


# GOULBURN RIVER

## Management Plan

Yancoal Warkworth Mine and Yancoal Hunter Valley Operations, New South Wales | December 2017



This Management Plan is the framework for the protection and management of a 1,066 hectare offset area under a legally binding conservation mechanism to satisfy conditions of Warkworth Mining Limited's Commonwealth approval (EPBC 2002/629) and NSW approval (NSW SSD-6464), and the 140 hectare offset area to satisfy conditions of the Hunter Valley Operations NSW approval (NSW PA 06-0261).



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This document has been prepared using maps prepared by:

Cambium Group

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Cover Photo: Goulburn River Biodiversity Area 2013

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### Declaration of accuracy

I declare that:

1. To the best of my knowledge, all the information contained in, or accompanying this Goulburn River Biodiversity Area Management Plan is complete, current and correct.
2. I am duly authorised to sign this declaration on behalf of the approval holder.
3. I am aware that:
  - a. Section 490 of the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) makes it an offence for an approval holder to provide information in response to an approval condition where the person is reckless as to whether the information is false or misleading.
  - b. Section 491 of the EPBC Act makes it an offence for a person to provide information or documents to specified persons who are known by the person to be performing a duty or carrying out a function under the EPBC Act or the *Environment Protection and Biodiversity Conservation Regulations 2000* (Cth) where the person knows the information or document is false or misleading.
  - c. The above offences are punishable on conviction by imprisonment, a fine or both.



Signed

DARIN (BILL) BAXTER

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Full name (please print)

YANCOAL AUSTRALIA

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Organisation (please print)

7 DECEMBER 2017

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Date

Document Title	Version	Date effective	Comment
Goulburn River BA Management Plan,	1	December 2016	Submitted for approval to DoEE and DPE on 17 February 2017. DPE approved on 26/6/2017.
Goulburn River BA Management Plan	2	December 2017	DoEE provided comments on 13/04/2017 and 22/06/2017 on the Southern BA Management Plan. The final text was approved by DoEE and these agreed changes have been made to V2 of the Goulburn River BA Management Plan. Also changes to reflect the new ownership of Coal & Allied by Yancoal.

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## Abbreviations and Definitions

asl	Above sea level
BA	Biodiversity Area (includes the Offset Area, infrastructure and other land)
BB	Braun-Blanquet (cover abundance score)
BC Act	NSW <i>Biodiversity Conservation Act 2016</i>
BFMP	Bushfire Management Plan
BVT	BioMetric Vegetation Type
CE	Critically Endangered
CEEC	Critically Endangered Ecological Community
CHWG	Cultural Heritage Working Group
CHGBIW	Central Hunter Grey Box – Ironbark Woodland
CHVEF	Central Hunter Valley Eucalypt Forest
Coal & Allied	Coal & Allied Industries Limited
COPs	National Codes of Practice
DoEE	Australian Government Department of the Environment and Energy (previously Department of the Environment (DoEE))
DPE	NSW Department of Planning and Environment
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>
GDP	Ground Disturbance Permit
ha	Hectare
HLLS	Hunter Local Land Services
km	Kilometre
LLS Act	<i>Local Land Service Act 2013</i>
Ma	Marine Migratory
MNES	Matters of National Environmental Significance
MZ	(BioBanking) Management Zone
NPW Act	<i>National Parks and Wildlife Act 1974</i>
NPWS	National Parks and Wildlife Service
NSW	New South Wales
OEH	NSW Office of Environment and Heritage
offset area	Area of vegetation and habitat secured by legally binding mechanism.
RCA	Rapid Condition Assessment
RTCA	Rio Tinto Coal Australia
SDS	Safety Data Sheets
SOPs	Standard Operating Procedures
TSC Act	NSW <i>Threatened Species Conservation Act 1995</i>
WON	Weed of National Significance
Yancoal	Yancoal Australia Limited

# 1 Introduction

The purpose of this Management Plan (Plan) is to describe the long term management and protection of the offset area located within the Goulburn River Biodiversity Area (BA). This Plan outlines conservation management actions and a monitoring programme for the Goulburn River BA to achieve the conservation objectives.

This Plan has been prepared to satisfy the conditions of Commonwealth and New South Wales (NSW) environmental approvals held by Warkworth Mining Limited and Hunter Valley Operations Pty Ltd (HV Operations) for open cut coal mines located in the Hunter Valley NSW. The Warkworth Mine owned by Warkworth Mining Limited forms part of the Mount Thorley Warkworth complex. Yancoal Australia Limited (Yancoal) manage the Warkworth Mine and HVO Mine.

The Plan's conservation objectives include a short term objective to measure the effectiveness of initial restoration efforts and longer term outcomes from the continued implementation of the Plan. The short term conservation objective is to protect and enhance the condition and extent of the conservation and habitat values of the offset areas within 10 years. The Plan details active restoration to increase the extent and enhance habitat for the Critically Endangered woodland birds, the Regent Honeyeater and Swift Parrot, and increasing connectivity and resilience to climate change. Section 2 provides a full description of the conservation values, including their baseline condition. In terms of measuring success of the Plan the conservation values have been identified as:

- Woodland;
- Grassland; and
- Fauna habitat (in particular habitat for Regent Honeyeater and Swift Parrot).

Key performance criteria have been set for each of the conservation values, and a full description is provided in section 3. Attainment of the objective and performance criteria is measured using targeted monitoring, which is detailed in section 5. The following points outline the monitoring programme to measure the regeneration pathway and enhancement of habitat condition;

- Habitat restoration monitoring – 27 key variables are measured every two years by an external Biodiversity Auditor to track changes in vegetation and habitat condition. The data is analysed to assess the trajectory towards the benchmark description for the vegetation community and improved condition in woodland habitats.
- Bird assemblages monitoring – systematic surveys are completed every two years by an external Biodiversity Auditor to collect data on bird usage, assemblages and habitat. Monitoring of bird assemblages is also indicative of biodiversity as a whole and environmental change.
- Rapid Condition Assessment – photo monitoring and rapid assessment of woodland condition is undertaken every year; and
- Property inspections – monitoring for early detection of potential threats to the conservation values and failures of the Plan.

The conservation management actions to be implemented are described in section 4. Each action has a specific Performance Criteria and Trigger, Response and Action plan to ensure the actions deliver the intended outcome and are adaptable. The actions are guided by relevant National Recovery Plans, as well as the requirements of the legally binding conservation mechanism. To demonstrate this alignment the conservation management actions are listed in Table 1 against the National Recovery Plan objectives or strategy for the Regent Honeyeater and Swift Parrot.



**Table 1 Alignment to the National Recovery Plans for Regent Honeyeater and Swift Parrot**

<b>Actions</b>	<b>National Recovery Plan for the Regent Honeyeater (2016)</b>	<b>National Recovery Plan for the Swift Parrot (2011)</b>	<b>Alignment / Contribution</b>
Controlled activities (Section 4.1)	Improve the extent and quality of regent honeyeater habitat.	To identify and prioritise habitats and sites used by the species across its range, on all land tenures. To implement management strategies to protect and improve habitats and sites on all land tenures	Protection of habitat in Hunter Valley identified as Priority habitat for conservation for both species. The prohibited activities address key threatening processes such as: habitat loss and alteration; forestry and firewood collection; and competition from honey bees.
Management of grazing for conservation (Section 4.2)	Improve the extent and quality of regent honeyeater habitat.	To implement management strategies to protect and improve habitats and sites on all land tenures	The grazing controls address key threatening processes such as: habitat loss and fragmentation; habitat degradation; and regeneration suppression.
Weed control (Section 4.3)	Improve the extent and quality of regent honeyeater habitat.	To implement management strategies to protect and improve habitats and sites on all land tenures	Control of weeds addresses key threatening process such as: regeneration suppression; encourage regeneration; and habitat loss.
Management of fire for conservation (Section 4.4)	Improve the extent and quality of regent honeyeater habitat.	To implement management strategies to protect and improve habitats and sites on all land tenures	Control of fuel loads to address key threatening process such as: frequent fire; and high intensity fires
Infrastructure improvement (Section 4.5)	Improve the extent and quality of regent honeyeater habitat.	To implement management strategies to protect and improve habitats and sites on all land tenures	Infrastructure to protect offset areas such as: fencing to exclude persons and grazing; safe access to implement management activities; and fire protection infrastructure.
Supplementary planting, (Section 4.8)	Improve the extent and quality of regent honeyeater habitat.	To implement management strategies to protect and improve habitats and sites on all land tenures	Active restoration of areas within the offset areas that have limited regenerative capacity and require introduction of plants to trigger regeneration to establish more and enhanced habitat.
Vertebrate Pest and Overabundant Native Animal Control. (Section 4.10)	Improve the extent and quality of regent honeyeater habitat.	To implement management strategies to protect and improve habitats and sites on all land tenures	Pest control to addresses key threatening process such as: Predation– cats; and Competition – noisy miners, starlings.
Ecological Monitoring – Bird Assemblages (Section 5.3.2)	Increase understanding of the size, structure, trajectory and viability of the wild population.	To monitor population trends and distribution throughout the range.	Biennial monitoring contributing to records of sighting, breeding and numbers.

The Plan requires the preparation of an Annual Report, to review all activities undertaken and review the monitoring data against the key performance criteria and conservation management actions performance criteria. The Trigger, Response and Action plans for each action and the risk assessment in section 6 ensure the Plan is comprehensive and adaptive to new risks and changing circumstances. Key risks identified include:

- Unlawful damage;
- Bushfire;
- Suppression of regeneration from weeds and / or uncontrolled grazing; and
- Climate change impacting native regeneration.

Consistent management of the offset area is best achieved through the implementation of one plan and, therefore, this Plan has been prepared to satisfy a range of requirements including:

- compliance with Commonwealth and State environmental approvals;
- legally binding conservation mechanism;
- contractual to engage consultants and contractors; and
- operational guide for Yancoal staff.

The Goulburn River BA is located near the township of Merriwa in NSW the land is owned by Warkworth Mining Limited and managed by Yancoal. The total area of the BA is 1,539 hectares (ha) and contains 1,206ha of native vegetation (offset area) to be protected as an offset area. Figure 1 provides the location of the BA and its proximity to Warkworth Mine and HVO, as well as the other BAs containing offset areas.

