, preferred habitat at Bowditch includes Hunter Lowland Red Gum Forest, Narrow-leaved Ironbark Woodland, Red Gum/Smooth-barked Apple/Narrow-leaved Ironbark Woodland & Narrowleaved Ironbark/Currawang Woodland and Shrubland. The Goulburn River BA offers Box-Ironbark woodland, Red Gum woodland and River Oak Forest. There is also a high potential for the species to utilise forage resources at the Offset Areas due to the proximity of known records. The species has been known to occur in large flocks at Howes Valley (151 individuals recorded in 1994) (SEWPaC 2012) and at Goulburn River, Yengo and Wollemi National Parks and Munghorn Gap Nature Reserve. One of the three key breeding regions for the species is in the Capertee Valley (OEH 2012), south-west of the BAs.

The Regent Honeyeater is considered to have potential to occur in the Offset Areas during migrations. There are Atlas records for the species within the locality of Goulburn River BA (OEH 2012).



Photo: Regents Honeyeater (Chris Tzaros)

## 2.6 Baseline biodiversity condition assessment

### 2.6.1 Rapid Condition Assessment

The Offset Areas within the BAs are principally mature woodland communities with few management issues. Therefore, a Rapid Condition Assessment (RCA) technique was used as a preliminary assessment of woodland condition within the BAs. The RCA is derived from the 'Save the Bush Toolkit' technique (Wakefield and Goldney, 1997), which identifies the presence or absence of key habitat components and threatening processes.

This technique is not applicable to all types of native vegetation (e.g. native grasslands, wetlands or pastures) but is a quick and reliable way to assess the condition of woodland communities. Details of the more comprehensive monitoring programme, which is to be implemented in the long-term to complement the RCAs, are provided in chapter 5.

The RCA requires answering true or false to a series of questions, with a tally of the "True" scores indicating woodland health. Where answers are false, improved management in these areas may be required. Sites scoring 16 - 20 "trues" are generally considered to be areas of healthy vegetation that are sustainable under current management. Sites scoring 10 - 15 "trues" are generally considered to be areas of moderately disturbed bushland that have key elements missing and need improved management. Scores lower than 10 are highly disturbed and have many key elements missing. They are generally unsustainable under the current management and require improved management. These RCA attributes are listed in **Table 7** with an example score for relatively undisturbed woodland.

**Table 7 Rapid Condition Assessment attributes**

Remnant attribute	Site
Low grazing intensity - never farmed	True
Tree and shrub regeneration present (<2m)	True
Infrequent fire regime (<5year intervals)	True
Healthy mature trees (no dieback)	False
Little to no evidence of rabbits	True
Little to no evidence of foxes/cats	True
Low abundance of weeds (most remnants contain some weeds)	True
No evidence of firewood collection	False
No obvious signs of erosion or salinity	True
Not susceptible to fertiliser application, herbicide or pesticide drift	True
Less than 20% trees with Mistletoe (NB some mistletoe is healthy)	True
Few tracks, trails or fence lines	True
Presence of native shrubs	True
Presence of large, old growth trees with hollows	True
Dead timber is left standing	True
Fallen timber and logs are left on the ground	True
Abundance of native ground flora	True
Presence of litter, cryptogams, cracks and rocks	True
Remnant is large (> 5ha is optimum)	True
Connected to or in close proximity to other remnant vegetation	True
<b>Total No. True answers (x/20)</b>	<b>18/20</b>

A series of permanent RCA sites were established across the BAs in November 2013. All RCA were undertaken in areas of suitable habitat for woodland birds. Sites were selected near access tracks so that future access to the sites will be maintained. Additionally, the sites might act as early indicators of emerging threats given the greatest risks from threats are often at the more easily accessible areas.

Photo monitoring plots were also established at each RCA site such that a series of photos (north, east, south, west and ground) were taken at each plot. This will provide a visual record of any changes in vegetation and habitat condition. Two photo monitoring plots were also established in derived native grassland at the Goulburn River BA, outside the Offset Areas. The photo monitoring plots can be accessed from the online Biodiversity Offset Portal at <https://biodiversityoffsets.idsportal.com.au/login.asp>.

**Table 8** provides the number of RCA sites and photo monitoring plots within each Offset Area, along with the average health rating. The complete data sheets can be found at

**Appendix C.** The average health rating was assessed as 17/20, meaning the areas are healthy and sustainable under current management.

**Table 8 Rapid Condition Assessment summary results and Photo Monitoring points**

Biodiversity Area	Offset Area	Rapid Condition Assessment	Photo Monitoring Plots	Average Health rating
Goulburn River	HVO	2	2	19/20
	Warkworth	9	9	16/20
	Non-offset area	n/a	2	
Bowditch	Warkworth	8	8	16/20
	Non-offset area	1	1	17/20
<b>Total</b>		<b>20</b>	<b>22</b>	<b>17/20</b>



**Photo: Grass trees Bowditch BA**

## 2.6.2 Fauna Baseline

Cumberland Ecology completed field surveys in 2012 across the BAs. **Table 9** list the threatened, migratory and marine migratory birds listed under the NSW *Threatened Species Conservation Act 1995* (TSC Act) and EPBC Act recorded at the Goulburn River and Bowditch BAs. A total of 27 listed birds and mammal have been recorded, which included 4 migratory (Mi) and marine migratory (Ma) birds.

**Table 9 Threatened, Migratory and/or Marine Migratory species recorded at the Biodiversity Areas**

Scientific name	Common name	TSC Act	EPBC Act	Bowditch	Goulburn River
<b>BIRDS</b>					
<i>Pyrrholaemus saggitatus</i>	Speckled Warbler	V		X	X
<i>Circus assimilis</i>	Spotted Harrier	V			Adj
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle		Mi/Ma		X
<i>Hieraaetus morphnoides</i>	Little Eagle	V			X
<i>Apus pacificus</i>	Fork-tailed Swift		Mi/Ma		X
<i>Hirundapus caudacutus</i>	White-throated Needletail		Mi		X
<i>Ardea alba</i> (syn. <i>Ardea modesta</i> )	Eastern Great Egret				
<i>Calyptorhynchus lathami</i>	Glossy Black Cockatoo	V		X	X
<i>Climacteris picumnus victoriae</i>	Brown Treecreeper (eastern subspecies)	V		X	X
<i>Stagonopleura guttata</i>	Diamond Firetail	V			X
<i>Melithreptus gularis gularis</i>	Black-chinned Honeyeater (eastern subspecies)	V			X
<i>Merops ornatus</i>	Rainbow Bee-eater		Mi/Ma	X	X
<i>Daphoenositta chrysoptera</i>	Varied Sittella	V		X	X
<i>Pomatostomus temporalis temporalis</i>	Grey-crowned Babbler (eastern subspecies)	V		X	
<i>Glossopsitta pusilla</i>	Little Lorikeet	V			X
<i>Neophema pulchella</i>	Turquoise Parrot	V		X	X
<i>Ninox connivens</i>	Barking Owl	V			X
<b>MAMMALS</b>					
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheathtail Bat	V		X	X
<i>Mormopterus norfolkensis</i>	Eastern Freetail-bat	V		P	P
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V	V	X	X
<i>Chalinolobus picatus</i>	Little Pied Bat	V			X
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	V		P	
<i>Miniopterus australis</i>	Little Bentwing-bat	V		X	X
<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing-bat	V		X	X
<i>Nyctophilus corbeni</i>	Greater Long-eared Bat	V	V		X
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V		P	P
<i>Vespadelus troughtoni</i>	Eastern Cave Bat	V		P	P

### Abbreviations

**V – Vulnerable Mi – Migratory Ma – Marine Migratory**

**X – positively identified P- possible could not be verified Adj – Identified on adjacent land**

## 2.7 Management Zones

The BAs have been stratified into management zones (MZs) based on the type and condition of the vegetation communities and in accordance with the management strategies and actions to be implemented (detailed in Chapter 4). The distribution of vegetation types within each MZ is outlined in **Table 10** and the MZs are mapped in **Figure 7** and **8**.

### 2.7.1 Management Zone A – Foothills and escarpments

An Offset Area that include the foothills and upper sandstone escarpments of relatively undisturbed woodlands. Some areas are dominated by dense regrowth woodland and forests but seem relatively free from agricultural disturbance.

This zone requires minimal management intervention. Disturbance should be minimised and monitoring should be conducted to detect and manage emerging threats.

### 2.7.2 Management Zone B – Valley floor and floodplain

An Offset Area which includes open woodland communities where clearing and grazing disturbance has occurred along the valley floor on both BAs and along the floodplains of the Goulburn and Munmurra Rivers at the Goulburn River BA. In some areas tree and shrub regeneration is quite substantial and the regenerative potential of this zone is very good.

Low to moderate management intervention is required in this zone. Disturbance should be minimised to allow the native vegetation to regenerate. At the Goulburn River property, strategic grazing should be used to reduce bushfire hazards and control weed impacts. Monitoring will be conducted to evaluate management strategies and to detect and manage emerging threats.

### 2.7.3 Management Zone C - Derived Native Grasslands

This management zone within the Goulburn River BA is not within the Offset Areas. In the Bowditch BA this management zone is within the Offset Area. The condition of the Derived Native Grassland varies from grassland dominated by native grasses (e.g. *Austrostipa verticillata*) to pasture dominated by exotic annuals.

Moderate management intervention is required in this zone. Strategic grazing will be used to maintain diversity, encourage tree and shrub recruitment from adjoining woodland/forest communities and reduce bushfire hazards. Monitoring will be conducted to evaluate management strategies and to detect and manage emerging threats.

### 2.7.4 Management Zone D - Riparian Zone

This management zone is an Offset Area. The Riparian zone is in moderate condition with *Casuarina cunninghamiana* growing along sections of the Goulburn and Munmurra Rivers including some large old growth trees and scattered regenerating trees. The understory has generally been overgrazed and is dominated by exotic annuals with some native shrub species. Incision and degradation of the riparian system now prevents flooding of the floodplains. Some bed and bank erosion is evident after summer floods.

Low to moderate management intervention is required in this zone. Grazing in the riparian zone will generally be restricted, however, strategic grazing will be used in the short to medium-term to reduce bushfire hazards and control weed impacts. Monitoring will be conducted to evaluate management strategies and to detect and manage emerging threats.

### 2.7.5 Management Zone E - Agriculture

These are non-offset area and have sustained long-term grazing and cultivation, they are highly disturbed area.

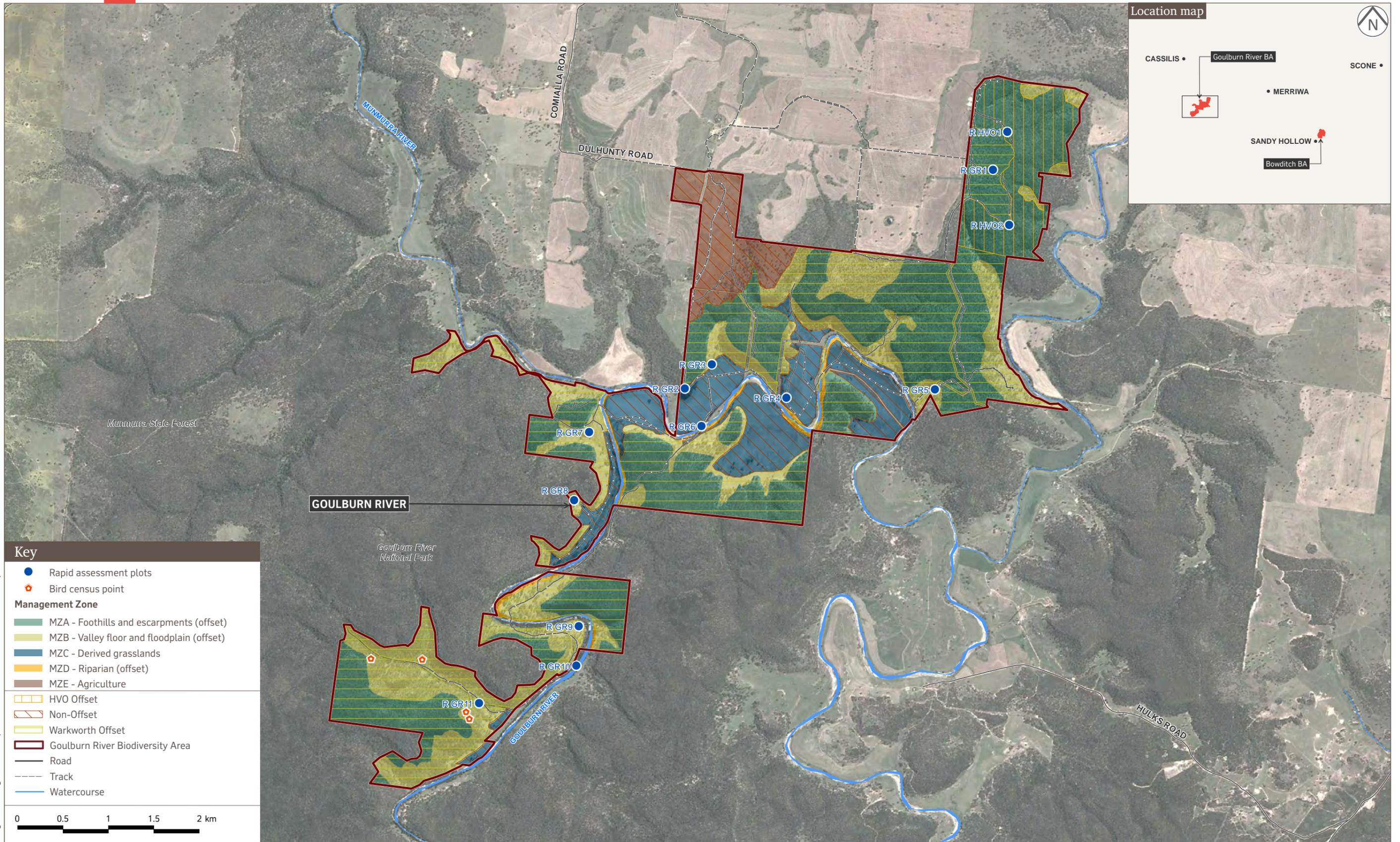
**Table 11** provides a breakdown on the RCAs conducted in each Management Zone and each vegetation community. For example, this indicates that the RCA conducted within Management Zone D – Riparian gave a health rating of 12/20. This result is an accurate representation of the disturbed River Oak Forest that occurs along the banks of the Goulbourn River.