The BA is currently managed in accordance with the Regional Offset Management Plan (2014). This Plan will supersede the Regional Offset Management Plan once it is approved by the Commonwealth and NSW regulators.

## 1.1 Intent

The intent of the Plan is to ensure compliance with all environmental approvals and support the legally binding conservation mechanism by:

- implementing the conservation management actions in Section 4 and monitoring in Section 5, to meet and measure attainment of the conservation objectives set out in Section 3.

The legally binding conservation mechanism must remain on the land title in perpetuity, for the cadastral blocks listed in Table 3.

## 1.2 Environmental Approvals

### 1.2.1 Commonwealth

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).

These approvals require Warkworth Mine to offset the impact upon Matters of National Environmental Significance by protecting and managing habitat for the Regent Honeyeater (*Anthochaera phrygia*) and Swift Parrot (*Lathamus discolor*).

Under these approvals, the Goulburn River BA is to be secured with a legally binding mechanism for enduring protection of 1,066ha of suitable habitat for EPBC2002/629. This Plan satisfies the requirement to prepare an Offset Management Plan (OMP).

### 1.2.2 New South Wales

The Warkworth Mine was granted the NSW Development Approval (SSD-6464) issued under the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) on 26<sup>th</sup> November 2015. This approval requires the Goulburn River BA to be secured under a legally binding mechanism (Condition 30) and for the ecosystem and species credits to be retired to satisfy Condition 28. This Plan satisfies the requirement under Condition 36, for a Biodiversity Management Plan to implement the biodiversity offset strategy.

HV Operations Pty Ltd was granted a NSW Project Approval (PA) by the NSW Minister for Planning for the HVO South Coal Project on 24 March 2009 under the provisions of the EP&A Act, reference NSW PA 06\_0261. The approval granted permission to clear 48ha of remnant native vegetation and 92ha of regrowth. To offset this impact 140ha of Narrow-leaved Ironbark Woodland is to be protected in perpetuity. This Plan satisfies the requirement under Condition 36 for a plan to implement the biodiversity offset strategy.

To ensure this Plan satisfies the requirement of all approvals Section 7 provides a compliance table to demonstrate attainment of the relevant conditions.

### 1.3 Function of the Management Plan

The Plan will provide the management framework for the BA with the aim to protect and enhance conservation values through the implementation of conservation management actions.

For the Plan to be successful it needs to define the baseline ecological condition of the BA, provide clear conservation objectives, detail the conservation management actions and measure success. To that end the Plan comprises the following sections:

- Biodiversity Areas: description of the BAs and baseline ecological condition of the vegetation communities and habitats, including the biodiversity credits to be retired;
- Conservation Objectives, Key Performance Indicators and Completion Criteria: outlines the conservation objectives for the Plan, conservation values and key performance indicators that have guided the development of conservation management actions and the monitoring programme;
- Conservation Management Actions: lists the primary management actions to be implemented to increase the extent, connectivity and condition of the plant community types and habitats, including Trigger, Response and Action plans;
- Monitoring: details the approach to data collection, analysis and interpretation to measure impacts of the conservation management strategies, to guide adaptive management, to identify positive trends in conservation values and assess attainment of Key Performance Indicators; and
- Risk Assessment: matrix of key risks in the implementation of the Plan and attainment of the objectives.

#### 1.3.1 Information Management

To secure monitoring data and assist in the management of the BA, Yancoal will maintain the online Biodiversity Offsets Portal whilst the BA is under their direct management. This Portal has been designed to centralise and share information among authorised users including regulators, and will include spatial data, an image library, Annual Reports, plans, Biobanking reports, survey results, records of management activities such as planting and weed control and other non-spatial data. The Portal will, improve communication among stakeholders, provide 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.

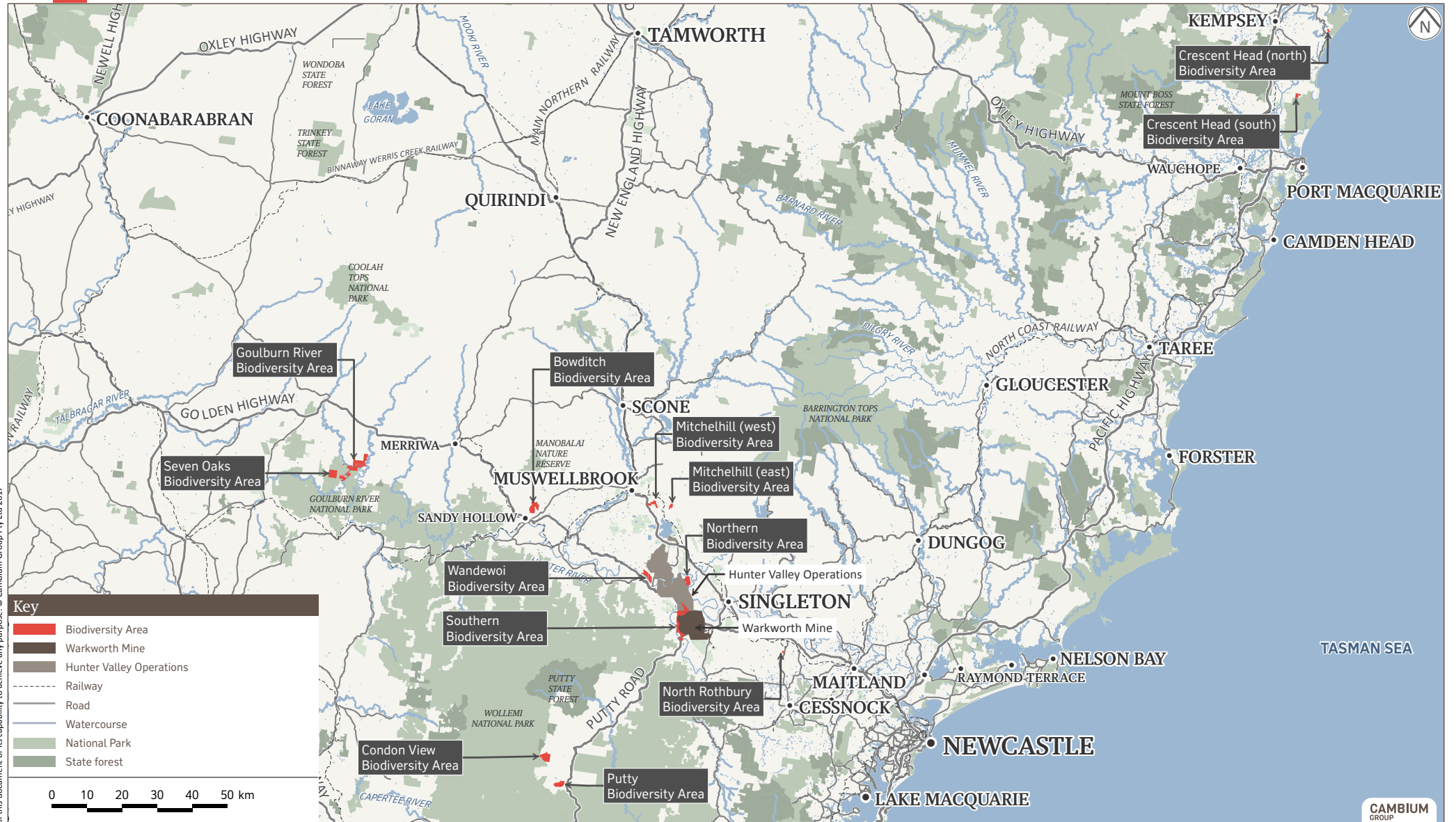
The Portal will also provide access to an Interactive Map that will allow users to visualise data in a geo-spatial context, assisting in data interpretation. This data will include aerial imagery, site information (e.g. cadastral, site access, topographic, infrastructure, geology) and data relating to 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.



# Location of the Warkworth Mine and Hunter Valley Operations Biodiversity Areas

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Figure 1



### 1.3.2 Key Stakeholders and Roles

The key 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>
Commonwealth Regulator: Administers approvals granted under the EPBC Act - EPBC 2002/629.	Australian Government Department of the Environment and Energy (DoEE)	<a href="mailto:PostApproval@environment.gov.au">PostApproval@environment.gov.au</a> (for submission of plan and matters related to the EPBC approval) <a href="mailto:EPBCMonitoring@environment.gov.au">EPBCMonitoring@environment.gov.au</a> (for submission of Annual Report and EPBC Annual Compliance reports)
NSW Regulator: Administers approvals granted under the EP&A Act – SSD-6464 and PA 06_0261.	Department of Planning & Environment (DPE)	Compliance (Mining) Mining & Industry Projects Department of Planning & Environment <a href="http://www.planning.nsw.gov.au">http://www.planning.nsw.gov.au</a>
NSW Regulator: Administers the <i>National Parks and Wildlife Act 1974</i> (NPW Act) and the <i>Biodiversity Conservation Act 2016</i> (BC Act)	Office of the Environment and Heritage (OEH)	Newcastle Office Regional Operations OEH <a href="http://www.environment.nsw.gov.au">www.environment.nsw.gov.au</a>
Land owner: Holds the title for the land	Warkworth Mining Limited whose operations are managed by Yancoal Australia Ltd.	Manager – Environment NSW
Project Proponent: Prepare and implement the Plan and complete reporting	Warkworth Mining Limited and HVO whose operations are managed and operated by Yancoal Australia Ltd.	Manager - Environment NSW
Biodiversity Auditor: Monitor improvement in condition of the biodiversity values and completed ecological monitoring.	Yancoal Australia Ltd.	Yancoal to engage suitably qualified person/s.

### 1.3.3 Review and reporting

The Plan will be reviewed within four years from the date the Plan is approved by the Commonwealth and NSW regulators. The purpose of the review is to: incorporate suggestions from the Biodiversity Auditor after completing the Ecological Monitoring; update information on the ecological condition and extent of the plant community types and habitats across the BA; and refine conservation management actions. The review will incorporate any updated National Recovery Plans and other literature to ensure the management actions of the Plan are aligned and consistent with current science and conservation management practice.

At the end of year 10 an Advisory Group comprising representatives for each of the stakeholders listed in Table 2 will be invited to complete a review of the implementation of the Plan. The review will be informed by the Annual Reports, all monitoring reports, EPBC Annual Compliance reports and NSW Independent Audit results. The outcomes from the 10 year review will include a revised timeframe for the conservation objective, conservation management actions, and monitoring programme and reporting schedule. All revisions of the Plan are to be approved by DoEE and DPE. The document may be updated to amend contact details, agency names or other secondary information.

Annual Reports will include a summary of monitoring data, and analysis of that data and management highlights.

The Annual Reports will be prepared and submitted to DoEE and DPE in **May 2018** following implementation of the first year (2017) and then each year following. The report will be prepared with input from a suitably qualified ecologist or environmental scientist.

Annual Reports will include the following information as a minimum:

- name and contact details of the Landholder and/or Leaseholder;
- list of conservation management actions undertaken, describing 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;
- analysis of monitoring results with recommendations for modifications, if any, to the management or monitoring activities;
- assessment of any new risks or potential threats to the BA and actions to be undertaken to manage these threats and/or risks; and
- assessment of the progress in attainment of the conservation objectives and key performance indicators.



## 2 Biodiversity Area

### 2.1 Location and Description

The Goulburn River BA is located 30 kilometres (km) west of Merriwa in NSW, approximately 100km northwest of the HVO and Warkworth Mine, and is accessed via Comialla Road.

The Goulburn River BA is 1,539 ha in size. It is comprised of 27 separate cadastral blocks, all are owned by Warkworth Mining Limited, a full list is provided in Table 3. Figure 2 shows the location of the BA, cadastral boundaries and the offset areas for Warkworth and HVO.

This Plan identifies the 1,206ha offset area including 140ha identified for HVO and 1,066ha for Warkworth mine. The BioBanking Assessment Report (AHEcology 2015) identified 1,206ha of vegetation and described Plant Community Types within seven Management Zones (MZs) based on the vegetation and condition. Figure 3 shows the location of these areas. The remaining land has been designated as non-offset area and infrastructure.

A summary of the credits generated for ecosystem credits is provided in Section 2.3 and species credits in Section 2.5.

The Goulburn River BA is known locally as 'The Rivers' and includes the convergence of the Munmurra and Goulburn Rivers. 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 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 (Cumberland Ecology 2013).

**Table 3 Biodiversity Area location details**

Local Government Area	Label	Area (ha)	Warkworth Offset Area (ha)	HVO Offset Area (ha)	Non Offset Area (ha)	Lot	DP
Upper Hunter	A	536.7	388.9	116.4	24.1	190	720349
Upper Hunter	B	31.4	7.2	23.6		174	750743
Upper Hunter	C	38.7			38.7	18	750743
Upper Hunter	D	24.2			24.2	9	750743
Upper Hunter	E	35.9	15.6		20.3	109	750743
Upper Hunter	F	38.7	36.1		1.9	202	750743
Upper Hunter	G	16.8	4.2		12.5	126	750743
Upper Hunter	H	17.2	2.5		14.4	125	750743
Upper Hunter	I	16.2	4.4		11.7	124	750743
Upper Hunter	J	16.5	3.4		13.1	123	750743
Mid-Western Regional	K	28.8	19.7		8.8	5	755422
Mid-Western Regional	L	15.9	4.8		10.8	22	755422
Mid-Western Regional	M	17.1	6.2		10.6	3	755422
Mid-Western Regional	N	15.6	6.4		9.2	4	755422
Upper Hunter	O	29.1	28.9			134	720347

Local Government Area	Label	Area (ha)	Warkworth Offset Area (ha)	HVO Offset Area (ha)	Non Offset Area (ha)	Lot	DP
Upper Hunter	P	19.2	19.0			118	750757
Upper Hunter	Q	15.1	13.1		1.7	11	750757
Upper Hunter	R	16.3	10.6		5.6	9	750757
Mid-Western Regional	S	251.7	157.1		93.3	14	755422
Upper Hunter	T	17.3	8.2		8.9	87	750757
Upper Hunter	U	18.3	12.7		5.5	88	750757
Mid-Western Regional	V	74.2	73.6			15	755422
Mid-Western Regional	W	59.9	59.0			138	720348
Mid-Western Regional	X	36.4	36.3			124	750757
Mid-Western Regional	Y	103.7	103.3			122	750757
Mid-Western Regional	Z	16.4	16.4			98	750757
Mid-Western Regional	AA	26.7	26.7			141	720348
Infrastructure						15	Multiple less than 1 ha
<b>Total*</b>		<b>1,539</b>	<b>1066</b>	<b>140</b>	<b>331</b>		

The NSW (Mitchell) Landscapes mapping (Mitchell 2002) shows several landscapes occurring across the Goulburn River BA with Lees Pinch Foothills being the most well represented, especially in areas where vegetation communities will be improved. This Mitchell Landscape is characterised by stony plateau, rugged hills and ridges with narrow valleys on Triassic and Jurassic quartz sandstones, shale and conglomerate, with general elevations of 250 to 750 m, and local relief of 300m. It is characterised by extensive rock outcrops with low cliffs and benches, coarse sandy soils with rubbly debris on steep slopes, accumulations of alluvial sand in the valleys and yellow texture-contrast soils on some benches (NPWS 2003).

Goulburn River BA is situated strategically within a number of important conservation areas and these are:

- Goulburn River National Park directly adjacent to the south and west;
- Munmurra Nature Reserve approximately 1.6 km to the west; and
- Durrigere State Conservation Area approximately 12 km to the north-west.

The protection and enhancement of the BA will help facilitate the movement of fauna across the landscape and extend broad areas of suitable habitats for threatened fauna species.

Elevations across the Goulburn River BA vary by approximately 100 m, with the valley floors being approximately 280 m above sea level (ASL) to 380 m ASL on the ridgetops.

The most northern sections of the Goulburn River BA border grazing lands. However, the more southerly areas are adjacent to Goulburn River National Park which is a vast tract of vegetated land which connects western landscapes to the sandstone coastal areas, via Wollemi, Yengo and the Blue Mountains National Parks.

The property has been cleared along the valley floors and used for grazing and in some sections cropping over a number of years. The vegetation of the lower foothills and upper sandstone escarpments is relatively free from agricultural disturbance and retains valuable biodiversity.

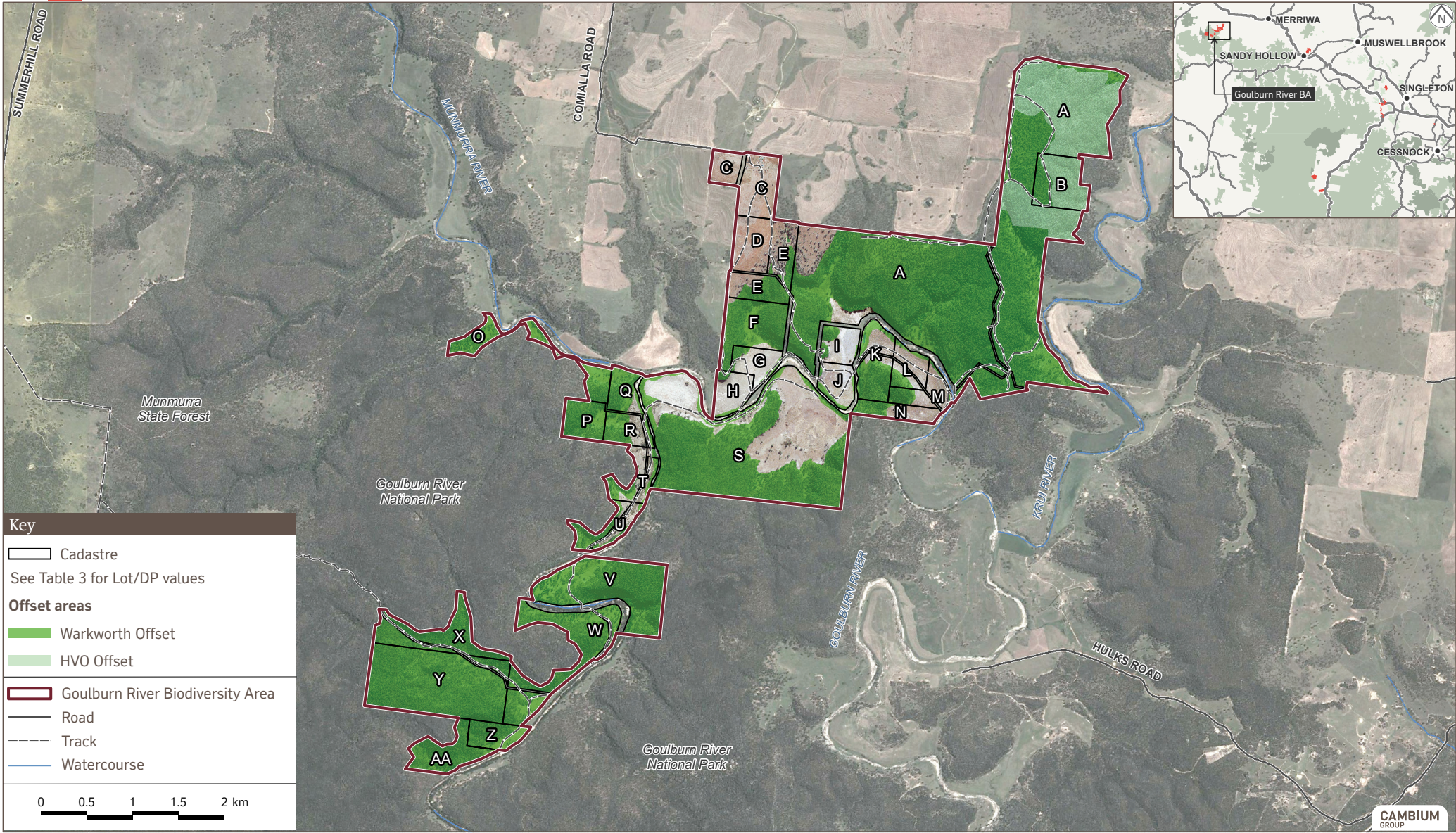
The non-offset areas are located on moderately undulating terrain at the top of the escarpment and on the floodplains below the steep escarpment. The areas at the top of the escarpment are dominated by exotic annuals due to their history of farming. The floodplain areas are covered with native grasses (e.g. *Austrostipa verticillata*) or pasture dominated by exotic annuals.