Table 10 Distribution and area of vegetation communities within Management Zones

Zones	Location	Vegetation Type	Goulburn River			Bowditch		Total Area (ha)
			HVO (ha)	Warkworth (ha)	Non-offset Area (ha)	Warkworth (ha)	Non-offset Area (ha)	
MZA	Upper slopes and ridges	Narrow-leaved Ironbark Woodland	140	566		137	47	
		Regenerating Blakely's Red Gum Shrubland		41				
		Narrow-leaved Ironbark/Currawang Woodland and Shrubland				38	31	
		Scribbly Gum/Yellow Bloodwood Woodland				257		
		Dry Rainforest					2	
		Yellow Bloodwood/Stringybark/Scrub She-Oak				3		
Sub-total			<b>140</b>	<b>607</b>		<b>435</b>	<b>80</b>	<b>1262</b>
MZB	Foothills and valley floors	White Box Woodland (CEEC)		340				
		Rough-barked Apple Open Forest		25				
		Slaty Gum Open Forest		69				
		Red Gum/Smooth-barked Apple/Narrow-leaved Ironbark Woodland				61		
		Hunter Lowland Red Gum Forest				22	7	
Sub-total				<b>434</b>		<b>83</b>	<b>7</b>	<b>524</b>
MZC	Grassland	Low Quality Derived Native Grassland ( potential CEEC)			232	2		234
MZD	Riparian	River Oak Forest		25				25
MZE	Agriculture	Exotic pastures			101			101
<b>TOTAL</b>				<b>1066</b>	<b>333</b>	<b>520</b>	<b>87</b>	<b>2,146</b>

Management Zones at the Goulburn River Biodiversity Area  
Regional Offset Management Plan

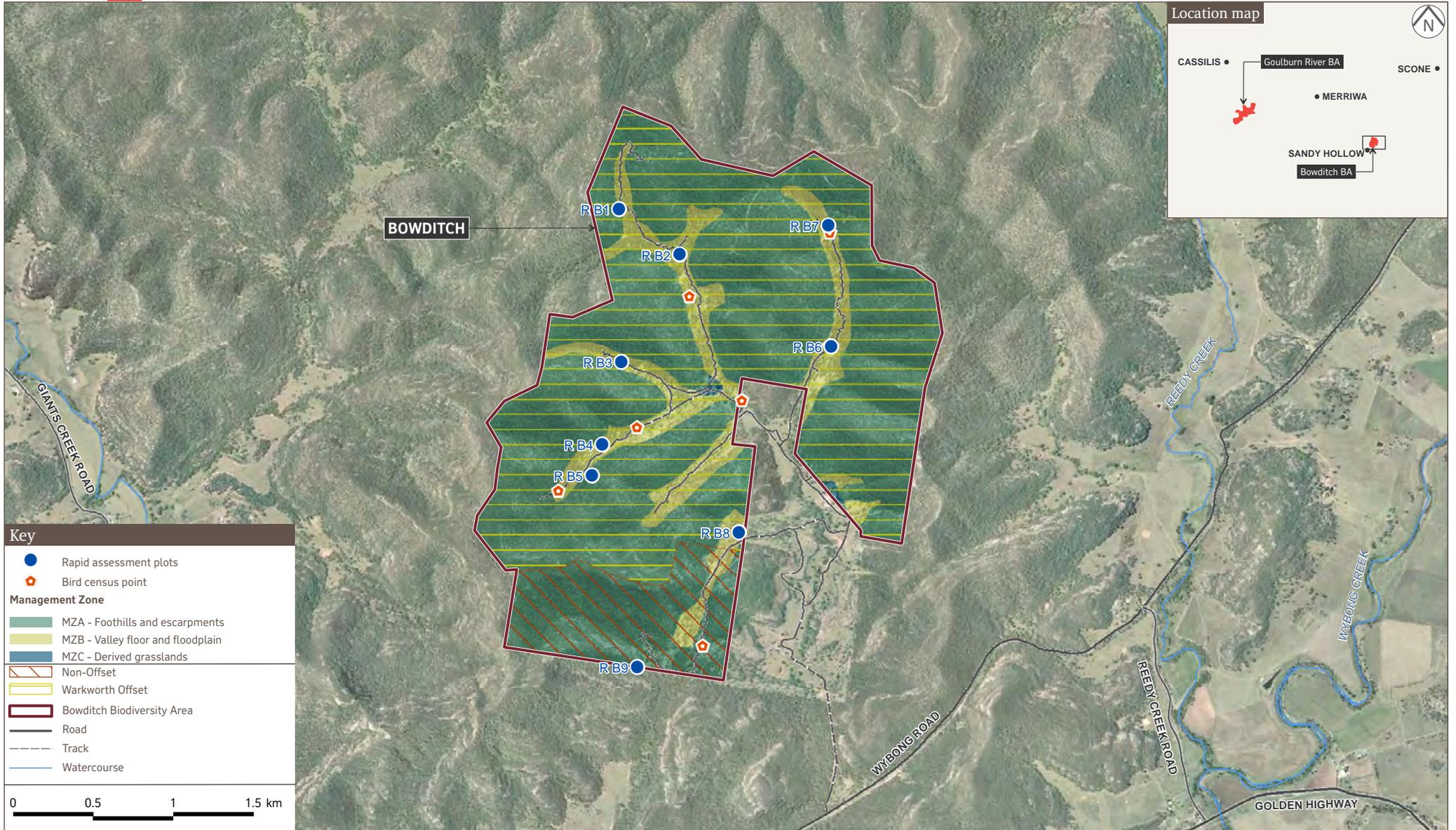
Figure 7



Management Zones at the Bowditch Biodiversity Area

Regional Offset Management Plan

Figure 8



**Table 11 Rapid Condition Assessment results by Management Zones, Plot Number and Vegetation Type**

Biodiversity Area	Offset Area	Management Zone	Number of plots	Plot Number	Vegetation Type	Health rating, respectively
Goulburn River	Warkworth	MZA	2	GR2	Regenerating Blakely's Red Gum Shrubland	20/20
				GR3	Narrow-leaved Ironbark Woodland	19/20
	MZB	5	GR5 and GR8	Slaty Gum Open Forest	18/20 and 16/20	
			GR7 and GR11	White Box CEEC	13/20 and 17/20	
			GR9	Rough-barked Apple Open Forest	15/20	
	MZD	2	GR6 and GR10	River Oak Forest	12/20 and 14/20	
	HVO	MZA	2	HVO1 and HVO2	Narrow-leaved Ironbark Woodland	19/20 and 20/20
Non-offset	MZC	2	GR3 and GR4	Low Quality Derived Native Grassland ( potential CEEC)	Photo Monitoring Plots only	
Bowditch	Warkworth	MZA	1	RB5	Narrow-leaved Ironbark Woodland	16/20
		MZB	7	RB1, RB6 and RB8	Hunter Lowland Red Gum Forest	14/20, 15/20 and 20/20
		RB2, RB3, RB4 and RB7		Red Gum/Smooth-barked Apple/Narrow-leaved Ironbark Woodland	15/20, 18/20, 13/20 and 17/20	
	Non-offset	MZA	1	RB9	Narrow-leaved Ironbark Woodland	17/20

## 3 Conservation Objectives, Key Performance Indicators and Completion Criteria

### 3.1 Conservation Objectives

All Offset Areas will be managed to achieve the following objectives:

- Maintain or increase the condition of the forest/woodland habitats of the Offset Areas;
- Enhance landscape connectivity within the Goulburn River National Park and within the surrounding landscape;
- Improve fauna movement and flora dispersal opportunities within the surrounding landscape;
- Provide refuge and habitat for local fauna populations and transient species, particularly threatened species;
- Provide an extension of protected reserves for threatened fauna species, including the Regent Honey-eater and Swift Parrot and other threatened fauna species known to occur in the area;
- Improve the integrity of the Goulburn and Munmurra Rivers and ephemeral gullies located within the Offset Areas, by functioning as a buffer to these areas as well as a habitat area; and
- Contribute to and enhance the existing network of protected vegetation within the Hunter Valley.

The conservation management strategies described in the following **Chapter 4** outline management activities that are permissible within the Offset Areas and aim to achieve the conservation objectives.

The methods to monitor the attainment of these objectives and provide feedback to adaptively improve land management are described in **Chapter 5**.

### 3.2 Key Performance Indicators

The Key Performance Indicators are aligned with the biodiversity values of the Offset Areas. The key biodiversity values across all the BAs are the ecological communities. Importantly, these communities support a range of “nested” conservation values that include:

- endangered flora and fauna; and
- habitat (watercourses / riparian vegetation / rocky outcrops)

**Table 12** and **Table 13** list the key biodiversity values and the nested conservation values for each BA, with their corresponding interim baseline description and key performance indicators. Note that the interim baseline metric has been developed using the Rapid Condition Assessment, fauna surveys and vegetation surveys undertaken during or prior to 2013. The first year of the ecological monitoring programme, outlined in Chapter 5, will complete the baseline ecological data sets and descriptions of baseline biodiversity values.

**Table 12 Goulburn River BA: Biodiversity Values and Key Performance Indicators**

<b>Biodiversity Value</b>	<b>Nested Conservation Value(s)</b>	<b>Description and baseline metric</b>	<b>Key Performance Indicator</b>
Woodland – Foothills and escarpments (MZA)		Total area: 747ha RCA Average Health rating -19/20	Maintain or increase area, connectivity and habitat condition over 15 years
	Fauna Habitat	Moderate potential habitat for Swift Parrot and Regent Honeyeater	Maintain or increase the condition and extent of habitat over 15 years
Woodland – Valley floor and flood plain (MZB)		Total area: 434ha (MZB) RCA Average Health rating -15/20	Observe an increase in area, connectivity and habitat condition over 15 years
	White Box Woodland (NSW EEC, C'wth CEEC)	Total area: 340ha (White Box Woodland) RCA Average Health rating -15/20	Observe an increase in area, connectivity and habitat condition over 15 years
	Fauna Habitat	Moderate quality potential habitat for Swift Parrot and Regent Honeyeater	Increase the condition and extent of habitat over 15 years
Derived Grassland (NSW EEC, C'wth EEC) (MZC)		Total area: 232ha	Observe a transition from Derived Native Grassland to White Box Woodland over 15 years
Forest – Riparian (MZD)	River Oak Forest	Total area: 25ha RCA Average Health rating – 13/20	Observe an increase in area, connectivity and habitat condition over 15 years
	Watercourse	No protection zone along Goulburn and Munmurra Rivers.	River protection through strategic grazing and/or construction of fences and/or off-stream watering points

**Table 13 Bowditch BA: Biodiversity Values and Key Performance Indicators**

<b>Biodiversity Value</b>	<b>Nested Conservation Value(s)</b>	<b>Description and baseline metric (December 2013)</b>	<b>Key Performance Indicator</b>
Woodland – Foothills and escarpments (MZA)		Total area: 515ha RCA Average Health rating 16/20	Maintain or increase area, connectivity and habitat condition over 15 years
	Fauna Habitat	Moderate quality potential habitat for Swift Parrot and Regent Honeyeater	Maintain or increase the condition and extent of habitat over 15 years
Woodland – Valley floor and flood plain (MZB)		Total area: 90ha RCA Average Health rating 16/20	Observe an increase in area, connectivity and habitat condition over 15 years
	Fauna Habitat	Moderate quality potential habitat for Swift Parrot and Regent Honeyeater	Increase the condition and extent of habitat over 15 years

### 3.3 Completion Criteria

The objectives will be deemed to be attained when the Key Performance Indicators defined in **Table 12** and **Table 13** have been achieved.

## 4 Conservation Management Strategies

This chapter outlines the management activities and methods to protect and enhance the biodiversity values of the Offset Area. It will focus on addressing the key threats to habitat of the Swift Parrot, Regent Honeyeater and White Box Woodland C/EEC, which include: clearing, fire, weed, feral animals, overgrazing and a lack of knowledge.

### 4.1 Controlled Activities

Under no circumstances are the following activities permitted within any of the Offset Areas:

- littering or dumping;
- removal of firewood, native plants or animals;
- removal of rocks, sand or gravel;
- clearing or destruction of native vegetation (unless required for to implement conservation action strategies, such as infrastructure construction or revegetation);
- hunting;
- trapping or shooting (unless controlling pest animals);
- use of fertilisers;
- aerial application of pesticide from planes or helicopters;
- continuous grazing;
- use of livestock feed; or
- keeping of European bee hives and domestic cats.

Farm dogs can be used for mustering purposes but are not permitted to roam without supervision or be used for hunting. They are to be humanely and securely housed when not working to reduce the risk of predation.

Vehicles may cause soil compaction, dispersal of weeds and vegetation disturbance. To minimise the impact vehicles on the BAs, vehicle access will be restricted to authorised personnel only. Wherever possible existing access tracks will be used and vehicle speed should not exceed a maximum of 40km/h.

Access to the regional offsets will be controlled through locked gates and fences and signs at main access points to inform all visitors they are entering a protected area. Locks and signs will be installed by Coal & Allied by the end of 2014.

### 4.2 Weed Control

Control of weed species is critical to restoring the natural composition, diversity and structure of the vegetation communities across the BAs. Weeds are typically non-indigenous plants which invade areas after significant disturbance, such as land clearing or over grazing. Weed control will focus on species that exclude or have the potential to exclude native species, disrupt recruitment of native species or impede ecological processes.

The Goulburn River BA is relatively devoid of noxious and perennial weeds and these were limited to scattered occurrences of *Opuntia stricta*, small patches of *Rubus fruticosus* along a river bank and *Verbena bonariensis* on some areas of the valley floors. Exotic species were generally limited to the more intensively grazed areas on the valley floors with the most common species being *Carthamus lanatus*, *Lolium rigidum*, *Arctotheca calendula*, *Erodium cicutarium*, *Vulpia sp.*, *Echium plantagineum*, *Trifolium* and *Medicago sp.* *Silybum marianum* may also be present in some of the stock camp areas.

At Bowditch BA, most of the grazed areas contained some level of exotic annual weeds including *Cirsium vulgare*, *Conyza bonariensis*, *Gomphocarpus fruticosus*, *Sida*

*rhombofolia*, *Hypochaeris radicata* and *Senecio madagascariensis*. Noxious weeds were limited to a few individuals of *Opuntia stricta*.