Cadastral boundaries and offset areas at the Goulburn River Biodiversity Area

Management Plan 2017

Figure 2

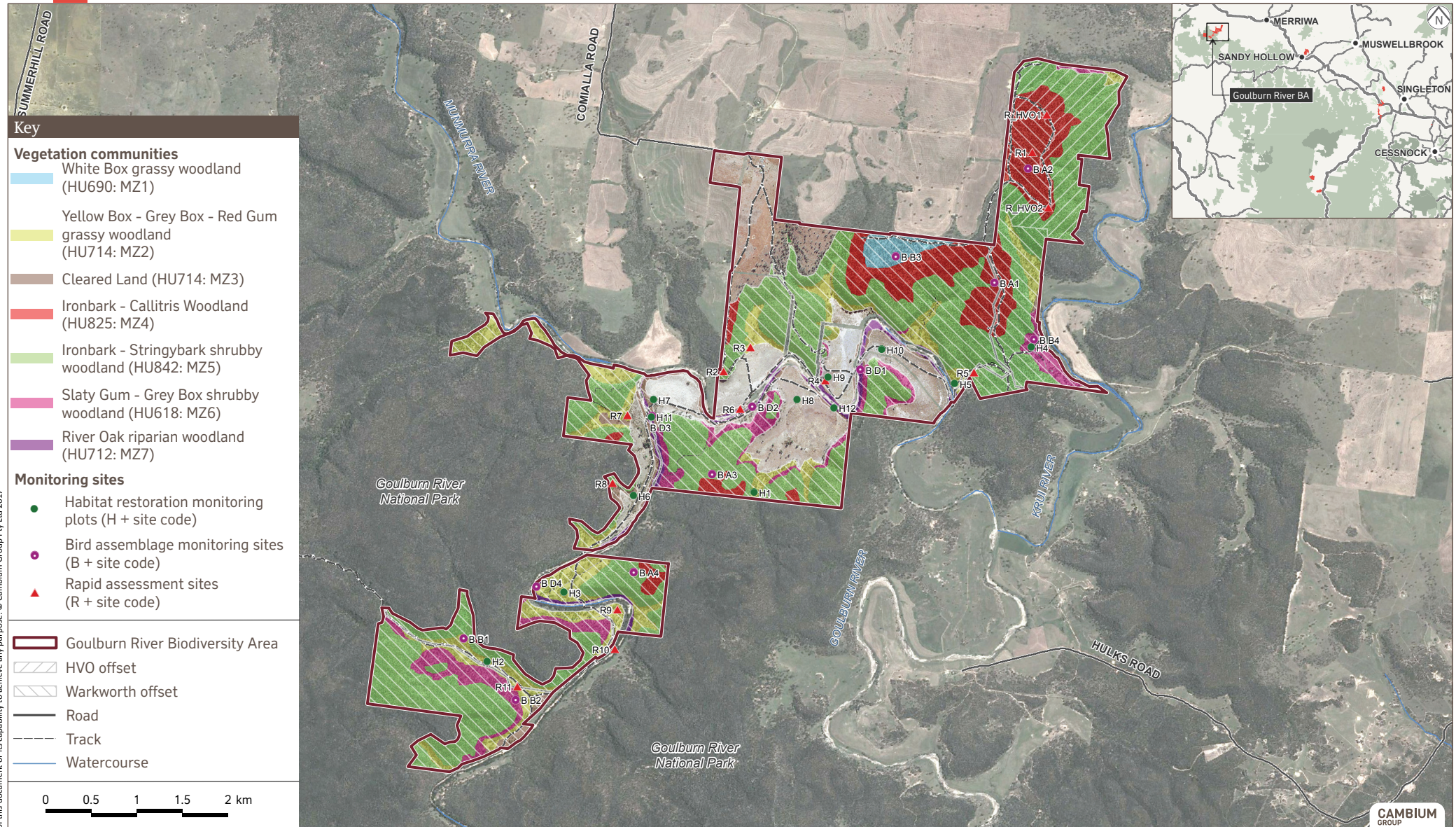




## Vegetation communities, management zones and monitoring sites at the Goulburn River Biodiversity Area

Management Plan 2017

Figure 3





## 2.2 Vegetation Communities

Goulburn River BA is characterised by river flats, gentle undulating slopes to rocky escarpments and ridgelines to approximately 100 m above the valley floor and the vegetation types reflect these changes. The upper slopes and ridgetops were vegetated by relatively intact and undisturbed Ironbark / Stringybark communities which occur across the shallow soils of the sandstone plateau. These communities graded down to Box shrubby / grassy woodlands on the footslopes to the Box Gum grassy woodlands on the valley floor, where soils are deeper and more fertile. These have been historically cleared and grazed over many years. The extent and condition of the valley floor vegetation communities varies from patchy occurrences of native vegetation in poor condition to derived grasslands where the vegetation communities have generally been cleared and altered from their original state. Riparian zones along the Goulburn and Munmurra Rivers are largely cleared to the top of the bank with scattered occurrences of *Casuarina cunninghamia* remaining.

The Goulburn River BA provides intact and complex fauna habitat across the sandstone escarpment and slopes. These intact landscapes represent highly valuable habitat for terrestrial mammals, some reptiles, bats and a range of birds (Cumberland Ecology 2013).

The Goulburn River BA supports 7 vegetation communities as shown in Table 4 as well as the Plant Community Types code and Management Zones used in the BioBanking Assessment Report. Figure 3 shows the distribution of the vegetation communities within the BA.

**Table 4 Vegetation communities across the offset areas**

Code	Vegetation Community	Management Zone (MZ)	BioBanking Condition	Area (ha)
HU690	White Box grassy woodland CEEC/EEC	MZ1	Moderate / Good_Medium	22.0
HU714	Yellow Box - Grey Box - Red Gum grassy woodland CEEC/EEC	MZ2	Moderate / Good_Poor	180.8
HU714	Grassland	MZ3	Low	36.9
HU825	Ironbark – Callitris woodland	MZ4	Moderate / Good_Medium	178.0
HU843	Ironbark / Stringybark shrubby woodland	MZ5	Moderate / Good_High	662.9
HU618	Slaty Gum - Grey Box shrubby woodland VEC	MZ6	Moderate / Good_Medium	96.4
HU712	River Oak riparian woodland	MZ7	Moderate / Good_Poor	29.0
Total				1,206

## 2.3 BioBanking Ecosystem credits

The Goulburn River BA BioBanking Assessment Report (AHEcology 2015) calculated a total of 18,948 ecosystem credits. However after exclusion of the HVO Offset Area only 16,717 are available for retirement by Warkworth Mine, as shown in Table 5.

**Table 5 Goulburn River Biodiversity Area ecosystem credits for retirement**

Code	Plant Community Type	Management Zone (MZ)	Area (ha)	Ecosystem Credits
HU690	Grey Box - White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley	MZ1	22.0	315
HU714	Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	MZ2	180.8	2,885
HU714	Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	MZ3	36.9	411
HU825	Narrow-leaved Ironbark – Black Cypress Pine shrub-grass woodland upper Hunter and northern Wollemi	MZ4	147.3	2,290
HU843	Narrow-leaved Stringybark - Grey Gum shrubby open forest on sandstone ranges of the Sydney Basin	MZ5	553.6	8,882
HU618	Slaty Box - Grey Gum shrubby woodland on footslopes of the upper Hunter Valley, Sydney Basin Bioregion	MZ6	96.4	1,573
HU712	River Oak riparian grassy tall woodland of the western Hunter Valley (Brigalow Belt South Bioregion and Sydney Basin Bioregion)	MZ7	29.0	361
<b>Total</b>			<b>1,066</b>	<b>16,717</b>

## 2.4 Threatened Species

The Goulburn River BA supports 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. Figure 4 shows the observation of threatened species across the BA.

Field surveys were completed across the BA in 2012 (Cumberland Ecology 2013). Table 6 lists the threatened, migratory and marine migratory birds listed under the NSW *Biodiversity Conservation Act 2016* (BC Act) and EPBC Act recorded at the Goulburn River BA. A total of 25 listed birds and mammals have been recorded, which included 4 migratory (Mi) and marine migratory (Ma) birds.

**Table 6 Threatened, Migratory and/or Marine Migratory species recorded at the Goulburn River Biodiversity Area (2012)**

Scientific name	Common name	BC Act	EPBC Act	Sighting
<b>BIRDS</b>				
<i>Pyrrholaemus saggitatus</i>	Speckled Warbler	V		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>Calyptorhynchus lathamii</i>	Glossy Black Cockatoo	V		X
<i>Climacteris picumnus victoriae</i>	Brown Treecreeper(eastern subspecies)	V		X

Scientific name	Common name	BC Act	EPBC Act	Sighting
<i>Daphoenositta chrysoptera</i>	Varied Sittella	V		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
<i>Daphoenositta chrysoptera</i>	Varied Sittella	V		X
<i>Glossopsitta pusilla</i>	Little Lorikeet	V		X
<i>Neophema pulchella</i>	Turquoise Parrot	V		X
<i>Ninox connivens</i>	Barking Owl	V		X
<b>MAMMALS</b>				
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheathtail Bat	V		X
<i>Mormopterus norfolkensis</i>	Eastern Freetail-bat	V		P
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V	V	X
<i>Chalinolobus picatus</i>	Little Pied Bat	V		X
<i>Miniopterus australis</i>	Little Bentwing-bat	V		X
<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing-bat	V		X
<i>Nyctophilus corbeni</i>	Greater Long-eared Bat	V	V	X
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V		P
<i>Vespadelus troughtoni</i>	Eastern Cave Bat	V		P

**Abbreviations**

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

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

The offset area is to suitable habitat for the Swift Parrot and Regent Honeyeater to satisfy the EPBC Act approvals. An Expert Report has been prepared to confirm the suitability of habitat on the Goulburn River BA for the Swift Parrot and Regent Honeyeater, as well as confirming the yield of species credits for the Regent Honeyeater.

Table 7 provides a summary of the suitable habitat, both existing and restoring, within the Warkworth Mine offset area. The Expert Report is available on the Biodiversity Offset Portal.

**Table 7 Area of suitable habitat within the Warkworth Mine Offset Area**

Biodiversity Area	Offset Area (ha)	Regent Honeyeater Habitat (ha)			Swift Parrot Habitat (ha)		
		Existing	Restoring	Total	Existing	Restoring	Total
Goulburn River	1,066	1,029	37	1066	1,000	37	1037

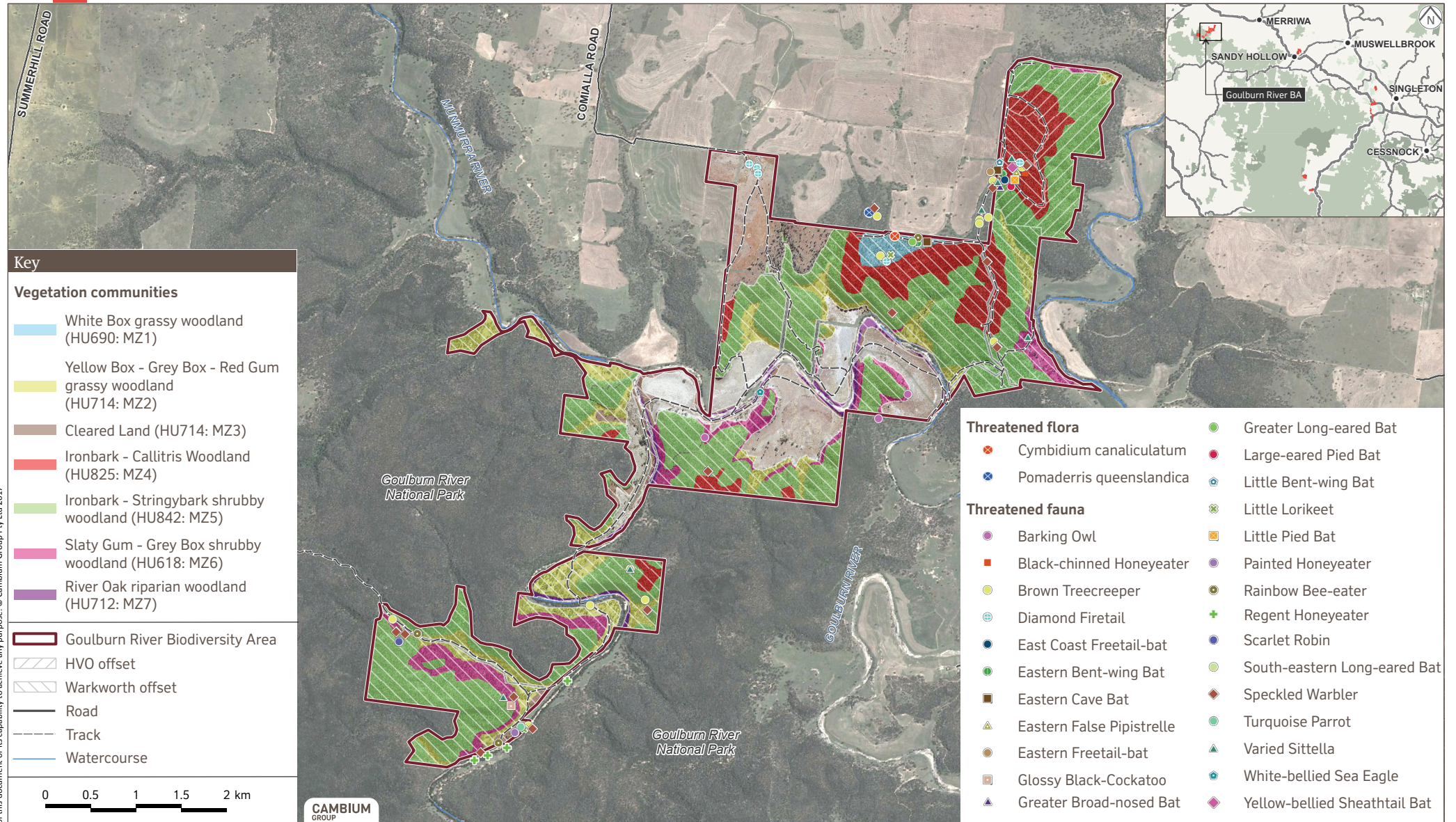
A brief description of these two species is provided below with a summary of the habitat suitability assessment provided in the Expert Report (Cumberland Ecology and Merops Services 2015).



## Threatened species records at the Goulburn River Biodiversity Area

Management Plan 2017

Figure 4





### 2.4.1 Swift Parrot

The Swift Parrot is a predominantly nectarivorous, migratory species endemic to south eastern Australia (Birds Australia 2013) and is listed as Critically Endangered under the EPBC Act and Endangered under the BC Act. 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).

Several tree species that provide feeding resources for the Swift Parrot are present within the Goulburn River BA, including Rough-barked Apple (*Angophora floribunda*), White Box (*Eucalyptus albens*), Yellow Box (*Eucalyptus melliodora*) and Grey Box (*Eucalyptus microcarpa*). These species could be used on occasion by the Swift Parrot for foraging, depending on flowering intensity. Based on this and several other factors, the Expert Report (Cumberland Ecology and Merops services 2015) concluded that the Swift Parrot is moderately-highly likely to occur in the following communities within the BA:

- HU618 – Slaty Box – Grey Gum shrubby woodland;
- HU714 – Rough-barked Apple – Red Gum – Yellow Box woodland;
- HU825 – Narrow-leaved Ironbark – Black Cypress Pine shrub-grass woodland;
- HU690 – Grey Box x White Box grassy open woodland; and
- HU843 – Narrow-leaved Stringybark – Grey Gum shrubby open forest.

### 2.4.2 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) and is listed as Critically Endangered under the EPBC Act and the BC Act. 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.

The Goulburn River BA is 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, and mistletoe. The nearest record of the Regent Honeyeater according to the OEH Atlas of NSW Wildlife is 1.9kms to the south of the property. 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 BA.

A range of tree species that provide feeding resources for the Regent Honeyeater are present within the BA, including some that are abundant. These feed trees include Blakely's Red Gum (*Eucalyptus blakelyi*), Rough-barked Apple (*Angophora floribunda*), River Oak (*Casuarina cunninghamiana*), White Box (*Eucalyptus albens*), Grey Gum (*Eucalyptus punctata*), Yellow Box (*Eucalyptus melliodora*), and Grey Box (*Eucalyptus microcarpa*). These species, as well as shrub and mistletoe species, could be used on occasion by the Regent Honeyeater for foraging, depending on flowering intensity. Another habitat often used by them is River Oak riparian forest or woodland where the Needle-leaved Mistletoe (*Amyema cambagei*) is found on the River Oaks (*Casuarina cunninghamiana*), which is present in the BA.

Based on this and several other factors, the Expert Report (Cumberland Ecology and Merops services 2015) concluded that the Regent Honeyeater is moderately-highly likely to occur in the following communities within the BA:

- HU690 – Grey Box x White Box grassy open woodland;
- HU714 – Rough-barked Apple – Red Gum – Yellow Box woodland;
- HU825 – Narrow-leaved Ironbark – Black Cypress Pine shrub-grass woodland;
- HU843 – Narrow-leaved Stringybark – Grey Gum shrubby open forest.
- HU618 – Slaty Box – Grey Gum shrubby woodland; and
- HU712 - River Oak riparian grassy tall woodland.



**Photo: Swift Parrot (Chris Tzaros)**



**Photo: Regents Honeyeater (Murray Chambers)**

## 2.5 BioBanking Species Credits

The Goulburn River BA BioBanking Assessment Report (AHEcology 2015) identified a total of 34,971 species credits. However, after exclusion of the HVO Offset Area only 30,001 credits are available for retirement by Warkworth Mine, as shown in Table 8.

**Table 8 Goulburn River Biodiversity Area species credits for retirement**

Scientific name	Common name	Species Credits
<i>Cymbidium canaliculatum</i> population in the Hunter Catchment		43
<i>Pomaderris queenslandica</i>	Scant Pomaderris	7
<i>Miniopterus schreibersii</i> subsp. <i>oceanensis</i>	Eastern Bentwing bat	5,661
<i>Vespadelus troughtoni</i>	Eastern Cave Bat	5,661
<i>Chalinolobus dwyeri</i>	Large eared Pied Bat	5,661
<i>Miniopterus australis</i>	Little Bentwing bat	5,661
<i>Anthochaera phrygia</i>	Regent Honeyeater	7,307
<b>Total</b>		<b>30,001</b>

## 2.6 Baseline Ecological Condition

### 2.6.1 Woodland condition

A Rapid Condition Assessment (RCA) technique was used as a preliminary assessment of woodland condition within the BA. **Appendix A** provides details on the RCA methodology.

Eleven permanent RCA sites were established across the Goulburn River BA in November 2013, and data has been collected annually since. Two are located within the 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, these sites might act as early indicators of emerging threats given the greatest risks from threats are often at the more easily accessible areas. Two grassland sites have been included for monitoring purposes. The location of the RCA plots is shown on Figure 3

Photo reference points were established at each RCA site where a series of photos (north, east, south, west and ground) are taken. This will provide a visual record of any changes in vegetation and habitat condition.

All RCA plot data and the photo monitoring plots can be accessed from the online Biodiversity Offsets Portal.

Table 9 provides the number of RCA sites along with the average health rating. All woodland RCA sites received a health rating of >13/20 with the average being 16.5/20 in 2013, 17/20 in 2014, and 17/20 in 2015 indicating these areas are healthy and sustainable under current management.

**Table 9 Rapid Condition Assessment summary results**

RCA Plot	MZ	2013	2014	2015
R 1	MZ4	20	20	20
R 2	MZ5	19	20	20
R 3	MZ2	Grassland	Grassland	Grassland
R 4	MZ3	Grassland	Grassland	Grassland
R 5	MZ5	18	18	19
R 6	MZ7	12	11	10
R 7	MZ2	13	16	17
R 8	MZ5	16	16	16
R 9	MZ2	15	15	16
R 10	Riparian	14	14	14

RCA Plot	MZ	2013	2014	2015
R 11	MZ2	17	18	19
R HVO1*	MZ4	19	19	19
R HVO2*	MZ4	20	19	19
<b>Average</b>		<b>16.5/20</b>	<b>17/20</b>	<b>17/20</b>

\* HVO Offset Area

### 2.6.2 Habitat condition

In October 2014, twelve permanent Habitat Restoration Monitoring plots were established across regenerating woodland, riparian and cleared vegetation communities. Section 5 describes the programme and the methodology to assess changes in habitat values within the offset area through time and relative to the benchmark values associated with the BioMetric Vegetation Type (BVT). The results are shown in Table 10 and have been compared against the benchmark. Three of the monitoring sites (M8, M9 and M10) are located within the non-offset grassland area, to act as a control, and have not been included in Table 10. Figure 3 indicates the location of the plots. A full description of the baseline monitoring results is provided in the Habitat Restoration Monitoring Report (Cambium Group 2015).