Noxious weeds declared under the *Noxious Weeds Act 1993* will be given priority for weed control. *Opuntia stricta* (Prickly Pear) is listed as a Class 4 Noxious Weed and has been recorded at both Goulburn River and Bowditch BAs. *Rubus fruticosus* (Blackberry) is also listed as a Class 4 Noxious Weeds and was recorded at Goulburn River BA. In addition, environmental weeds that pose the greatest risk to native species recruitment particularly of native grasses will also be controlled to some degree.

#### 4.2.1 Management Objective

To observe a decline in the abundance of noxious and environmental weeds across the Offset Areas over a period of five years.

#### 4.2.2 Method

The aim is to incorporate a variety of control methods and reduce the reliance on herbicides. This integrated weed management strategy will use of a range of suitable chemical and non-chemical control methods.

It is important to keep un-infested areas clear of weeds. Outbreaks in these areas will be a priority for intensive eradication and will be closely monitored to identify re-infestation or spread.

The preferred control methods are described in **Table 14**.

The use of chemicals in the BAs will be undertaken by accredited professionals with verified specific experience in native plant and weed identification and management. All chemical weed control will be in accordance with the registered label or current minor use permit, Material Safety Data Sheet (MSDS) and appropriate safety standards. Chemical use in the vicinity of waterways will be restricted to herbicides and adjuvants registered for use in or near aquatic environments.

Chemical weed control operations pose a substantial risk to successful natural regeneration processes unless carefully planned, implemented and monitored. Planning considerations relevant to weed control operations in natural or assisted revegetation areas include:

- Selection of personnel based on demonstrated experience and skill in selective weed control methods in regeneration areas; and
- Timing of proposed application in relation to recent or planned revegetation works.



Photo: Goulburn River BA

Table 14 Weed Control Methods

Control Method	Potential use in control regime
<p>Herbicide Control – is the application of chemical to kill the weed by interfering in the plants growth processes.</p>	<p><b>Land based control only:</b> Spot application of herbicide is the preferred method of application. Boom spray application is permissible in LMU3 as part of ground preparation for revegetation and in LMU4 for pasture establishment.</p> <p><b>Herbicides:</b> Only registered herbicides should be used for the control of the weed species and used in accordance with the directions on the label. Users have a legal obligation to read and follow the instructions on the label. Where appropriate, selective herbicides will be used to minimise impacts on native vegetation.</p> <p><b>Handling and application:</b> Herbicides must be handled and applied with consideration of their toxic nature and potentially harmful effects on human health, livestock and the environment. Only accredited and trained operators are permitted to apply herbicides. During application weather condition, nozzles, equipment and operator are to be closely monitored throughout application to reduce the risk of drift and subsequent off- target damage. Coarse to very coarse nozzles should be used to increase droplets size. Suitable weather conditions for spraying are extremely important.</p> <p><u>Weather guidelines</u></p> <ul style="list-style-type: none"> <li>• Read the product label and follow all label instructions.</li> <li>• Spray when wind is steady and ideally 3–15 km/h.</li> <li>• Avoid variable or gusty wind conditions.</li> <li>• Avoid calm conditions - small droplets may remain suspended for long periods.</li> <li>• Spray when wind blows away from sensitive areas.</li> <li>• Avoid spraying in temperatures above 28 °C.</li> <li>• Aim to spray when Delta T is between 2 and 8 and not greater than 10.</li> <li>• Do not spray when inversion conditions exist.</li> <li>• Aim to spray when the atmosphere is neutrally stable.</li> <li>• Most chemicals require a rain free period – check the label.</li> <li>• Be aware of local topographic and convective influences on wind speed and direction.</li> <li>• Record on-site weather conditions at spray time.</li> </ul> <p>For more detail please refer to <a href="http://www.bom.gov.au/info/leaflets/Pesticide-Spraying.pdf">www.bom.gov.au/info/leaflets/Pesticide-Spraying.pdf</a>.</p> <p><b>Reporting:</b> The Pesticides Regulation 2009 requires all commercial pesticide users (that includes farmers, leaseholders and spray contractors) to keep records on their pesticide application.</p>
<p>Land Management – good land management practices can reduce the incidence and impact of weeds.</p>	<p><b>Grazing Management:</b> Across the Goulburn River BA strategic grazing will be used to encourage desirable native grass and forb species. Annual weed establishment can be reduced by maintaining high groundcover levels and strong perennial plant cover. Over grazing is to be avoided.</p> <p><b>Weed hygiene:</b> All machinery is to be cleaned and washed down to reduce the spread of weed seed. New livestock being introduced to a property will be quarantined for several days, so any potential weed seeds can pass through their system in a known area and be treated later.</p> <p><b>Weed Identification:</b> Leaseholders and other key stakeholders visiting the Offset Areas will be required to report any new infestation of weeds.</p>
<p>Manual removal – removal of the weed plant and roots from the site.</p>	<p>Physical removal of new weeds, unearthing of root systems and containment and removal of seed.</p>

### 4.2.3 Implementation and Reporting

Control of noxious and environmental weeds will be the responsibility of Coal & Allied and the Leaseholder. The adaptive management monitoring programme requires regular observation of weeds within the Offset Areas. This will include identification and mapping of noxious and environmental weed infestations and the preparation and implementation of an annual weed control programme prepared by Coal & Allied in consultation with the Leaseholder. All control activities will be reported to Coal & Allied, including locations, method, date, duration and type and quantity of herbicide applied. This information will be provided through monthly reports that will be stored and accessed by the online Biodiversity Offsets Portal.

The impact of weeds will be observed through the monitoring programmes. This information will be used to monitor the success of the control methods.

### 4.2.4 Performance and completion criteria

	Year 1 PC	Year 2 PC	Year 3 PC	CC
Weed extent and density mapping	Baseline and year 1 revision completed as part of ecological monitoring programme	Year 2 revision completed as part of ecological monitoring programme	Year 3 revision completed as part of ecological monitoring programme	All revisions completed
Weed control programme	Weed control programme implemented, mapped and reported	Weed control programme implemented, mapped and reported	Weed control programme implemented, mapped and reported	All weed control events implemented mapped and reported
Weed species and extent		Minimum 5% Exotic Plant Cover as recorded during monitoring programme compared to previous year	Minimum 5% Exotic Plant Cover as recorded during monitoring programme compared to previous year	Weeds should not have spread to previously uninfested areas.  Overall reduction in of at least 10% Exotic Plant Cover as recorded baseline data and ongoing monitoring data.

## 4.3 Pest Animal Control

Many pest (or feral) animals pose a threat to native fauna through competition for habitat resources, degradation of habitat and direct predation. The recovery plans for Swift Parrot and Regents Honeyeater list the following key threatening processes, which are relevant to the pest animal control across the BAs:

- competition and grazing by the feral European rabbit;
- competition and habitat degradation by feral goats;
- competition from feral honey bees;
- environmental degradation caused by feral deer;
- predation by feral dogs;
- predation by the European red fox;
- predation by the feral cat; and
- competition from starlings.

In addition there are legal obligations to control pest animals under the Rural Lands Protection Act 1998. Listed animals for control observed across all BAs include:

- feral pig;
- European rabbit; and
- feral dog.

Other feral animals recorded during surveys at the Goulburn River and Bowditch BAs include feral cats, foxes and brown hares.

The Game and Feral Animal Control Act 2002 requires the control of feral deer.

#### 4.3.1 Management Objective

To observe a decline in the abundance of feral populations and evidence of damage across the Offset Areas over a period of five years.

#### 4.3.2 Method

An annual pest animal control programme is to be developed for the BAs by Coal & Allied in conjunction with the Leaseholder and the HLLS.

The target pest species will include feral pigs, dogs, foxes, cats, rabbits and hares.

A variety of control methods will be utilised provided they are:

- species specific (wherever possible);
- cause no or little damage to the natural environment;
- are humane;
- meet relevant Work, Health, Safety and Environment regulatory requirements; and
- are regularly monitored.

#### 4.3.3 Implementation and Reporting

The control of pest animals will be the responsibility of Coal & Allied and the Leaseholder. Coal & Allied will support participation in regional control programmes.

Pest animal control management activities will commence immediately, including participation in regional control programmes coordinated by HLLS and control by current tenants. Annual control programmes are to be prepared by the end of 2014 to allow Leaseholders to contribute to the development of the programme.

All control activities are to be reported to Coal & Allied, including locations, method, date, duration and estimate of number of target pest animals controlled. This information will be stored and accessed by the online Biodiversity Offsets Portal.

The pest management programme will be guided by regular observation by the Leaseholders and information gathered through the monitoring programmes.

#### 4.3.4 Performance and completion criteria

	Year 1 PC	Year 2 PC	Year 3 PC	CC
Pest control and monitoring	At least one control period complete. Report complete and recommendation followed	At least one control period complete. Report complete and recommendation followed	At least one control period complete. Report complete and recommendation followed	All control events completed and reported

## 4.4 Strategic Grazing

Strategic grazing will be used as a powerful management tool to enhance vegetation in MZC and MZE by promoting regeneration, controlling weeds and erosion, and reducing excessive fire fuel loads. Strategic grazing links grazing to the available resources and is a recognised management tool in the restoration of degraded vegetation communities. To ensure that the correct balance is achieved and grazing doesn't impede restoration, adaptive management monitoring of grazing is to be used to reduce the risk of overgrazing.

The strategic grazing principles to guide grazing across the MZC and MZE include:

- plants need adequate rest, and rest periods are adjusted to suit the recovery needs and growth rates of the desirable plants;
- stocking rates are regularly adjusted to match the current carrying capacity of the available landscape;

- grazing plans are proactive and require continual monitoring and control;
- periods of grazing should be as short as practical; and
- aims to increase species diversity amongst plants, animal and soil biology

Strategic grazing regimes will be matched to the site conditions and management outcomes, and will use trigger points to commence and cease grazing. The trigger points will be based on estimates of grassland condition and ground cover, which will be assessed on a monthly basis by the Leaseholder. The ecological monitoring programme (in Section 5.2) will observe, in detail, the impact on indicators such as native plant recruitment and weed abundance. In addition, quarterly agriculture audits, undertaken by an Agricultural Auditor on behalf of Coal & Allied, will help monitor the impacts of the grazing regimes.

Beef cattle will be the approved livestock used for strategic grazing as they are less selective in their grazing. They are able to graze many of the taller and more fibrous native grasses in the area and can effectively graze paddocks dominated by Plains Grass (*Austrostipa aristiglumis*).

Continuous grazing of paddocks must be avoided, as it results in the elimination of the more palatable species of native grasses and forbs, including lilies and orchids. No continuous grazing is permitted in MZA, MZB or MZD.

Recruitment of native plants can be enhanced by timing strategic grazing to avoid periods when desired native plants are in flower and setting seed. Native and exotic grasses vary in their time of maximum growth, flowering and seeding. Hence it is critical to know what species are present when planning a strategic grazing regime. Therefore management is to be based on observation and experience rather than strict prescription.

#### 4.4.1 Management Objective

To observe an increase in native species % cover over a five year period and maintain groundcover to control weeds and prevent erosion across the BAs.

#### 4.4.2 Method

Beef cattle will be the approved livestock used for strategic grazing, as they are less selective in their grazing. Grazing will not be permitted in MZA, MZB and MZD, except when there is a need to reduce potential fire hazard risk or to control weeds. Permission must be granted by Coal & Allied. Coal & Allied will advise DoE and P&E of any grazing occurring in these management zones.

The amount of feed available will influence stocking rates and duration of grazing. This may vary from one grazing period to the next. In a general sense a strategic grazing regime will take into account:

- timing of grazing;
- intensity of grazing;
- frequency of grazing; and
- duration of grazing.

Strategic grazing regimes will be aimed at encouraging native grasses, and will use trigger points to commence and cease grazing as outlined in **Table 15**. An average ground cover of 100% should be maintained at all times. Data on the impact of strategic grazing will be collected on a monthly or quarterly basis by the Leaseholder, as described in the Adaptive Management Monitoring (Chapter 5.5). The Adaptive Management Monitoring will be reviewed annually by the Biodiversity Auditor as part of the Rapid Condition Assessment monitoring to ensure the leaseholder is reporting accurately.

Table 15 Targeted strategic grazing regimes

Management outcomes	Targeted strategic grazing regime
Reduce Exotic Grasses and Weeds	<p>MZE</p> <p><b>Trigger point:</b> Observed pasture condition in spring has an annual exotic grass or weed component greater than 15% of ground cover and perennial native grass component less than 40% of ground cover.</p> <p><b>Summer</b></p> <p>Maintain 2,000-4,000kg Dry Matter/ha (sward height 10-20cm). Encourage high plant litter levels to minimise the bare ground that favours annual grass/weed germination.</p> <p>Aim for 90 to 100% ground cover.</p> <p><b>Autumn</b></p> <p>Keep grazing pressure low or defer grazing until late winter/spring to crowd out germinating annual grasses/weeds.</p> <p><b>Winter</b></p> <p>Increase frequency of grazing. Do not reduce groundcover below 90%. Note: during winter St John's Wort is less toxic to livestock.</p> <p><b>Spring</b></p> <p>Use short-term high density grazing to control annual grass/weed growth and restrict seed set. Graze to 1,500 -2000kg Dry Matter /ha (sward height 5-10cm).</p> <p>Reduce grazing pressure before stem elongation of native grasses.</p>
Encourage Perennial Native Grasses	<p>MZC</p> <p><b>Trigger point:</b> Observed pasture condition of perennial native grass component greater than 40% of ground cover and desired native species presence less than 7 plants per square metre (low diversity).</p> <p><b>Summer</b></p> <p>Maintain a minimum of 90-100% ground cover, with plant residue levels of between 2,000 and 3,000kg Dry Matter /ha (sward height 10-20cm).</p> <p><b>Late Summer</b></p> <p>Retain high plant litter levels to minimise the bare ground that favours annual grass/weed germination.</p> <p><b>Late Summer/Early Autumn</b></p> <p>Retain minimum of 90% ground cover, including dry standing residue and litter. Good ground cover is needed to reduce the risk of erosion from high intensity storms.</p> <p>Allow a minimum 8 week recovery (no grazing) to allow setting of grass seeds at least every second year.</p> <p><b>After Autumn Break</b></p> <p>Monitor and assess establishment of native grass seedlings. Graze to residue of 2,000kg Dry Matter /ha (sward height 10 cm) to protect seedlings.</p> <p><b>Winter</b></p> <p>Reduce grazing interval (increase recovery period) to match plant growth.</p> <p><b>Spring</b></p> <p>Shorten grazing intervals to match growth rates. Additional grazing pressure may be needed where exotic annuals dominate. Graze to 2,000kg Dry Matter/ha (sward height 10cm). Prevent annual weeds from seeding during spring.</p> <p>If adequate native grass seed heads emerge in the late spring, rest to increase seed production of the native species, as well as replenishing energy reserves prior to summer.</p>

#### 4.4.3 Implementation and Reporting

Leaseholders will be required to submit Adaptive Management Assessment reports when cattle are grazing in BAs, as detailed in the Adaptive Management Monitoring (Chapter 5.5), in conjunction with data from Ecological Monitoring programmes, the effects of strategic grazing regimes will be closely monitored and adapted where required.

#### 4.4.4 Performance and completion criteria

	Year 1 PC	Year 2 PC	Year 3 PC	CC
Stocking rate management and monitoring	Monthly Adaptive Management assessment reports submitted and strategic grazing regimes adapted accordingly	Monthly Adaptive Management assessment reports submitted and strategic grazing regimes adapted accordingly	Monthly Adaptive Management assessment reports submitted and strategic grazing regimes adapted accordingly	All Adaptive Management assessment reports submitted and stocking rates managed to trigger points
Native vs exotic plant % cover	Monitoring completed as per schedule	Monitoring completed as per schedule	Monitoring completed as per schedule	Overall positive trend of increase in native species % cover and decrease in exotic species % cover as recorded in monthly Adaptive Management and ecological monitoring data

## 4.5 Revegetation

To achieve an increase in the extent and condition of the ecological communities, a range of revegetation techniques may be adopted including assisted natural regeneration, replanting and regrowth management.

### 4.5.1 Management Objective

To observe an increase in native plant abundance and diversity across the BAs over a period of ten years.

### 4.5.2 Method

#### Assisted natural regeneration

To assist natural regeneration across the BAs, a strategic grazing regime will be used that is suited to the site requirements, as described in the previous chapter. The MZA, MZB and MZD will be excluded from grazing, except when there is a need to reduce potential fire hazard risk or control weeds. Permission must be granted by Coal & Allied.

#### Replanting and Seed Collection

Replanting involves the establishment of indigenous plants to create self-sustaining functional remnant vegetation communities. Replanting will be undertaken in areas that have been highly disturbed, have lost the ability to regenerate naturally and/or require soil stabilisation. Replanting techniques may include direct seeding or planting of tube stock.

The following activities described in **Table 16** are to be followed.

**Table 16 Replanting activities**

Activity	Minimum requirement
Species selection	Species selected are to be listed on the description of the vegetation communities issued by the NSW Scientific Committee or NSW government description. Seed can be collected from site or regionally from equivalent vegetation communities.
Cultivation	Cultivation for tube stock planting should be to a depth of 500-600mm at least 6 months prior to planting and when soil moisture is low to improve sub surface soil shatter. Cultivation for direct seeding may include light soil scarification.
Preplant weed control	Chemical control of weeds at least 1week prior to planting or seeding. An area of at least 1m diameter around each tree or seeding patch is to be sprayed to remove all competition for site resources.
Tube stock planting	Planting must only occur when there is suitable soil moisture, typically 1 -2 days after 25mm of rainfall, in spring or autumn. Tube stock is to be at least 25mm in height, with a well-established root system and in good condition. The tube stock root plug is to be saturated at the time of planting. Soil conditioner is to be applied into the planting hole and all plants should be planted deep, with their root plug at least 50mm below ground and gently firmed in to remove any air pockets in the soil.

Activity	Minimum requirement
Direct seeding	Seed is to be free of weed seed. Seeding must only occur when there is suitable soil moisture, typically 1 -2 days after 25mm of rainfall, in spring or autumn.
Mulching / weed mat	Tube stocks are to have weed mats installed at the time of planting to provide longer term control of competition.
Watering	Watering is to occur at the time of planting or seeding, and if required for 6 months post planting.
Maintenance	Maintenance period should apply for at least 18months.

It is preferable that seed for planting and seeding activities is from local or endemic provenances. Therefore, it will be permissible to collect seed from remnant patches of vegetation communities across the property. However seed collection must be for non-commercial purposes and meet the standards of the "Guidelines and Codes of Practice" developed by Florabank ([www.florabank.org.au](http://www.florabank.org.au)), or subsequent equivalent, and the following limitations and permissions apply:

- Collect seed in the BA only if seed of the particular species and genotype is not available elsewhere or if the seed collected is intended for seedlings that will be planted within the BA;
- Seeds may be collected from within endangered ecological communities;
- Seeds may not be collected from species individually listed on schedules 1, 1A or 2 of the TSC Act without prior written approval from the Director General, or under a licence granted under S132c of the Act or S91 of the TSC Act;
- Seeds may be collected from any protected species listed under Section 131 (Schedule 13) of the TSC Act; and
- Seeds may be collected from any other native species.

### Regrowth management

Very dense stands dominated by Eucalyptus saplings can occur after significant site or soil disturbance, locking the vegetation community in an unnatural state. These stands prevent the recruitment of other species and are unlikely to achieve the biodiversity and conservation objectives in the longer term. Regrowth control or thinning of these stands will ensure that a diverse and sustainable woodland community is established with a similar structure, function and composition to the medium to high quality woodlands occurring within the BAs.

Thinning of regrowth will be undertaken according to techniques specified in "A Guide to Managing Box Gum Grassy Woodlands" (Rawlings, 2010). Permits under the *Native Vegetation Act 2003* will be required to for thinning activities, therefore sound ecological evidence will be required to support this activity.

### 4.5.3 Implementation and Reporting

The strategic grazing regime to assist natural regeneration is a shared responsibility held by the Leaseholder and Coal & Allied. This is not expected to be fully operational until 2014. The data generated from the monitoring programmes is to be analysed on a quarterly basis by Coal & Allied to ensure that grazing regimes are not causing harm to the ecological communities.

Replanting activities are likely to commence in 2015 and these operations will be administered by Coal & Allied. Seed collection activities will also be administered by Coal & Allied.

All revegetation activities are to be reported to Coal & Allied, including location, area, method and date. This information will be stored and accessed by the online Biodiversity Offsets Portal.

#### 4.5.4 Performance and completion criteria

	Year 1 PC	Year 2 PC	Year 3 PC	CC
Seed collection and replanting activities of Goulburn River BA	Review monitoring data to identify areas that require re-planting.  If re-planting is identified, develop a re-establishment plan and implement within 12 months	Review monitoring data to identify areas that require re-planting.  If re-planting is identified, develop a re-establishment plan and implement within 12 months	Review monitoring data to identify areas that require re-planting.  If re-planting is identified, develop a re-establishment plan and implement within 12 months	BA contain species and a density of plantings representative of the target vegetation type and is self-sustaining.
Monitoring	Monitoring of replanting areas undertaken	Monitoring of replanting areas undertaken	Monitoring of replanting areas undertaken	Monitoring of replanting areas completed

## 4.6 Infrastructure Maintenance/Improvement

Construction of new or maintenance of existing infrastructure will be required to manage stock access to the Offset Areas and provide safe access for Leaseholders, consultants, contractors and Coal & Allied personnel. Construction or maintenance activities may cause localised site disturbance. To protect biodiversity and cultural heritage values a ground disturbance permit checklist will be adopted. This will ensure compliance with all legal and environmental protection measures, such as the *Native Vegetation Act 2003*.

### 4.6.1 Management Objective

To maintain and construct infrastructure that support the implementation of the OMP, with minimal impact on biodiversity values, erosion control measures and compliance with all regulatory requirements.

### 4.6.2 Method

The following are the permissible actions and guidelines for the construction or maintenance of infrastructure, such as access/fire trails, fences, stockyards, water troughs and pipes:

- Vegetation clearing is permissible, as per the Native Vegetation Regulation 2013 for central regions, for:
  - (a) permanent boundary fence - ten metres either side;
  - (b) permanent internal fence - ten metres total width of clearing;
  - (c) temporary fence - three metres total width of clearing; or
  - (d) road or track - six metres total width of clearing.
- constructed fences will be stockproof and native fauna friendly (no barb wire is to be used for the top two wire strands);
- fallen timber and any other obstructions can be removed to maintain access;
- standing timber that poses an unacceptable safety risk can be felled;
- all works will be undertaken in a manner that minimises disturbance to soil and hydrological characteristics, and avoids erosion, as per OEH guidelines *Erosion and sediment control on unsealed roads* (OEH 2012);
- old fences will be removed and unwanted tracks closed within the Offset Area; and
- site disturbance may be required to facilitate revegetation activities.

### 4.6.3 Implementation and Reporting

The Coal & Allied Ground Disturbance Permit (GDP) checklist will be adopted to ensure compliance with all legal and environmental protection measures prior to any significant disturbance.

A description of the activity is to be provided to Coal & Allied and work cannot commence until checklist is completed and approved.

The GDP checklist considers the impact of the disturbance on:

- cultural heritage – search relevant sources to determine their presence;
- land ownership and tenement – ensure action is located on land owned or managed by Coal & Allied;
- environment – search relevant sources to identify presence of listed ecological communities, flora or fauna;
- regulatory approval – legal authority for the action;
- rehabilitation – requirement for rehabilitation; and
- water – potential water impacts and mitigation.

All infrastructure improvements will be recorded to Coal & Allied via the quarterly audits. All relevant information will be stored and revised geographic information layers will be accessed by the online Biodiversity Offset Portal.

Routine inspections and maintenance of infrastructure (access/fire tracks, fence lines and gates) will be undertaken to ensure they are to standard and fit for purpose.

### 4.6.3 Performance and completion criteria

	Year 1 PC	Year 2 PC	Year 3 PC	CC
Access track mapping and access point signage and security	Map all internal trails install signposts and locks on key access points.			Mapped and installed.
Fence mapping showing fencelines and gate types, redundant fences and fences to be retained	Map all internal fences			Mapped.
Fence maintenance		Initiate maintenance based on inspection results		All fences maintained and in sound condition.
Redundant fence removal	Redundant fences identified and removal commenced	Redundant fence removal to continue	Redundant fence removal to continue	No redundant fences
Annual inspections and issues rectified within 4 weeks if possible	To be completed annually and a record of maintenance kept.	To be completed annually and a record of maintenance kept	To be completed annually and a record of maintenance kept	All annual inspection completed.

## 4.7 Fire Management

Bushfire prevention is required under the *Rural Fires Act 1997*. The absence of fire and the reduction of livestock grazing will lead to a build-up of fire fuel and risk of high intensity bushfire. Both Coal & Allied, as the owner, and the Leaseholders, as the occupiers of the land, are required to take practicable steps to prevent the occurrence of bush fires on the land and minimise the spread of bushfire. Coal & Allied, with assistance from the Liverpool Range Rural Fire Service, have prepared a Bushfire Management Plan which identifies fire risks, control measures and communication procedures.

The quick identification of a threatening bushfire, notification of the Rural Fire Service and suppression is the primary goal.

All Leaseholders, as a condition of their lease agreement, will be encouraged to have at least one occupier of the properties as a member of the Rural Fire Service. Coal & Allied will provide maps and contact details of the properties to the Rural Fire Service.

### 4.7.1 Management Objective

To protect lives, biodiversity values and infrastructure assets from the impacts of bushfires.

### 4.7.2 Method

Key control measures will focus on:

- documentation of access and water supply points for suppression activities;
- use of grazing to reduce fuel build-up along potential ignition sources, such as public roads, prior to the fire season;
- use of cool burns (with any required approvals and/or permits from Rural Fire Service) to reduce fuel build-up to protect biodiversity and nested conservation values;
- establishment of asset protection zones around priority infrastructure;
- investment in water and other fire suppression assets; and
- communication of Bushfire Management Plan and response procedures with key stakeholders, including Leaseholders, neighbours, consultants, contractors and employees.

Any fuel hazard reduction burns will be planned in accordance with the Bush Fire Environmental Assessment Code for New South Wales (Rural Fire Service, February 2006) and the guidelines contained in the Threatened Species Hazard Reduction Lists for the Bush Fire Environmental Assessment Code.

Current recommendations under the Code are:

- in woodland vegetation, fire should not occur within 5 years of a previous fire and consideration should be given to burning within 40 years of any previous fire; and
- in grassland vegetation derived from the woodland vegetation, the recommended fire intervals are the same as woodland vegetation.

### 4.7.3 Implementation and Reporting

Annual meetings will be held between Leaseholders, Rural Fire Service and Coal & Allied to review the Bushfire Management Plan and prepare the annual actions list to prepare for the proceeding fire season.

Any fire incidents will be recorded via the quarterly Agriculture Audit reports and relevant information captured on the online Biodiversity Offsets Portal. All relevant fire protection and mapping information will be stored and accessed by the online Biodiversity Offsets Portal.

### 4.7.4 Performance and completion criteria

	Year 1 PC	Year 2 PC	Year 3 PC	CC
Bushfire Management Plan for Regional BAs	Implemented Review and revise if required	Implemented Review and revise if required	Implemented Review and revise if required	All required actions of BFMP have been implemented  BFMP has been reviewed annually and revised if required

## 4.8 Erosion Control

Soil erosion occurs when vegetation has been removed exposing bare soils, making them susceptible to erosion where water flow is able to mechanically remove or disperse the soil. This often occurs along creek lines but can occur in bare paddocks where vegetation clearing or over grazing exposes bare soils. Bare soils in locations where high volumes of water occur can lead to severe soil erosion.

### 4.8.1 Management Objective

To minimise the erosion and sedimentation of land, watercourses and waterbodies within the BAs.

### 4.8.2 Method

There is some potential for erosion to occur within the BAs. Management options for erosion control include excluding grazing (discussed in section 4.2.4 above), controlling vehicle access, maintenance of tracks and rehabilitation of drainage lines, watercourses and riparian areas where significant erosion impacts are identified.

### 4.8.3 Implementation and reporting

Erosion within the Offset Areas area will be monitored through inspections by Coal & Allied and Leaseholders, as well as other observations recorded during the adaptive management monitoring programme. Appropriate erosion remediation measures will be undertaken in consultation with the HLLS and NSW OEH.