The woodland communities within MZ2 and MZ6 are within or approaching benchmark values (within 50-100%) for at least half of the site attributes at all plots. Structural modification due to prior grazing pressure was evident and demonstrated by a lack of understory shrubs and a high percent cover of grasses. Exotic plants within the MZ were in low abundance being below 10% in all woodland plots, with 3 plots having less than 5% cover. Canopy regeneration was generally present within or surrounding the plots.

The riparian vegetation within MZ7 had an intact canopy within the monitoring plots; however, the canopy was patchy across the BA. Other than the presence of a canopy, the structure and composition of the Riparian vegetation was highly modified within the plots, with an abundance of exotic ground cover.

The cleared grassland within MZ3 represented exotic pasture that has been managed for grazing for many years. Very few native plants were recorded with the majority of plots being dominated by exotic grasses and herbs. MZ3 and MZ7 are scheduled for planting as described in Section 4.8.



Photo: Goulburn River, Goulburn River BA (RTCA 2013)

**Table 10 Summary of Habitat Restoration Monitoring Result 2014 compared to benchmark values**

Attributes		NPSR	NOS	NMS	NGCG	NGCS	NGCO	EPC	Logs(m)	Hollows	Regen
<b>MZ2 HU714:</b> Rough-barked Apple -Red Gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion											
Benchmark	min	31	5	2	2	2	2	<5	>30	2	
	max		50	35	30	40	25				
G M1		17	24	0	85	0	1	5.25	42	1	0
G M2		17	13	0	32.5	0	20	1.5	158	1	1
G M3		22	36	0	75	0	0.25	10	7	0	1
G M5		27	32	0	67.5	0	2.5	2.75	37	0	1
<b>Average</b>		<b>20.8</b>	<b>26.2</b>	<b>0</b>	<b>65</b>	<b>0</b>	<b>5.9</b>	<b>4.8</b>	<b>61</b>	<b>0.5</b>	<b>0.75</b>
<b>MZ6 HU618:</b> Slaty Box - Grey Gum shrubby woodland on foot slopes of the upper Hunter Valley, Sydney Basin Bioregion											
Benchmark	min	35	25	11	5	5	5	<5	>73	3	
	max		40	50	45	30	20				
G M4		24	18	5	17.5	5.25	1.25	4	17	0	0
<b>Average</b>		<b>24</b>	<b>18</b>	<b>5</b>	<b>17.5</b>	<b>5.25</b>	<b>1.25</b>	<b>4</b>	<b>17</b>	<b>0</b>	<b>0</b>
<b>MZ7 HU712:</b> River Oak riparian grassy tall woodland of the western Hunter Valley (Brigalow Belt South Bioregion and Sydney Basin Bioregion)											
Benchmark	min	38	10	10	20	1	10	<5	>10	0.1	
	max		50	50	60	5	30				
G M11		5	44	0	33.75	0	0	50	18	0	0
G M12		6	51	0	0.75	0	0	71.25	0	0	1
<b>Average</b>		<b>5.5</b>	<b>47.5</b>	<b>0</b>	<b>17.25</b>	<b>0</b>	<b>0</b>	<b>60.62</b>	<b>9</b>	<b>0</b>	<b>0.5</b>
<b>MZ3 HU714:</b> Rough-barked Apple -Red Gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion											
Benchmark	min	31	5	2	2	2	2	<5	>30	2	
	max		50	35	30	40	25				
G M6		5	0	0	21.25	0	0	77.5	0	0	0
G M7		3	0	0	4	0	0	95	0	0	0
<b>Average</b>		<b>4</b>	<b>0</b>	<b>0</b>	<b>12.6</b>	<b>0</b>	<b>0</b>	<b>86.25</b>	<b>0</b>	<b>0</b>	<b>0</b>

	0-10% or >200% of benchmark (>66% cover for EPC)
	10-50% or 150-200% of benchmark (33-66% cover for EPC)
	50-100% or 100-150% of benchmark (5-33% cover for EPC)
	within benchmark or > benchmark for NPSR, Hollows and Logs (0-5% cover for EPC)

NPSR Native plant species richness  
 NOS Native over-storey % cover  
 NMS Native mid-storey % cover  
 NGCG Native ground cover (grass) % cover  
 NGCS Native ground cover (shrubs) % cover

NGCO Native ground cover (other) % cover  
 EPC Exotic plant cover % cover  
 Logs (m) Length of logs (m)  
 Hollows No. trees with hollows

### 2.6.3 Bird usage

In 2014 bird assemblages monitoring was completed from 28 July to 02 August (AECOM 2014), as described in Section 5, the location of the monitoring plots are shown in Figure 3. The monitoring is designed to observe changes in ecological conditions and the habitat value over time, in particular assess the status of Swift Parrot and Regent Honeyeater movements and habitat usage within the BA.



Eighty-seven species of birds were recorded at the Goulburn River BA sites during this study. The highest diversity was in foothills and escarpments and the lowest in riparian areas. Threatened birds recorded in woodland area and are predominantly woodland specialists. An extract of these observations is presented below in Table 11 the locations are shown in Figure 4.

At the time of writing this Plan a total of 10 individual Regent Honeyeaters were observed in the Goulburn BA, including two nesting pairs, confirmed on 10 December 2016.

**Table 11 Summary of locations where threatened birds species were observed and number of individuals at the Goulburn River BA (2014)**

Species	Scientific name	B2 MZ4	B4 MZ5	B7 MZ1	B8 MZ6
Black-chinned Honeyeater	<i>Melithreptus gularis</i>	1			
Brown Treecreeper	<i>Climacteris picumnus</i>	1	1	1	
Diamond Firetail	<i>Stagonopleura guttata</i>	1		1	
Varied Sittella	<i>Daphoenositta chrysoptera</i>	3 (Fly over)	1		
Speckled Warbler	<i>Chthonicola sagittatus</i>				1



**Photo: Diamond Firetail Goulburn River BA (Niche 2016)**

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

#### 3.1 Conservation Objectives

The conservation objective for this Plan is to protect and enhance the condition and extent of the conservation values of the offset area within 10 years at the Goulburn River BA.

The conservation management actions described in the following Section 4 outline activities to achieve the conservation objectives.

The methods to monitor the attainment of these objectives are described in Section 5. The monitoring data will be annually reviewed to adapt conservation management strategies through continual improvement.

The key conservation outcomes from the long term management and protection of the offset areas include:

- enhanced landscape connectivity within the surrounding landscape;
- improved fauna movement and flora dispersal opportunities within the surrounding landscape;
- increased condition and area of suitable habitats for threatened fauna species within protected reserves, specifically for the Regent Honeyeater and Swift Parrot; and
- enhanced network of protected vegetation within the Hunter Valley.

#### 3.2 Key Performance Indicators

The Key Performance Indicators will measure conservation values, being woodland and habitat to indicate an enhancement of ecological and habitat condition. The woodland area to be measured contains habitat for the Regent Honeyeater and Swift Parrot and long term conservation gains will be achieved through improved condition and connectivity of woodland habitat for these birds. Table 12 lists the key conservation values within the offset area, as well as their Key Performance Indicators and Completion Criteria. The monitoring programme, outlined in Section 5, details the attributes to be measured to provide evidence and demonstrate achievement of the Key Performance Indicators from the implementation of the conservation management actions detailed in Section 4.

**Table 12 Goulburn River BA Conservation Values and Key Performance Indicators**

Conservation Values	Key Performance Indicator	Completion Criteria
Woodland	Extent and condition of 1,169ha over 10 years.	Observed and measured increase and / or maintained Rapid Condition Assessment scores over 10 years (measured annually) in MZ2, MZ3, MZ4, MZ5 and MZ7.
Habitat	Improved habitat condition over 10 years.	Observed trajectory towards and/ or attainment of benchmark values at MZ2, MZ3, MZ6 and MZ7 (Table 10) over 10 years (measured biennially).
	Bird usage over 10 years.	Observed increased or maintained species richness and usage by woodland birds over 10 years (measured biennially)

#### 3.3 Completion Criteria

The objectives will be deemed to be attained when the Completion Criteria defined in Table 12 have been met to the satisfaction of the DoEE and DPE.

## 4 Conservation Management Actions

This Section outlines the management actions to protect and increase the extent and condition of the conservation values in the offset area. The offset area is defined by the vegetation community and Biobanking Management Zones as shown in Figure 3. They focus on addressing the key threats to the conservation values, such as unauthorised activity, clearing, altered fire regimes, weeds, feral animals, and overgrazing.

The following details the purpose, scope and methodology for the actions. Each action has been assigned Performance and Completion Criteria (noting Year 1 is 2017), and Trigger, Response and Action plan, to identify corrective actions in the event of unexpected outcomes from implementing the Plan, and support adaptive implementation.

Figure 5 indicates the MZs including key management infrastructure this includes:

- approximately 18.5 km boundary fences and 6 km of internal fences;
- 5 boundary gates;
- Approximately 31 km of access tracks; and
- Outside the offset area:
  - 1 house and 1 workers cottage (both unoccupied)
  - 22,500L poly tanks with Storz fittings; and
  - 3 sheds and 1 grain silo

Yancoal is accountable for the implementation of the conservation management actions, as shown in Table 2, this key responsibility rest with the Manager, Environmental. The Manager is supported by staff who engage and supervise qualified consultants and contractors to complete the Biodiversity Auditor role, other monitoring, weed and pest animal control, supplementary planting, construction and maintenance of infrastructure and other works as described in the following Section.

### 4.1 Controlled activities

#### 4.1.1 Prohibited actions

The offset area will have legal protection that includes penalties to enforce its protection. Yancoal will ensure that all employees or representatives, contractors, consultants and visitors are aware of these legal protections and penalties prior to entering the offset area.

The following activities will not be permitted within the offset area (Figure 3):

- littering or dumping of waste;
- removal of standing or fallen dead timber, firewood, native plants or animals;
- removal of rocks, sand or gravel;
- clearing or destruction of native vegetation (unless required to implement conservation management actions , such as infrastructure construction or re-vegetation);
- hunting;
- trapping or shooting (unless controlling pest animals);
- broad-acre use of fertilisers;
- broad-acre aerial application of pesticide from planes or helicopters;
- continuous grazing;
- use of livestock feed; or
- keeping of European bee hives, domestic cats and/or dogs.

#### 4.1.2 Exemption for clearing vegetation

Native vegetation cannot be cleared or disturbed within offset area with the exception of:

- clearing to implement the conservation management actions described in this Section, being:
  - a) infrastructure improvements;
  - b) control of weeds and vertebrate pests;
  - c) protect personal safety;
  - d) establish and/or maintain firebreaks, to manage fuel loads; and
  - e) ground preparation or thinning to support revegetation activities, including care and maintenance of planting areas (even if not currently prescribed in this Plan).

To ensure compliance with all legal and environmental protection measures the Yancoal Ground Disturbance Permit (GDP) process will be adopted.

The GDP process is a checklist that 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 Yancoal;
- 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.

#### 4.1.3 Access

Access to the offset area will be controlled through locked gates and fences and signs at main access points to inform all visitors they are entering a protected area. 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.

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

#### 4.1.4 Recreation activities and residences

Passive recreation activities are permitted, where they do not negatively impact upon the conservation values being protected, and only after permission is granted by Yancoal and a risk assessment is completed and approved.

The residences within the BA may be leased to provide increased security to deter detrimental activities such as illegal harvesting of firewood, rubbish dumping and hunting. The residences are outside the offset areas and the lease arrangement will provide clear directions to ensure protection of the BA.

#### 4.1.5 Cultural Heritage

No cultural heritage sites will be disturbed by any management actions implemented through the provisions of this Plan. Any identified cultural heritage sites or values have been recorded and will be managed to ensure their protection.

#### 4.1.6 Waste

Within the offset area there is one disused waste dump and approximately 7 km of internal fencing to be removed.

#### 4.1.7 Performance Criteria

Controlled Activities	Annual Criteria from Year 1 to Year 10
Prohibited actions	No reported incidents of prohibited actions undertaken by Yancoal, contractors, consultants or other agents of Yancoal.
Exemption of clearing vegetation	Any clearing of vegetation reported in the Annual Report.
Access	Signage and locks (where required) maintained.
Recreation and residences	Completed risk assessment for any recreation activities. All occupants of residences compliant with requirements of the Plan
Cultural heritage	No Cultural heritage sites knowingly disturbed and any protective barricading maintained.
Waste	Waste removed from disused dump and damaged and unwanted internal fences removed.
Monitoring	All Property Inspections (Section 5.4) completed.

#### 4.1.8 Trigger, Response and Action plan

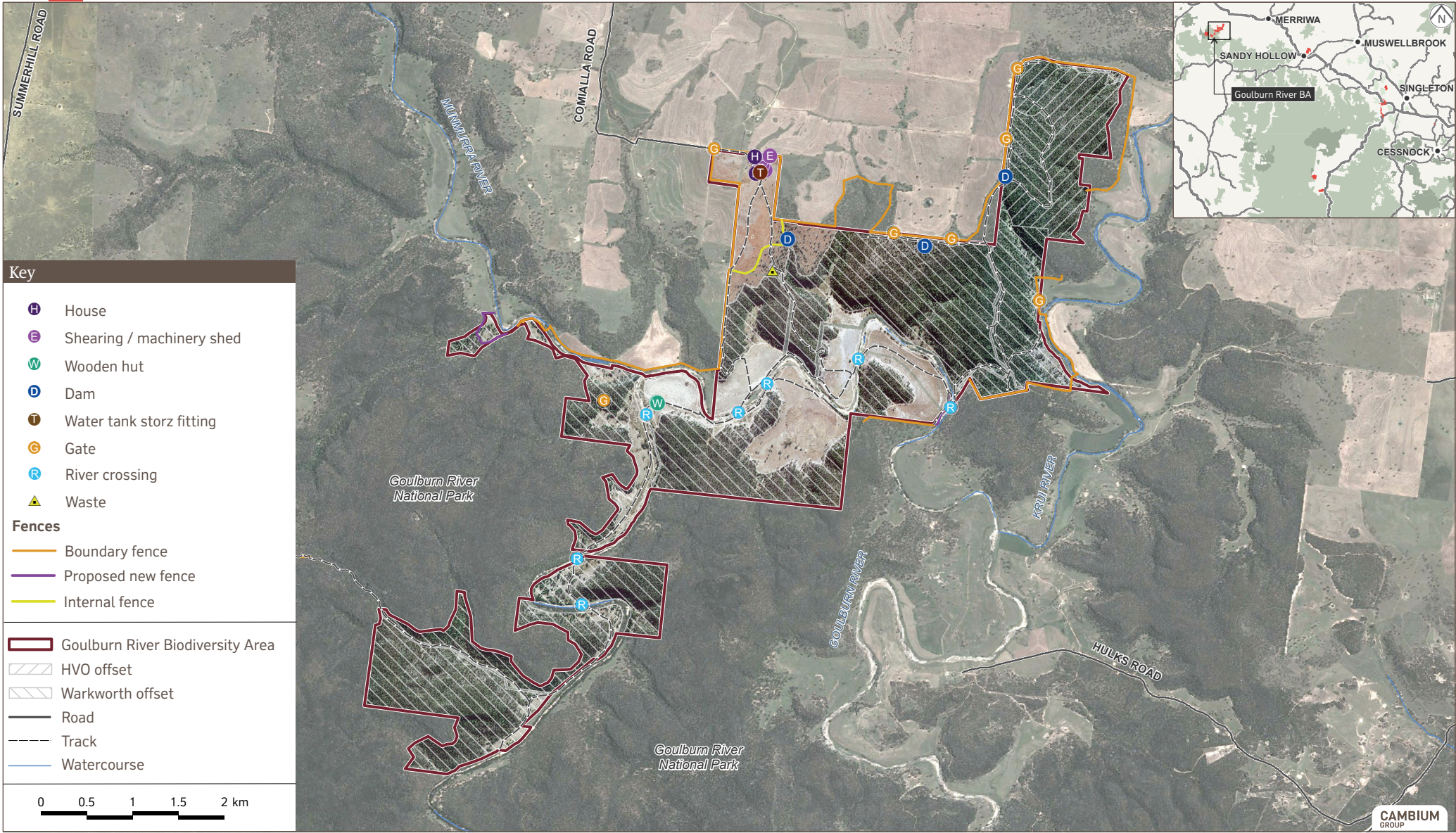
Trigger	Response
Damage to conservation values by persons undertaking controlled activities – reported through Management Monitoring (Section 5.4) or other visitors to the BA.	Report incident to relevant authority within 30 days. Include incident report in the Annual Report complete self-assessment of the significant residual impact from the damage. In situations where there is assessed to be a significant residual impact a rehabilitation plan including active and or passive restoration works is to be prepared and implemented. Review security measures and offset induction procedure.



Key infrastructure and waste at the Goulburn River Biodiversity Area

Management Plan 2017

Figure 5





## 4.2 Management of grazing for conservation

Strategic grazing will be used as a management tool to promote regeneration, control weeds, and reduce excessive fire fuel loads. Strategic grazing is preferred because the short duration and intensive regimes that prevent or minimise selective grazing and thereby ensure that overall gains in biodiversity can be achieved.

Grazing will be excluded from the offset area, except to improve conservation values or reduce fire risk. Grazing will only be implemented where prescribed by the biodiversity auditor or BioBanking accredited assessor. The trigger point to cease grazing will be less than 70 % ground cover (i.e. no greater than 30% bare ground) and average height of ground cover of less than 12cm (approximately 2500kg dry matter per/ha). The trigger point will be measured using the following quadrat sampling method for ground cover and herbage mass (Lang 2005) by the Biodiversity Auditor:

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 (the number of sample will be increased by 1 for each addition 5ha for areas greater than 50ha).
- 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: (Sum of B x 100) / (Sum of B + Sum of C).
- f. Calculate average mass by: Sum of D / Number of samples.

This quadrat data will be provided for the commencement and at the completion of grazing in the annual reports along with the following information:

- livestock movement including dates of entry and removal from the grazing area;
- a map of the grazed offset area;
- number of livestock, type and condition;
- quantity of supplement (if any);
- any livestock health or other management issues; and
- daily rainfall data.

Grazing periods will not exceed four weeks and temporary watering points and fencing will be used to protect sensitive areas, such as planting areas.

### 4.2.1 Performance Criteria

Strategic Grazing	Annual Criteria from Year 1 to Year 10
Grazing	Grazing is conducted in accordance with this Plan and reported in annual report
Unauthorized stock grazing is prevented	Boundary fences maintained
Monitoring	Complete Rapid Condition Assessment and Property Inspections (Section 5.4)

## 4.2.2 Trigger, Response and Action plan

Trigger	Response and Action
Fence damaged and not excluding stock from neighbouring property– impact reported through Management Monitoring (Section 5.4) or visitor to BA.	Repair fence within 15 days and inspect fence at least one month after repair completed and continue Management Monitoring.  Return stock to owner and discuss the importance of maintaining stock exclusion from the offset area and options to improve the efficacy of the fencing.
Over grazing – groundcover less than 70 % ground cover and average height of ground cover of less than 12cm as reported by Ecological monitoring or trigger point exceeded under strategic grazing.	Undertake ground cover survey, advise auditor and determine whether/not the trigger values are exceeded (ie less than 70% groundcover, less than 12 cm height). If confirmed remove stock from affected management area.
Biodiversity Audit recommends strategic grazing is required to reduce weed competition and / or encourage regeneration of native plants when completing Ecological Monitoring.	Biodiversity auditor or BioBanking accredited assessor to prepare plan to implement strategic grazing to control weeds, manage fire hazard and/or encourage regeneration.  Record and report all strategic grazing activities and outcomes.
Neighbour raises concerns over high biomass increasing fire risk - observed high levels of biomass/grass prior to fire season.	Review monitoring reports and Bushfire Management Plan.  Discuss appropriate course of action with neighbour and Rural Fire Service.  Review and update Bushfire Management Plan.

## 4.3 Weed Control

Control of weed species is critical to restoring the natural species composition, diversity and structure of the vegetation communities across the BA. Weeds are typically non-indigenous plants that 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 aim of weed control is to incorporate a variety of control methods and reduce the reliance on herbicides to keep un-infested areas clear of weeds and control the spread of existing weed infestations.