### 4.8.4 Performance and completion criteria

	Year 1 PC	Year 2 PC	Year 3 PC	CC
Annual inspections and reporting	Completed, trends identified and ameliorative measures implemented	Completed, trends identified and ameliorative measures implemented	Completed, trends identified and ameliorative measures implemented	Annual reports completed

## 4.9 Cultural Heritage

Any cultural heritage sites or values identified will be recorded and managed to ensure their protection. Management of cultural heritage sites will be aligned with the Rio Tinto Coal Australia Cultural Heritage Management System and the NSW OEH Due Diligence Code of Practice for the Protection of Aboriginal Objects, to guide the protection of and interaction with the sites across the BAs.

The location and information relating to cultural heritage sites will be stored and accessed from the online Biodiversity Offsets Portal.

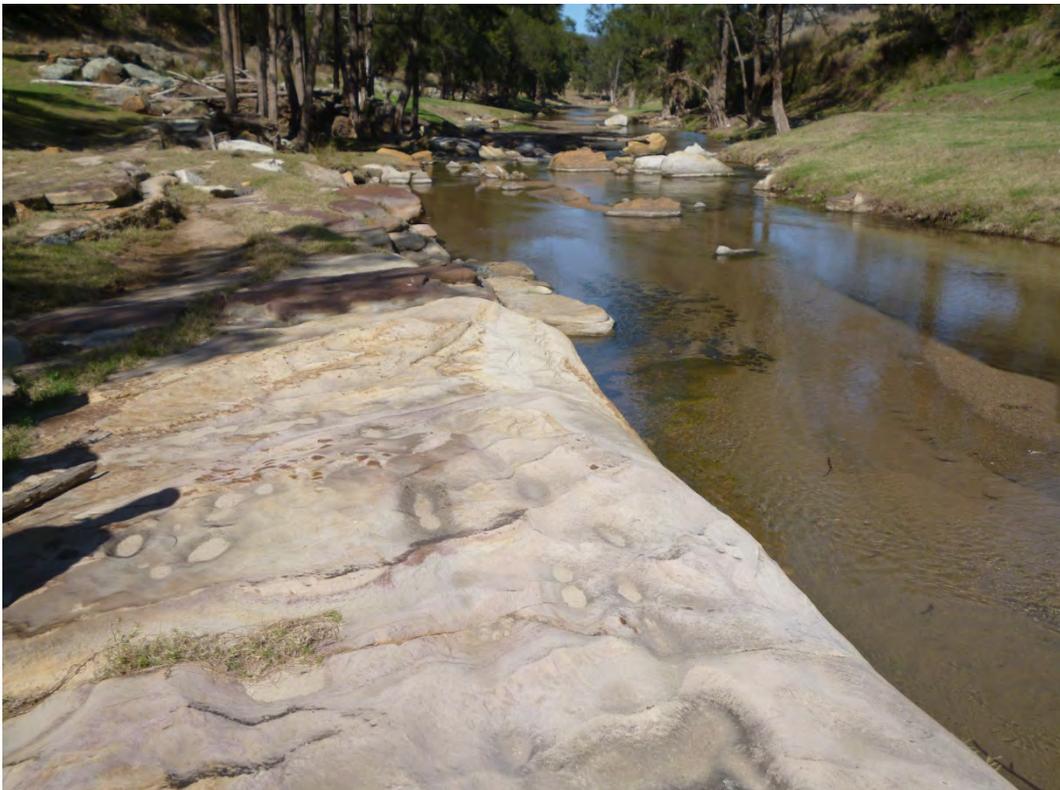


Photo: Goulburn River, Goulburn River BA (Georgia Bennett)

## 5 Monitoring Programme

This Section outlines the comprehensive monitoring programme has been designed to assess changes in the habitats of the Offset Areas against the Key Performance Indicators outlined in Chapter 3.

### 5.1 Monitoring Approach and Frequency

The monitoring programme comprises four components to capture environmental change at different scales and reflecting the different conservation and management objectives:

- Landscape monitoring: to assess vegetation changes and habitat connectivity at the landscape scale in the long-term (7 years);
- Habitat restoration and bird assemblage monitoring: to quantify changes in vegetation structure, key fauna habitat features and bird assemblages in the short to medium-term (2 years);
- Rapid Condition Assessment: to monitor woodland condition and identify emerging threats in the short-term (annually); and
- Adaptive management monitoring: to identify threats and inform management activities within woodland and grassland communities consistent with the adaptive management approach in the short-term (quarterly).

The frequency of monitoring activities will vary according to the monitoring schedule provided in **Table 17**. To enhance understanding and knowledge of all key stakeholders in the management of the Offset Areas, the Leaseholders and Coal & Allied representatives, where feasible, will accompany the Biodiversity Auditors during the field based components of this monitoring programme.

All monitoring results will be stored on the Biodiversity Offsets Portal.

**Table 17 Monitoring Schedule**

	2013	2014	2015	2016	2017	2018	2019	2020
Landscape Monitoring	X							X
Habitat Restoration and Bird Assemblage Monitoring		X		X		X		X
Rapid Condition Assessment	X	X	X	X	X	X	X	X
Adaptive Management Monitoring				Monthly (if livestock within MZ) Quarterly (if no livestock with MZ)				

### 5.2 Landscape Monitoring

Aerial photographic imagery will be updated every 7-10 years. This imagery will be analysed and the findings ground-truthed to assess the extent of canopy regeneration within the Offset Areas.

The analysis of tree canopy cover will be used to map changes in the distribution and condition of woodland habitats and the connectivity of vegetation remnants. An increase in the extent and condition of woodland habitats will be indicative of successful management of the Offset Areas towards the Key Performance Indicators.

## 5.3 Habitat Restoration and Bird Assemblage Monitoring

Habitat restoration and bird assemblage monitoring aims to assess changes in the condition and extent of the woodland habitats within the BAs and the ongoing usage of these habitats by woodland birds.

### 5.3.1 Habitat Restoration Monitoring

Habitat restoration monitoring will focus on the Management Zones that have been degraded from previous land management practices and therefore require management intervention to restore habitat values, namely MZB, MZC and MZD.

The objectives of the habitat restoration monitoring are to:

- Demonstrate a change in degraded habitats towards benchmark (Biometric) values; and
- Demonstrate recruitment of canopy species through transition up age classes (measured as Diameter at Breast Height (DBH));

The habitat restoration monitoring programme will assess changes in habitat values within the BAs through time and relative to the benchmark values presented in the Biometrics Vegetation Types Database (NSW DEH, 2013). These benchmark values relate to species richness and percent cover of native plants in the various vegetation layers as well as counts of tree hollows and the length of fallen timber. Additional habitat features will also be included in this monitoring programme to track canopy regeneration and health.

Current vegetation classification for the BAs is not consistent with the Biometric Vegetation Types Database. Therefore, following the first round of monitoring, current descriptions of the vegetation communities will be updated to conform with the Biometric Vegetation Types Database so that benchmark values for each community can be derived.

#### 5.3.1.1 Field Methods

Seventeen monitoring plots will be established across the BAs according to the following breakdown:

- Goulburn River: 5 plots in MZB (foothills and valley floor), 5 plots in MZC (derived native grassland) and 2 in MZD (riparian); and
- Bowditch: 5 plots in MZB (foothills and valley floor).

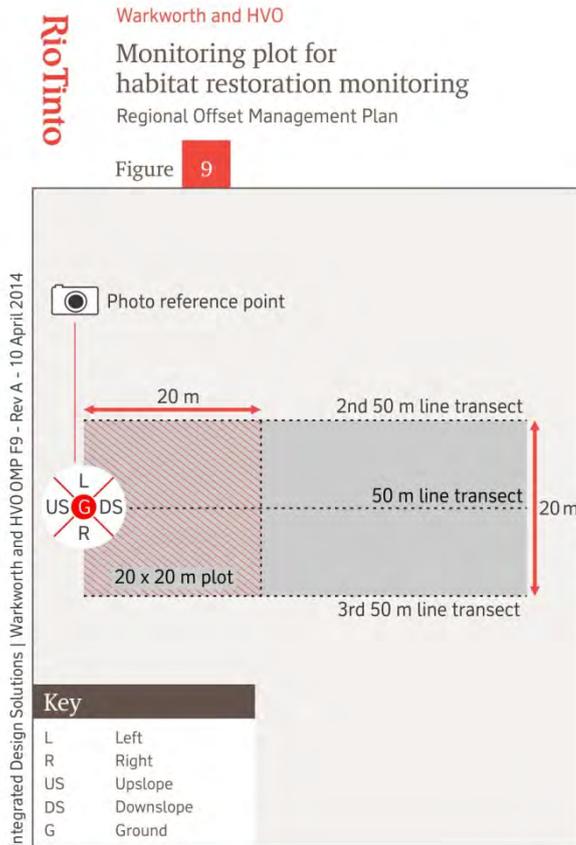
The plot will be 50m x 20m and will be established such that the plot runs downslope. A 20m x 20m quadrat will be positioned within this larger plot and three 50m transects will run its length (**Figure 9**). Where possible, four marker pegs will be used to establish a permanent plot position. GPS coordinates are taken to ensure monitoring plots can be relocated over time.

The 50m x 20m plot will be used to record details of the over-storey (canopy) layer including species richness, canopy regeneration and canopy health. Specific habitat features, such as the abundance of tree hollows, flowers/fruit, mistletoe and fallen logs will also be recorded at this scale

The 20m x 20m quadrat will be used to record details of the mid-storey and ground stratum structure including details of the composition and % cover of native/exotic species for various plant groups (e.g. grasses, shrubs, other herbaceous plants). Additional habitat features such as rocks, litter and bare ground will also be recorded at this scale.

Three 50m transects will be used to assess the % foliage cover of the over-storey. These data will be collected at 10 points (i.e. at every 5m) along the length of the transects.

Further details of the field sampling methods, including a table summarising the variables (measurements) that will be recorded, their unit of measurement and the sampling unit are provided in **Appendix D**.



### 5.3.1.2 Photo Reference Points

A photo reference point also will be established and permanently marked within each habitat monitoring plot. Photo reference points will be established at the top of the middle 50m transect at each monitoring site. During each monitoring event, a series of photos will be taken from this point to provide a visual record of any changes in vegetation and habitat condition. Depending on the location of the monitoring plot, this might include:

- changes in vegetation structure (e.g. presence/ absence of canopy species, shrubs, tussock grasses);
- the presence/condition of special habitat features (e.g. rock outcrops, flowering/fruited species); and
- changes in identified threatening processes (e.g. weed infestations, erosion).

At each photo reference point, a minimum of five photos will be taken, in the following directions:

- downslope;
- upslope;
- across the slope – left (when facing downslope);
- across the slope – right (when facing downslope); and
- directly down.

The photo records will be displayed on the Biodiversity Offsets Portal such that monitoring photos can be viewed against the baseline (2014) photo. This will provide an ongoing and gradual visual record of changes in habitats as the management strategies are implemented as well as changes in existing threats and early warning of emerging threats at monitoring sites.

### 5.3.2 Bird Assemblage Monitoring

Bird assemblage monitoring will focus on areas of existing woodland habitat namely MZA, MZB and MZD.

The objectives of the bird assemblage monitoring are to:

- Demonstrate ongoing habitat usage by woodland birds and a decrease in the relative abundance of bird species typical of forest margins and grasslands; and
- Assess the presence of Swift Parrot and Regent Honeyeater within the Offset Areas and collect information regarding their movements and habitat usage.

Birds are typically abundant and widespread taxa whose populations are easily surveyed. Although they are relatively mobile, many species can show specialisation in their habitat requirements. Patterns in the distribution and abundance of bird assemblages can be indicative of biodiversity as a whole and of environmental change. Accordingly, bird assemblages will be monitored as indicators of general ecosystem condition.

A desktop study has been undertaken to predict the timing and distribution of the Swift Parrot and Regent Honeyeater in the Merriwa region so that habitat and bird assemblage surveys can be designed to maximise the likelihood of detecting these species. Swift Parrots are likely to occur in the region occasionally and in very low numbers between July and October to feed on winter-flowering eucalypts (Swift Parrot Recovery Team 2000; Saunders and Heinsohn 2008; Saunders and Tzaros 2011; OEH 2012). The Regent Honeyeater is known to breed around the Upper Hunter Valley and Mudgee regions. The species has regular movements with seasonal patterns of abundance and breeding related to regional patterns in flowering of key forage species (Franklin, Menkhorst et al. 1989; Menkhorst, Schedvin et al. 1999; OEH 2012; SEWPaC 2012).

Accordingly, habitat restoration and bird assemblage monitoring will start in winter/spring 2014 to collect baseline data and subsequent monitoring will occur in winter/spring 2016, 2018 and 2020 (**Table 17**). Birds Australia will be consulted prior to the commencement of these surveys to coordinate survey effort and increase the likelihood of observations, therefore the timing of survey maybe adjusted.

#### 5.3.2.1 Field Methods

Habitat area searches will be conducted in accordance with Birds Australia Atlas search methodology (Birds Australia 2013) and EPBC Act bird survey guidelines (DEWHA 2010). This method involves searching a set area and recording data only from within the pre-defined search zone. A two ha area will be surveyed for 20 minutes by two observers.

Twenty monitoring plots will be established across the BAs according to the following breakdown:

- Goulburn River: 4 plots in MZA (upper slopes and ridges), 4 plots in MZB (foothills and valley floor) and 4 in MZD (riparian); and
- Bowditch: 4 plots in MZA (upper slopes and ridges) and 4 plots in MZB (foothills and valley floor).

Incidental and opportunistic surveys will also be conducted where suitable habitat areas for the Swift Parrot or Regent Honeyeater are observed when travelling to and between monitoring sites. All opportunistic sightings of these species and their locations will be recorded. General notes and important habitat resources such as tree hollows, flowering trees and nests will be recorded incidentally and photographed, as will any notable bird activities such as specific forage behaviour or signs of breeding activity.

### 5.4 Rapid Condition Assessment

The Rapid Condition Assessment (Wakefield and Goldney, 1997) technique, which was used as a preliminary assessment of woodland condition within the BAs (see chapter 2.6.1 for details) will be repeated on an annual basis. Each year, RCA sites in mature and regrowth vegetation will be revisited to record the presence or absence of key habitat components and threatening processes.

The results of the RCA, Adaptive Management Monitoring and photo reference points will be used to monitor woodland condition and identify emerging threats.

## 5.5 Adaptive Management Monitoring

Adaptive management monitoring will be undertaken on a monthly basis where livestock grazing is present, or quarterly if there is no livestock grazing present, to provide regular feedback on the effectiveness of management strategies and to ensure early detection of emerging threats within grassland and semi-cleared vegetation. This monitoring will focus on the MZB, MZC and D that have been degraded from previous land management practices and therefore require management intervention to restore habitat values.

Adaptive management monitoring will include an assessment of ground cover characteristics (total % cover, % cover native plants, herbage mass), weeds abundances, feral animal activity and rainfall data as well as a record of any observation of threatened species, special habitat features and infrastructure condition. This information will inform management decisions including:

- Weed control - new or significant changes to noxious weed infestations and control activities;
- Pest animal control - damage or presence of feral pest animal and control activities;
- Strategic Grazing – requirements for grazing, changes in seasonal growing conditions and grassland growth;
- Fire management - fire fuel hazard assessments and control activities;
- Bird survey locations – sites where threatened birds have been observed or where there are flowering trees will be re-visited during bird assemblage monitoring; and
- Infrastructure improvements - requirements for new infrastructure as well as maintenance or repair of existing infrastructure (roads/fences).

Further details of the field sampling methods are provided in **Appendix E**.

## 6 Conclusion

The Regional OMP is the framework document for an effective conservation management system. The written document, that identifies the objectives, key performance indicators, conservation management strategies and monitoring programme, is supported by the online Biodiversity Offsets Portal.

The Portal is a tool to effectively disseminate information, such as objectives, monitoring results and safety and project management advices. The Portal includes an interactive map that enables users to access the latest spatial and management data to create accurate maps to direct on ground management activities and ensure the protection of the ecological communities and their nested conservation values.

This Regional OMP will rely upon the development and implementation of annual control programmes and rigorous assessment of monitoring results to ensure it adapts to climatic changes and informs on going management.

**Table 18** identifies the key risks to the Regional OMP, proposed contingency measures and the relevant chapter in the Regional OMP that addresses this risk. The table identifies the key responsible person and the components of the monitoring programme aimed to observe the presence or impacts of the risk. This adaptive management approach to risk and contingency management is made effective by the monitoring programmes, communication of information via the online Biodiversity Offsets Portal to relevant stakeholders and implementation of conservation management strategies.

Table 18 Risk and Contingency Assessment Matrix

Risk	Description of risk	Contingency Measure	Reference in OMP	Key responsible person	Monitoring Programme
Weed Incursion	Introduction of new weeds through stock movements.	Weed hygiene.	Chapter 4.2 (Weed Control) Table 14 (Weed Control Methods)	Leaseholder.	Chapter 5.5 (Adaptive Management Monitoring)
	Vehicles spreading weeds	Establishment of containment zones. Weed hygiene.	Chapter 4.2 (Weed Control) Table 14 (Weed Control Methods)	Leaseholder All visitors to the BAs	Chapter 5.5 (Adaptive Management Monitoring)
	Absence of groundcover and poor pasture condition.	Maintenance of ground cover and pasture condition by following trigger points to commence and cease grazing.	Chapter 4.4 (Strategic Grazing)	Leaseholder RTCA	Chapter 5.5 (Adaptive Management Monitoring)
Over Grazing	Stock grazing preventing natural regeneration or over grazing.	Select and apply the correct targeted strategic grazing regime, review monitoring data.	Chapter 4.4 (Strategic Grazing)	Leaseholder RTCA Biodiversity Auditor	Chapter 5.3 (Habitat Restoration and Bird Assemblage Monitoring) Chapter 5.5 (Adaptive Management Monitoring)
	Stock grazing causing stream bank degradation.	Use of strategic grazing and/or construction of fences and/or off-stream watering points	Chapter 4.4 (Strategic Grazing) Chapter 4.8 (Erosion Control) Chapter 4.6 (Infrastructure Maintenance/Improvement)	Leaseholder RTCA Biodiversity Auditor	Chapter 5.3 (Habitat Restoration and Bird Assemblage Monitoring) Chapter 5.5 (Adaptive Management Monitoring)
Pest Animals	High populations of pest animals restricting native plant regeneration or growth.	Annual control of pest animals and monitoring impacts.	Chapter 4.3 (Pest Animal Control)	Leaseholder RTCA Biodiversity Auditor	Chapter 5.3 (Habitat Restoration and Bird Assemblage Monitoring) Chapter 5.5 (Adaptive Management Monitoring)
	Negative outcomes for control programmes – ie baiting	Prohibit the use of baiting and adhere to method in OMP.	Chapter 4.1 (Controlled Activities) Chapter 4.3 (Pest Animal Control)	Leaseholder Agriculture Auditor	
Fire	Wildfire entering the BAs.	Implementation of annual Bushfire Management Plan	Chapter 4.7 (Fire Management)	Principal Advisor - Offsets Rio Tinto	
	Increases fire intensity due to higher fuel loads	Strategic grazing to control hazardous fuel loads.	Chapter 4.4 (Strategic Grazing) Chapter 4.7 (Fire Management)	Leaseholder RTCA	Chapter 5.5 (Adaptive Management Monitoring)
	Fire ignition on BAs	Implementation of annual Bushfire	Chapter 4.7 (Fire Management)	Principal Advisor - Offsets Rio	

Risk	Description of risk	Contingency Measure	Reference in OMP	Key responsible person	Monitoring Programme
		Management Plan		Tinto	
Unauthorised Access	Access to BAs from unauthorised personnel	Boundary fencing, locks on gates and signs at main entry points	Chapter 4.1 (Controlled Activities)	Principal Advisor - Offsets	
Drought	Reduction of ground cover and damage to native flora.	Destock	Chapter 4.4 (Strategic Grazing)	Leaseholder RTCA	Chapter 5.5 (Adaptive Management Monitoring)
Herbicide Drift	Chemical spray drift.	Follow government regulations and only spray in variable weather conditions. Use alternative weed control measures where practical (e.g. Biological control)	Chapter 4.2 (Weed Control) Chapter 4.1 (Controlled Activities)	Leaseholder RTCA	Chapter 5.5 (Adaptive Management Monitoring)
Vegetation Management	Removal or clearing of native vegetation, including dead timber and live plants.	Property security, where possible leaseholder will live on the properties. Clearing of vegetation for essential farm infrastructure will adhere to relevant legislation.	Chapter 4.1 (Controlled Activities) Chapter 4.1 (Infrastructure Maintenance/Improvement)	Leaseholder Biodiversity Auditor	Chapter 5.3 (Habitat Restoration and Bird Assemblage Monitoring) Chapter 5.5 (Adaptive Management Monitoring)
	High density regrowth restricting native species diversity	Review monitoring data.	Chapter 4.5 (Revegetation)	Biodiversity Auditor	Chapter 5.3 (Habitat Restoration and Bird Assemblage Monitoring) Chapter 5.5 (Adaptive Management Monitoring)
Erosion	Loss of native vegetation cover	Strategic grazing or destock	Chapter 4.4 (Strategic Grazing)	Leaseholder Biodiversity Auditor	Chapter 5.3 (Habitat Restoration and Bird Assemblage Monitoring) Chapter 5.5 (Adaptive Management Monitoring)
	Stream bank erosion	Limit livestock access to creeks. Provide off stream stock water.	Chapter 4.4 (Strategic Grazing) Chapter 4.8 (Erosion Control) Chapter 4.6 (Infrastructure Maintenance/Improvement)	Leaseholder Biodiversity Auditor	Chapter 5.5 (Adaptive Management Monitoring)

## 7 References

- Birds Australia (2013). "Birds Australia [Electronic resource]." from <http://www.birdsaustralia.com.au/>.
- Cumberland Ecology (2009) Summary of initial site inspections of potential offsite offsets for the Warkworth extension. Letter report to Rio Tinto Coal Australia Pty Limited.
- Cumberland Ecology (2011) Additional strategic offsets for Warkworth extension: Bowditch, O'brien & Hunt. Letter report to Rio Tinto Coal Australia Pty Limited.
- Cumberland Ecology (2013) Warkworth Biodiversity Areas – Baseline Fauna Investigations. Report prepared for Rio Tinto Coal Australia Pty Limited.
- DEC (NSW) (2005). Swift Parrot - profile. Hurstville, Department of Environment and Conservation (NSW).
- DEC (NSW) (2006). Regent Honeyeater - profile. Hurstville, Department of Conservation (NSW).
- Debus, S. (2009). Birds: Comiala Road (Merriwa) proposed offset site. Prepared for Cumberland Ecology (internal report). Armidale, NSW.
- Debus, S. (2011). Mount Thorley Warkworth Operations Avifauna Monitoring: MTW Green Offsets and Offsets at Archerfield, Putty, Goulburn River and Seven Oaks, Winter 2011. Report to Coal & Allied (Rio Tinto Coal Australia). Armidale, NSW.
- DEWHA (2010). Survey guidelines for Australia's threatened birds. Canberra, ACT, Commonwealth Department of Environment, Water, Heritage and the Arts.
- DNA Environmental (2011) Biodiversity Management Plan for Warkworth Biodiversity Areas. Report prepared for Warkworth Mining Limited.
- Franklin, D. C., Menkhorst, P. W. *et al.* (1989). Ecology of the Regent Honeyeater *Xanthomyza phrygia*. EMU: 141-154.
- Garnett, S. T. and G. M. Crowley (2000). The Action Plan for Australian Birds, Environment Australia, Canberra
- Menkhorst, P., Schedvin, N. and Geering, D. (1999) Regent Honeyeater (*Xanthomyza phrygia*) Recovery Plan 1999-2003 Department of Natural Resources and Environment, Canberra, ACT.  
(<http://www.environment.gov.au/biodiversity/threatened/publications/recovery/regent-honeyeater/>)
- NSW DEH (2013) <http://www.environment.nsw.gov.au/biobanking/vegtypedatabase.htm>
- NSW Scientific Committee (2004). Regent honeyeater - endangered species listing. Hurstville, Department of Environment and Conservation (NSW).
- OEH (2011). Atlas of NSW Wildlife. Retrieved 2011, from <http://wildlifeatlas.nationalparks.nsw.gov.au/wildlifeatlas/watlas.jsp>.
- OEH 2012, OEH guidelines Erosion and sediment control on unsealed roads
- OEH (2012). Regent Honeyeater - profile. Hurstville, Office of Environment and Heritage.
- OEH (2012). Swift Parrot - profile. Hurstville, Office of Environment and Heritage.
- Oliver D. L. (1998). Short Communication: Roosting of Non-breeding Regent Honeyeater *Xanthomyza phrygia*. Emu 98: 65-69.
- Pizzey, G. and F. Knight (2003). The Field Guide to the Birds of Australia. Australia, HarperCollins Publishers Pty Ltd.
- Saunders, D. L. and Heinsohn, R. (2008). Winter habitat use by the endangered, migratory Swift Parrot (*Lathamus discolor*) in New South Wales, Australia. Emu 108: 81-89.
- Saunders, D. L. and Tzaros, C. L. (2011). National Recovery Plan for the Swift Parrot (*Lathamus discolor*). Melbourne, Birds Australia.

(<http://www.environment.gov.au/biodiversity/threatened/publications/recovery/pubs/lathamus-discolor-swift-parrot.pdf> )

SEWPaC (2012). Regent Honeyeater in Species Profile and Threats Database. Canberra, ACT, Commonwealth Department of Sustainability, Environment, Water, Population and Communities.

Swift Parrot Recovery Team (2000). Swift Parrot Recovery Plan 2001-2005. Hobart, Department of Primary Industries, Water and Environment.

Rawlings, K. *et al.* (2010). A Guide to Managing Box Gum Grassy Woodlands. Caring for Our Country, Australian Government, Canberra ACT.

Wakefield, S. and Goldney, D.C. (1997). Save the Bush Toolkit. Charles Sturt University, Bathurst.

# Appendix A - Approval Conditions Relating to Offsets

**Table 1 EPBC 2002/629**

Approval Condition	EPBC 2002/629	Reference
1	<p>By no later than 13 July 2014, unless otherwise agreed by the Minister in writing, the person taking the action must register a legally binding conservation covenant over the Biodiversity Management Areas identified in the map at Attachment A. The mechanism/s must provide enduring protection of no less than:</p> <p>a) 1,586 ha of suitable habitat for <i>Anthochaera phrygia</i> (regent honeyeater) and <i>Lathamus discolor</i> (swift parrot).</p>	Noted
2	<p>To offset the impacts to the regent honeyeater and swift parrot, the person taking the action must submit to the Minister for approval an Offset Management Plan (OMP) for all of the Biodiversity Management Areas by no later than 13 April 2014.</p> <p>The OMP must include, but not be limited to, the following information:</p> <p>a. a textual description and map to clearly define the location and boundaries of all of the Biodiversity Management Areas. This must be accompanied with the offset attributes and a shapefile</p> <p>b. details of management actions to protect and enhance the extent and condition of habitat values of the Offset Areas including but not limited to rehabilitation, weed control, fire management, erosion and sediment control, management of livestock and restrictions on access of no less than 1,586 hectares of habitat for the regent honeyeater and swift parrot</p> <p>c. the timing, responsibilities and performance criteria for management actions</p> <p>d. a monitoring plan including the undertaking of ecological surveys by a qualified ecologist to assess the success of the management actions against identified milestones and objectives</p> <p>e. a process to report, to the department, the management actions undertaken in the Offset Areas and the outcome of those actions, including identifying any need for improved management</p> <p>f. a description of the potential risks to successful management and rehabilitation in the Offset Areas, and a description of the contingency measures that would be implemented to mitigate these risks</p> <p>g. details of parties responsible for management, monitoring and implementing the plan, including their position or status as a separate contractor.</p> <p>The approved OMP must be implemented. The person taking the action must publish the approved OMP on their website within 1 month of the OMP being approved by the Minister. The approved OMP must remain published until the expiry of the approval or until such time as agreed in writing by the Minister.</p> <p>Note: For clarity, the Biodiversity Management Areas in condition 1 and identified on the map in Attachment A can accommodate offset requirements for more than one species habitat within the one area, if a qualified ecologist verifies that suitable habitat is present and includes specific habitat requirements for the relevant species.</p>	<p>Chapter 2 (Location and description)</p> <p>Chapter 3 (Conservation Objectives and Key Performance Indicators)</p> <p>Chapter 4 (Conservation Management Strategies)</p> <p>Chapter 4 (Conservation Management Strategies)</p> <p>Chapter 5 (Monitoring Programme)</p> <p>Chapter 1 (Review and Reporting)</p> <p>Chapter 6 (Table 18)</p> <p>Chapter 1 (Table 2)</p>

Table 2 PA 06\_0261

Approval Condition	PA 06_0261, Schedule 3	Reference						
29	<b>REHABILITATION AND LANDSCAPE Biodiversity Offset Strategy</b>							
	<p>The Proponent shall implement the biodiversity offset strategy as described in the Warkworth Extension EA, summarised in Table 15 below and shown conceptually in Appendix 5, to the satisfaction of the Director-General.</p> <p>Table 15: Summary of the Biodiversity Offset Strategy</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="color: red;">Area</th> <th style="color: red;">Offset Type</th> <th style="color: red;">Minimum Size (hectares)</th> </tr> </thead> <tbody> <tr> <td>Goulburn River Biodiversity Area</td> <td>Existing vegetation to be enhanced (Narrow leaved ironbark woodland)</td> <td>140</td> </tr> </tbody> </table> <p>Note: This 140 ha of vegetation in the Goulburn River Biodiversity Area is additional to the 1,299.3 ha of vegetation to be offset on this property under the project approval for the Warkworth Extension Project (09_0202). The biodiversity offset strategy may be integrated with the similar strategy for the Warkworth Extension Project.</p>	Area	Offset Type	Minimum Size (hectares)	Goulburn River Biodiversity Area	Existing vegetation to be enhanced (Narrow leaved ironbark woodland)	140	Figure 3
Area	Offset Type	Minimum Size (hectares)						
Goulburn River Biodiversity Area	Existing vegetation to be enhanced (Narrow leaved ironbark woodland)	140						
29A	<b>Long Term Security of Offset</b>							
	<p>By the end of December 2013, unless the director-general agrees otherwise, the proponent shall enter or cause to be entered into a conservation agreement or agreements pursuant to section 69B of the National Parks and Wildlife Act 1974 for the offset area identified in condition 29, recording the obligations assumed by the proponent under the conditions of this approval in relation to the offset area, and register the agreement/s pursuant to section 69F of the National Parks and Wildlife act 1974. The conservation agreement/s must remain in force in perpetuity.</p> <p>This conservation agreement may be combined with any similar agreement required under the project approval for the Warkworth Extension Project (09_0202).</p>	<p>Extension requested from DoP (letter dated 19 December 2013)</p> <p>New date: 13 July 2014.</p>						
29B	<b>Offsets for Warkworth Extension Project</b>							
	<p>The Proponent shall not undertake any mining operations or development within the Southern Biodiversity Area or Northern Biodiversity Area as indicated on the plan in Appendix 10, other than any conservation-related activity under an approved Rehabilitation and Biodiversity Management Plan under either this approval or MP 09_0202.</p> <p>Note: The Southern Biodiversity Area and Northern Biodiversity Area form part of the biodiversity offset strategy for the Warkworth Extension Project (MP 09_0202).</p>	This will be covered by the Local Offsets Management Plan (currently in preparation)						
36	<b>Rehabilitation and Biodiversity Management Plan</b>							
	<p>The Rehabilitation and Biodiversity Management Plan must include:</p> <p>(a) the objectives for rehabilitation of the site and offset area;</p> <p>(b) a description of how the rehabilitation of the site would be integrated with the rehabilitation and offset strategies of the Warkworth/Mt Thorley, Wambo, United, HVO North,</p>	<p>This OMP only covers the Goulburn River BA</p> <p>Chapter 3 (Conservation Objectives)</p> <p>Chapter 2 (Figure 3)</p> <p>Chapter 2.7 (Management Zones)</p>						

Approval Condition	PA 06_0261, Schedule 3	Reference
	Ravensworth West, Ravensworth South, Narama and Ashton mines to ensure there is a comprehensive strategic framework for the restoration and enhancement of the landscape over time;	
	(c) a description of the short, medium, and long term measures that would be implemented to:	
	<ul style="list-style-type: none"> <li>• · implement the Biodiversity Offset Strategy;</li> </ul>	Chapter 4 (Conservation Management Strategies)
	<ul style="list-style-type: none"> <li>• · rehabilitate the site;</li> </ul>	Chapter 4.5 Revegetation (not applicable to on-site rehabilitation)
	<ul style="list-style-type: none"> <li>• · manage the remnant vegetation and habitat on the site;</li> </ul>	Chapter 2.7 (Management Zones)
	<ul style="list-style-type: none"> <li>• · maximise effective habitat linkages to surrounding vegetated lands;</li> </ul>	Chapter 2.7 (Management Zones)
		Chapter 3 (Conservation Objectives)
		Chapter 4 (Conservation Management Strategies)
	<ul style="list-style-type: none"> <li>• · conserve and reuse topsoil;</li> </ul>	Not applicable for the Goulburn River BA
	<ul style="list-style-type: none"> <li>• · control weeds, feral pests and access; and</li> </ul>	Chapter 4.2 (Weed Control)
		Chapter 4.3 (Pest Animal Control)
		Chapter 4.6 (Infrastructure Maintenance)
	<ul style="list-style-type: none"> <li>• · manage any potential conflicts between the rehabilitation works and Aboriginal cultural heritage;</li> </ul>	Chapter 4.9 (Cultural Heritage)
	(d) detailed performance and completion criteria for the rehabilitation of the site and implementation of the biodiversity offset strategy;	Chapter 3.2 (Key Performance Indicators)
		Chapter 3.3 (Completion Criteria)
	(e) a detailed description of how the performance of the rehabilitation of the mine and implementation of the biodiversity offset strategy would be monitored over time to achieve the stated objectives;	Chapter 5 (Monitoring Programme)
	(f) a detailed description of what measures and procedures would be implemented over the next 3 years to rehabilitate the site and implementation of the biodiversity offset strategy;	Chapter 4 (Conservation Management Strategies)
	(g) a description of the potential risks to successful rehabilitation and/or revegetation, and a description of the contingency measures that would be implemented to mitigate these risks; and	Chapter 6 (Table 18)
	(h) details of who (by person and/or position) is responsible for monitoring, reviewing, and implementing the plan.	Chapter 1 (Table 1)
	<i>Notes: Reference to "rehabilitation" in this approval includes all works associated with the rehabilitation and restoration of the site as described in the EA.</i>	
39	<b>Conservation and Biodiversity Offset Implementation Bond</b>	
	By the end of December 2013, the Proponent shall lodge a conservation bond with the Department to ensure that the	Extension requested from DoP (letter dated 19

Approval Condition	PA 06_0261, Schedule 3	Reference
	<p>Biodiversity Offset Strategy is implemented in accordance with the performance and completion criteria of the Rehabilitation and Biodiversity Management Plan.</p> <p>The sum of the bond shall be determined by:</p> <p>(a) calculating the full cost of implementing the offset strategy (other than land acquisition costs); and</p> <p>(b) employing a suitably qualified quantity surveyor to verify the calculated costs.</p> <p>If the offset strategy is completed generally in accordance with the completion criteria in the Rehabilitation and Biodiversity Management Plan to the satisfaction of the Director-General, the Director-General will release the bond.</p> <p>If the offset strategy is not completed generally in accordance with the completion criteria in the Rehabilitation and Biodiversity Management Plan, the Director-General will call in all or part of the conservation bond, and arrange for the satisfactory completion of the relevant works.</p> <p>With the agreement of the Director-General, this bond may be combined with rehabilitation security deposit administered by the DRE, and may be combined with bonds in respect of offsets required for the Warkworth Extension Project.</p>	<p>December 2013) New date: 13 July 2014.</p>

## Appendix B - Fauna baseline (2012)

In 2012 Cumberland Ecology completed desktop and field surveys to develop a fauna baseline and assess the habitat potential of the BAs.

The desktop survey involved collection of existing information, including preliminary assessments of the BAs and their surrounds and vegetation mapping, was reviewed to inform the current study. Additional information on the ecological values of the BAs and their surrounds was also obtained through the interrogation of the OEH Atlas of NSW Wildlife database and SEWPaC EPBC Act Protected Matters Search Tool (PMST), which was used to guide threatened species searches during field survey.

Fauna surveys were conducted during 2012 over a number of sessions and seasons to maximise the opportunity to record vertebrate fauna, particularly threatened species. Surveys were conducted, where practicable, in accordance with accepted conventional guidelines and included habitat assessments, various terrestrial mammal survey techniques (Infra-red cameras, Elliot traps, cages and hairtubes); nocturnal surveys (spotlighting and call playback); bird surveys; active searches for reptiles and bat surveys (harp traps and ultrasonic call recording devices). Incidental fauna were recorded during each survey session.

The broad habitat features described below provide known and potential forage, shelter and breeding opportunities for a suite of fauna species, including those listed under the TSC Act and/or EPBC Act, which are present within the Goulburn River and Bowditch BAs.

The following habitat features are present include:

- Structural complexity and diversity in the form of mixed-age trees, including remnant trees and regeneration, and understory vegetation that provides breeding habitat, forage habitat and refuge sites for woodland birds, bats, other small mammals and reptiles;
- Woodland margin/ ecotonal habitat at the woodland-grassland interface, which provide a combination of forage habitat and refuge for ground-foraging fauna, and hunting areas for raptors;
- Tree hollows in stags and mature trees that provide shelter and breeding habitat for a range of hollow-dependant fauna including hollow-roosting microbats;
- Ground cover, leaf litter, fallen timber and woody debris suitable as shelter for small arboreal and terrestrial fauna species and reptiles;
- Blossom-producing shrubs, feed trees, mistletoe and grasses suitable as forage habitat for a range of nectarivorous and granivorous birds and mammals;
- Areas of grassland that provide forage habitat for various terrestrial fauna and some birds;
- Riparian and aquatic habitat that provide sources of drinking water for all fauna, as well as habitat for reptiles and amphibians; and
- Significant rock outcrops, crevices and caves suitable as shelter and breeding habitat for reptiles, terrestrial mammals and cave-roosting bats.

Mixed-age forest and woodland occurs across all the BAs. Trees mature enough to form various sized hollows and thus provide habitat for different arboreal mammals are a severely limiting resource. This is particularly so in the regenerating woodland areas. More mature vegetation is typically found on the slopes and escarpments where less clearing has taken place due to relative inaccessibility for grazing, although scattered large remnant trees do occur on the valley flats.

The BAs support large areas of woodland and forest that represent a mixture of moderately valuable to highly valuable habitat for terrestrial mammals, some reptiles,

bats and woodland and nectar-feeding birds. Various common woodland bird species were recorded foraging on the ground or in the canopy of trees. A number of threatened bird species, including the Speckled Warbler (*Pyrrholaemus saggitatus*), Grey-crowned Babbler (*Pomatostomus temporalis temporalis*) and Varied Sittella (*Daphoenositta chrysoptera*) were detected in this habitat type as well as both hollow-dependent and cave-roosting bat species.

Woodland margins provide habitat for ground-foraging fauna such as small woodland birds that tend to forage in lightly wooded areas amongst timber debris and within proximity of the protective cover of trees and shrubs. Threatened birds such as the Diamond Firetail (*Stagonopleura guttata*), recorded at Goulburn River) often occur and forage on the margins of woodland or in open forests near clearings. This species uses the proximity of the woodland to provide quick access to shelter (Pizzey and Knight 2003). Woodland margins also provide habitat for raptors and terrestrial mammals such as macropods.

Past vegetation clearing for logging and grazing has removed much of the original forest habitat that was present on the more fertile valley floor and riparian areas of the BAs. Most such areas are now dominated by grassland. Some areas of Bowditch have scattered remnant trees and evidence of regenerating woodland, and some areas of dense regenerating shrubs in the mid-story are present at both BAs. The grasslands generally provide suitable foraging habitat for large mammals, including macropods like the Eastern Grey Kangaroo (*Macropus giganteus*), Common Wallaroo (*Macropus robustus*) and Red-necked Wallaby (*Macropus rufogriseus*). The grassland can also provide shelter and forage habitat for small mammals in areas where there is an adequate layer of tussock grass, and microhabitats exist under woody debris, leaf litter and rocks for reptiles. Large open areas provide ample foraging habitat for insectivorous and granivorous birds, and hunting resources for raptors, owls and some bat species. Rabbits were recorded in high numbers in open grassland at the BAs.

Riparian vegetation along the Goulburn and Munmurra Rivers at the Goulburn River BA and various small creek lines and soaks at Bowditch represent valuable habitat as it typically contains mixed aged trees, including mature trees with hollows, a grassy or shrubby understory and fallen timber and rocks. Other sections of riparian vegetation, such as at Goulburn River, have been highly modified from their original state due to clearing and ongoing stock and vehicle access, and now persist as very narrow and interrupted corridors. However, there is enough riparian and surrounding woodland vegetation in the BAs to represent movement corridors. These watercourses extend outside of the Offset Areas and connect large patches of surrounding vegetation in the wider locality, facilitating landscape-scale movements, particularly for species such as the Spotted-tailed Quoll and microbats. Overall, the riparian vegetation offers quality seasonal flowering resources, foraging habitat, movement corridors and roosting and nesting habitat for small arboreal mammals and birds, and breeding and shelter habitat for amphibians.

Farm dams are present at both BAs and provide substantive and permanent water sources for all wildlife. These watercourses provide valuable sources of drinking water for all fauna and can support reptiles and amphibians, particularly if fringing vegetation is present.

**Table 1 Potential of Threatened and Migratory/Marine species to occur within the Biodiversity Areas**

Scientific Name	Common Name	TSC Act	EPBC	Bowditch	Goulburn River
<b>BIRDS</b>					
<i>Anthochaera phrygia</i>	Regent Honeyeater	CE	E/Mi	Moderate	Moderate
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	V		Moderate	Moderate
<i>Circus assimilis</i>	Spotted Harrier	V		Moderate	High – recorded on adjacent land
<i>Climacteris picumnus victoriae</i>	Brown Treecreeper (eastern subspecies)	V		Present	Present
<i>Glossopsitta pusilla</i>	Little Lorikeet	V		Moderate	Present
<i>Grantiella picta</i>	Painted Honeyeater	V		Moderate	High – recorded on adjacent land
<i>Hieraaetus morphnoides</i>	Little Eagle	V		Moderate	Present
<i>Lathamus discolor</i>	Swift Parrot	E	E	Moderate	Moderate
<i>Lophoictinia isura</i>	Square-tailed Kite	V		Moderate	Moderate
<i>Melanodryas cucullata</i>	Hooded Robin	V		Moderate	High – recorded on adjacent land
<i>Melithreptus gularis gularis</i>	Black-chinned Honeyeater (eastern subspecies)	V		Moderate	Present
<i>Merops ornatus</i>	Rainbow Bee-eater		Mi/Ma	Present	Present
<i>Neophema pulchella</i>	Turquoise Parrot	V		Present	Present
<i>Ninox connivens</i>	Barking Owl	V		Moderate	Present
<i>Ninox strenua</i>	Powerful Owl	V		Moderate	Moderate
<i>Petroica boodang</i>	Scarlet Robin	V		Moderate	Moderate
<i>Pomatostomus temporalis temporalis</i>	Grey-crowned Babbler (eastern subspecies)	V		Present	Moderate
<i>Pyrrholaemus saggitatus</i>	Speckled Warbler	V		Present	Present
<i>Rhipidura rufifrons</i>	Rufous Fantail		Mi	Moderate	Low
<i>Stagonopleura guttata</i>	Diamond Firetail	V		Moderate	Present
<i>Tyto novaehollandiae</i>	Masked Owl	V		Moderate	Moderate

Scientific Name	Common Name	TSC Act	EPBC	Bowditch	Goulburn River
<b>MAMMALS</b>					
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll (southeast mainland population)	V	E	Moderate	Moderate
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V	V	Present	Present
<i>Chalinolobus picatus</i>	Little Pied Bat	V		Moderate	Present
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	V		High – possible recording	Moderate
<i>Miniopterus australis</i>	Little Bentwing-bat	V		Present	Present
<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing-bat	V		Present	Present
<i>Mormopterus norfolkensis</i>	Eastern Freetail-bat	V		High – possible recording	High – possible recording
<i>Myotis macropus</i>	Southern Myotis	V		Moderate	Moderate
<i>Nyctophilus corbeni</i>	Greater Long-eared Bat	V	V	Moderate	Present
<i>Petaurus norfolcensis</i>	Squirrel Glider	V		Moderate	Moderate
<i>Petrogale penicillata</i>	Brush-tailed Rock-wallaby	E	V	Moderate	Moderate
<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale	V		Unlikely	Unlikely
<i>Phascolarctos cinereus</i>	Koala	V	V	Moderate	Moderate
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V		High – possible recording	High – possible recording
<i>Vespadelus troughtoni</i>	Eastern Cave Bat	V		High – possible recording	High – possible recording
<b>REPTILES</b>					
<i>Aprasia parapulchella</i>	Pink-tailed Legless Lizard	V	V	Moderate	Low
<i>Hoplocephalus bungaroides</i>	Broad-headed Snake	E	V	Moderate	Unlikely
<b>Abbreviations</b>					
CE – Critically endangered	E – Endangered	V – Vulnerable	Mi – Migratory	Ma – Marine Migratory	
X – positively identified	P – possible could not be verified				

# Appendix C - Rapid Condition Assessment results November 2013

**Table 1 Goulburn River Biodiversity Area - Rapid Condition Assessment results, November 2013**

**Date** 25/11/2013 - 26/11/2013  
**Auditor** Michael Lloyd (RTCA), Emilie Mascarenhas (IDS)  
**Note:** True - enter 1

Site #	R_GR1	R_GR2	R_GR3	R_GR4	R_GR5	R_GR6	R_GR7	R_GR8	R_GR9	R_GR10	R_GR11	R_HVO1	R_HVO2
	Yes	Yes	No	No	Yes								
Management Zone	MZA	MZA	MZC	MZC	MZB	MZD	MZB	MZB	MZB	MZB	MZB	MZA	MZA
Low grazing intensity - never farmed	1	1										1	1
Tree and shrub regeneration present (<2m)	1	1			1						1	1	1
Infrequent fire regime (<5year intervals)	1	1			1	1	1	1	1	1	1	1	1
Healthy mature trees (no dieback)	1	1			1	1	1	1	1	1	1	1	1
Little to no evidence of rabbits	1	1				1	1	1		1	1	1	1
Little to no evidence of foxes/cats	1	1			1	1	1	1	1	1	1	1	1
Low abundance of weeds (most remnants contain some weeds)	1	1			1		1	1	1	1	1	1	1
No evidence of firewood collection	1	1			1	1	1	1	1	1	1	1	1
No obvious signs of erosion or salinity	1	1	grassland	grassland	1		1	1	1		1	1	1
Not susceptible to fertiliser application, herbicide or pesticide drift	1	1			1	1	1	1	1	1	1	1	1
Less than 20% trees with Mistletoe (NB some mistletoe is healthy)	1	1			1	1		1	1	1	1	1	1
Few tracks, trails or fence lines	1	1			1	1	1	1	1	1	1	1	1
Presence of native shrubs	1	1			1						1	1	1
Presence of large, old growth trees with hollows	1	1			1			1	1				1
Dead timber is left standing	1	1			1	1	1	1	1	1	1	1	1
Fallen timber and logs are left on the ground	1	1			1	1	1	1	1	1	1	1	1
Abundance of native ground flora	1				1			1	1	1	1	1	1
Presence of litter, cryptogams, cracks and rocks	1	1			1	1						1	1
Remnant is large (> 5ha is optimum)	1	1			1		1	1	1	1	1	1	1
Connected to or in close proximity to other remnant vegetation	1	1			1	1	1	1	1	1	1	1	1
<b>Health Rating</b>	<b>20</b>	<b>19</b>	<b>0</b>	<b>0</b>	<b>18</b>	<b>12</b>	<b>13</b>	<b>16</b>	<b>15</b>	<b>14</b>	<b>17</b>	<b>19</b>	<b>20</b>

Table 2 Bowditch Biodiversity Area - Rapid Condition Assessment results, November 2013

<b>Date</b>	25/11/2013 - 26/11/2013									
<b>Auditor</b>	Michael Lloyd (RTCA), Emilie Mascarenhas (IDS)									
<b>Note:</b> True - enter 1										
	<b>Site #</b>	R_B1	R_B2	R_B3	R_B4	R_B5	R_B6	R_B7	R_B8	R_B9
	<b>Offset</b>	Yes	No							
	<b>Management Zone</b>	MZB	MZB	MZB	MZB	MZA	MZB	MZB	MZB	MZA
Low grazing intensity - never farmed									1	
Tree and shrub regeneration present (<2m)			1	1		1		1	1	
Infrequent fire regime (<5year intervals)		1	1	1	1	1	1	1	1	1
Healthy mature trees (no dieback)		1	1	1		1	1	1	1	1
Little to no evidence of rabbits		1	1	1		1	1	1	1	1
Little to no evidence of foxes/cats		1	1	1	1	1	1	1	1	1
Low abundance of weeds (most remnants contain some weeds)				1	1			1	1	1
No evidence of firewood collection		1	1	1	1	1	1	1	1	1
No obvious signs of erosion or salinity		1	1	1	1	1	1	1	1	1
Not susceptible to fertiliser application, herbicide or pesticide drift		1	1	1	1	1	1	1	1	1
Less than 20% trees with Mistletoe (NB some mistletoe is healthy)		1	1	1	1	1	1	1	1	1
Few tracks, trails or fence lines		1	1	1	1	1	1	1	1	1
Presence of native shrubs		1	1	1	1	1	1	1	1	1
Presence of large, old growth trees with hollows		1	1			1	1	1	1	1
Dead timber is left standing				1	1	1	1	1	1	1
Fallen timber and logs are left on the ground		1	1	1	1	1	1	1	1	1
Abundance of native ground flora				1					1	1
				1					1	
Remnant is large (> 5ha is optimum)		1	1	1	1	1	1	1	1	1
Connected to or in close proximity to other remnant vegetation		1	1	1	1	1	1	1	1	1
<b>Health Rating</b>		<b>14</b>	<b>15</b>	<b>18</b>	<b>13</b>	<b>16</b>	<b>15</b>	<b>17</b>	<b>20</b>	<b>17</b>

## Appendix D - Habitat Restoration Monitoring – Field Methods

Details of the field methods for Habitat Restoration Monitoring are provided below and a summary of the key variables that will be extracted from this data for analysis is provided in Table 1.

### • 50x20m plot

**Over-storey composition and species richness:** Systematically cover the entire 50x20m plot identifying all over-storey species (tallest woody stratum >1m).

**Over-storey regeneration:** When identifying over-storey species, also record stem diameter class (0-10cm, 10-20cm or >20cm) for each tree.

**Additional habitat features:** When identifying over-storey species, note the presence of tree hollows (minimum entrance width of 5cm), mistletoe or flowers/fruit on each tree and any dead trees. Also record the length of fallen logs (minimum diameter 10cm and minimum length 0.5m) within the plot.

### • 20x20m quadrat

**Community species richness:** Systematically cover the entire 20x20m quadrat identifying and recording all native species in the mid-storey (all vegetation between the over-storey and >1m including tall shrubs, under-storey trees and tree regeneration) and all native species in the ground stratum noting native grasses (plants belonging to the Family Poaceae), native shrubs (woody vegetation <1m), other native species (other native non-woody vegetation in ground stratum e.g. forbs, herbs, lilies, rushes, sedges) and exotic species.

**Community structure:** Divide the 20x20m quadrat into four 10x10m quarters and estimate the % cover of native species in each stratum (mid-storey, ground stratum (grasses), ground-stratum (shrubs), ground stratum (other) and exotics) within each quarter. Average the four estimates to obtain an average % cover for each stratum in the 20x20m quadrat.

**Additional habitat features:** Within each quarter of the quadrat, also estimate % cover of litter, rock and bare ground. Average the four estimates to obtain an average % cover for each habitat feature in the 20x20m quadrat.

### • 50m transect

**Community structure:** At 10 points along each of the three 50m transects (every 5m) estimate % foliage cover directly overhead (over-storey) using reference images provided in the BioMetric 3.1 Operational Manual (Department of Environment, Climate Change and Water, NSW, 2011). Average the estimates to obtain an average % foliage cover for the plot.

**Table 1 Key variables used to monitor changes in the vegetation/habitat condition**

Variable	Measurement units	Sampling units
<b>SPECIES RICHNESS</b>		
Native over-storey	Species ID and No. species/sampling unit	50x20m plot
Native mid-storey	Species ID and No. species/sampling unit	20x20m quadrat
Native ground stratum (grasses)	Species ID and No. species/sampling unit	20x20m quadrat
Native ground stratum (shrubs)	Species ID and No. species/sampling unit	20x20m quadrat
Native ground stratum (other)	Species ID and No. species/sampling unit	20x20m quadrat
Exotic ground stratum	Species ID and No. species/sampling unit	20x20m quadrat
Total	Species ID and No. species/sampling unit	20x20m quadrat for mid-storey and ground strata, 50x20m plot for over-storey
Total Native	Species ID and No. species/sampling unit	20x20m quadrat for mid-storey and ground strata, 50x20m plot for over-storey
Total Exotic	Species ID and No. species/sampling unit	20x20m quadrat for mid-storey and ground strata, 50x20m plot for over-storey
<b>COMMUNITY STRUCTURE</b>		
Native over-storey	% cover	3x50m transects
Native mid-storey	% cover	20x20m quadrat
Native ground stratum (grasses)	% cover	20x20m quadrat
Native ground stratum (shrubs)	% cover	20x20m quadrat
Native ground stratum (other)	% cover	20x20m quadrat
Exotic	% cover	20x20m quadrat
<b>OVERSTOREY REGENERATION &amp; HEALTH</b>		
Over-storey species regeneration	No. species	50x20m plot
Over-storey species stem diameter class (0-10cm)	No./sampling unit	50x20m plot
Over-storey species stem diameter class (10-20cm)	No./sampling unit	50x20m plot
Over-storey species stem diameter class (>20)	No./sampling unit	50x20m plot
<b>ADDITIONAL HABITAT FEATURES</b>		
Litter	% cover	20x20m quadrat
Rock	% cover	20x20m quadrat
Bare ground	% cover	20x20m quadrat
Log	Length	50x20m plot
Tree hollows	Number	50x20m plot
Dead trees	(% tree population)	50x20m plot
Mistletoe	(% tree population)	50x20m plot
Flower/fruit	(% tree population)	50x20m plot

## Appendix E - Adaptive Management Monitoring – Field Methods

To rapidly assess the ground cover and herbage mass the following quadrat sampling method will be used (Lang 2005):

For each assessment, record the: date and record the location using a hand-held GPS or on a map. Using a wooden or metal square (quadrat) of at least 0.5m x 0.5m internal dimensions, undertake the following steps:

a. Walk at random path within each area to be assessed and throw the quadrat a short distance.

b. For each throw look only at the area within the quadrat and assess and record the following:

A = the percentage of total pasture cover (living and dead);

B = the percentage cover of live native plants;

C = the percentage cover of live non-native plants; and

D = measure height of pasture cover using Meat and Livestock Australia Pasture Ruler to estimate herbage mass.

c. Take at least 10 random samples for each assessment area (paddock).

d. Calculate the percentage of the assessment area covered by vegetation (living or dead):

Sum of A / Number of samples.

e. Calculate the percentage of the living vegetation that is live native groundcover by:

$(\text{Sum of B} \times 100) / (\text{Sum of B} + \text{Sum of C})$ .

f. Calculate average mass by: Sum of D / Number of samples.

This quadrat data will be provided in monthly reports along with the following information:

- livestock movement including dates of entry and removal from paddocks, number of livestock, type and condition;
- quantity of supplement;
- any livestock health or other management issues; and
- daily rainfall data.

**Table 1 Adaptive Management Assessment Template**

**Site Details**

Biodiversity Area	Bowditch	
Property		
Management Zone		
Paddock (if named)		
Latitude*		*or map attached
Longitude*		
Natural tree regeneration present (Yes/No)		
Ground cover regeneration present (Yes/No)		

**Livestock Details**

Entry date	
Removal date	
Number	
Type	
Condition	
Supplement quantity	
Other livestock health/management issues	

**Pasture Assessment**

**Quadrat number (minimum 10)**

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
% total pasture cover (living and dead)															
% cover live native plants															
% cover live non-native plants															
height of pasture/herbage mass															
weeds present (1) or absent (0)															
feral animal activity present (1) or absent (0)															

**Other observations/comments** (e.g. weed species, type of feral animal evidence (diggings, scats, live/dead animal sighting etc), revegetation, flowering trees etc)

--

**Summary**

% vegetation cover	#####
% live native ground cover	#####
average herbage mass	#####
% quadrats with weeds	#####
% quadrats with feral animal activity	#####