### 4.3.1 Control areas

The 2014 Habitat Monitoring and BioBanking Assessment Report observed that of the 198 species recorded across the BA 29% (i.e. 57 species) are considered to be weed species. These weed species are generally confined to the valley floor as there is little evidence of their spread from the valley floor into the intact areas of native vegetation on the slopes and ridges. The control activities are to focus on non-offset areas, MZ2, MZ3, MZ6 and MZ7.

To limit weed dispersal from tracks and incursions from the river, weed management will also focus on containment zones of 50 m from the tracks and Goulburn River. Any weeds outside of these areas will be controlled based on the observations from the monitoring programme. The weed containment zones are shown in Figure 6, along with the observation of noxious weeds from all of the BioBanking assessment data collected in 2014 to target control efforts. The figure also shows the primary control works completed for St John's Wort, Paterson's Curse, Blackberry and Willows in 2015 and 2016.

### 4.3.2 Control methods and target weed species

An integrated weed management approach utilising a range of suitable control methods that include:

- biological control - a long term technique;
- herbicide control - a short to medium technique;
- land management – a medium to long term technique; and
- manual control – a short term technique.

The preferred control methods are described in Table 13.

All noxious weeds declared under the *Biosecurity Act 2015* will be given priority for weed control. Noxious weeds recorded in the BA are *Rubus fruticosus* (Blackberry), *Opuntia stricta* (Prickly pear), and *Echium plantagineum* (Paterson's Curse).

In addition, environmental weeds and/or exotic plants recorded with a relatively high Braun-Blanquet (BB) cover abundance ranking (Braun Blanquet 1928) will also be controlled only where they pose a risk to native species recruitment particularly of native grasses.

The BB cover abundance ranking included:

- 1 = < 5% (rare number of individuals);
- 2 = < 5% (species common at the site);
- 3 = 5 – 25%
- 4 = 26 – 50%;
- 5 = 51 – 75%; and
- 6 = 76 – 100%.

Table 14 lists the target weed species to be controlled, their declaration class under the *Biosecurity Act 2015* or nomination as a Weed of National Significance (WON), control methods, timing and intensity required to manage these weeds, based on the *NSW Department of Primary Industries Noxious and Environmental Weed Control Handbook* (NSW DPI 2014). The photos have been sourced from <http://weeds.dpi.nsw.gov.au/>. Should a control event not be required or conditions are unsuitable (due to dry plants under stress) then evidence of this will be provided in the Annual Report.

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, Safety Data Sheets 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.



## Weed control areas at the Goulburn River Biodiversity Area

Management Plan 2017

Figure 6

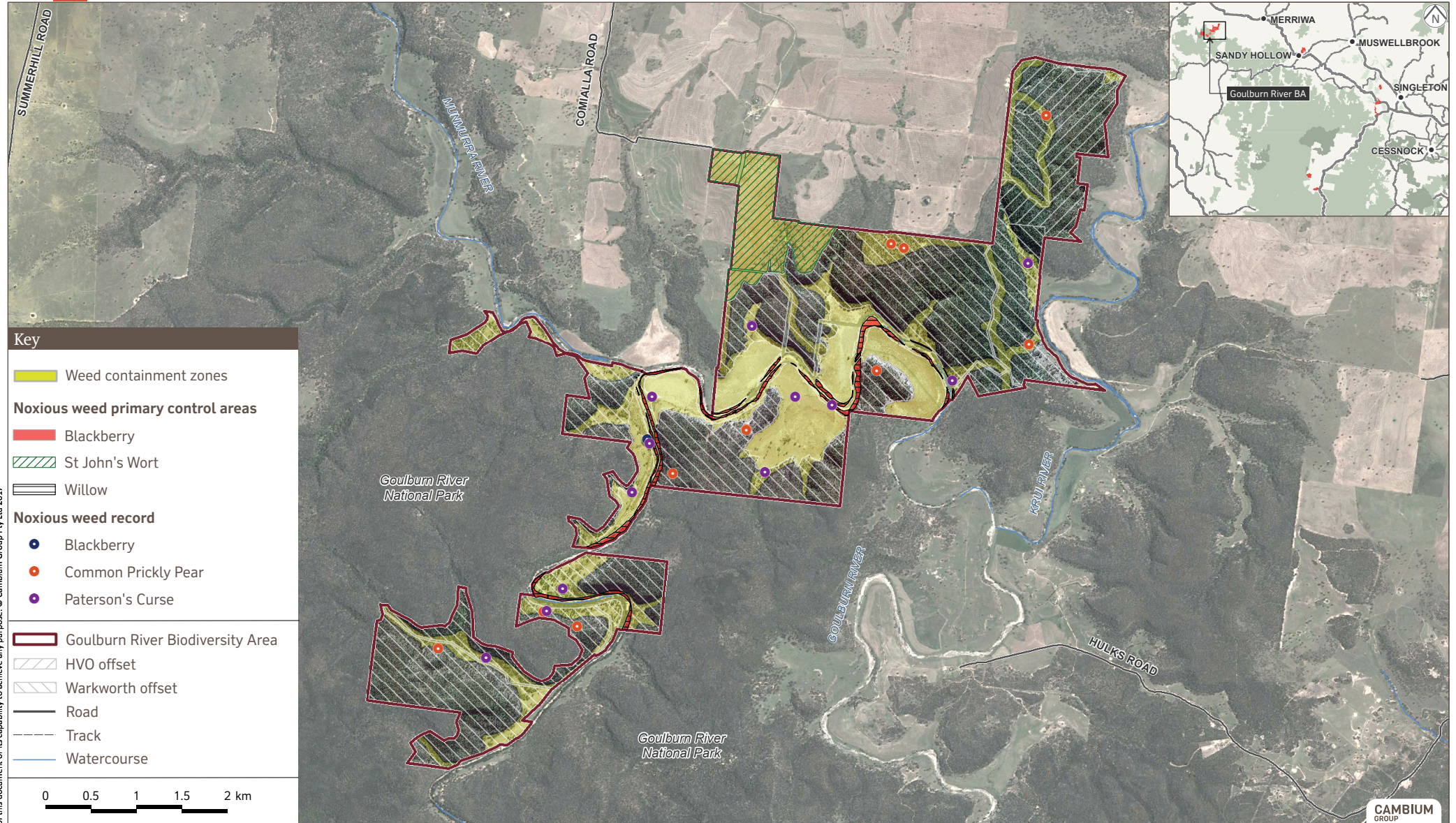












Table 13 Weed Control Methods

Control Method	Potential use in control regime
Chemical Control – is the application of chemicals to kill the weed by interfering in the plants growth processes.	<p>Spot application of herbicide is the preferred method of application. Boom spray application is permissible as part of ground preparation for re-establishment activities. Areas that cannot be accessed safely by ground based methods the use of Unmanned Aerial Vehicles (UAV) can be used.</p> <p><b>Herbicides:</b></p> <p>Only registered herbicides will 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></p> <p>Herbicide is to be applied to actively growing plants.</p> <p>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 in the identification of native plant operators are permitted to apply herbicides.</p> <p>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.</p> <p>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 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></p> <p>All commercial pesticide users (that includes farmers, leaseholders and spray contractors) must keep records on their pesticide application.</p>
Land Management – good land management practices can reduce the incidence and impact of weeds.	<p><b>Weed hygiene:</b></p> <p>All machinery will be cleaned and washed down to reduce the spread of weed seed.</p> <p>Livestock being introduced to a BA 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></p> <p>Yancoal staff and other key stakeholders visiting the BA will be required to report any new infestation of weeds.</p>
Grazing management	<p>Grazing may be used to control weeds subject to not meeting or exceeding ground cover trigger values (section 4.2) and there is evidence the weed species are preferentially grazed by stock.</p> <p>Spray graze - applying a hormone herbicide and grazing 7-10 days later. Other grazing management practices that are recommended by the Biodiversity Auditor or the Hunter Local Land Services (HLLS).</p>
Biological Control – is a long term control technique.	<p>This is a complementary strategy and alone it may not eradicate the weed. Any use of biological controls will be undertaken in conjunction with advice from OEH and the HLLS.</p>

Control Method	Potential use in control regime
Slashing – mechanical cutting of weeds to prevent seed production	Areas heavily infested with exotic grasses can be treated with slashing equipment mounted on a tractor prior to flowering (likely to be late spring/ early summer).
Manual removal – removal of the weed plant and roots from the site.	Physical removal of new weeds, unearthing of root systems and containment and removal of seed.




Table 14 Target weed species, treatment method and control period and intensity

Species	Photo	Class*	WON	Distribution	Control method	Control period and intensity
Blackberry ( <i>Rubus fruticosus</i> )		4	✓	Non-offset areas, MZ2, MZ3, MZ6 and MZ7. Not within monitoring plots	Spot spray (small infestations) or aerial spray UAV (large infestations) with registered herbicide Biological control (Blackberry Rust <i>Phragmidium violaceum</i> )	Spring to autumn From Year 1 to Year 4, at least two control events per year. Ongoing maintenance, minimum of one control event per year.
Paterson's Curse ( <i>Echium plantagineum</i> )		4	-	Non-offset areas, MZ2, MZ3, MZ6 and MZ7. BB cover abundance score 2 (>5% - common)	Spot spray or boomspray using registered herbicide Control can be achieved by using spray graze. Biological control as advised by HLLS.	Autumn to winter From Year 1 to Year 4, at least two control events per year. Ongoing maintenance, minimum of one control event per year.
Prickly Pear ( <i>Opuntia stricta</i> )		4	✓	Non-offset areas, MZ2, MZ3, MZ6 and MZ7. BB cover abundance score 1 (<5% - rare).	Spot spray with registered herbicide Biological control ( <i>Cactoblastis cactorum</i> ) and Cochineal ( <i>Dactylopius spp.</i> ) – better suited to large infestations or inaccessible areas.	All year – control period. From Year 1 to Year 4, at least two control events per year. Ongoing maintenance, minimum of one control event per year.
Scotch Thistle ( <i>Onopordum acanthium</i> )		4	-	Non-offset areas, MZ2, MZ3, MZ6 and MZ7. Not within monitoring plots	Spot spray with registered herbicide Hoeing or chipping to remove small infestations	All year (actively growing rosettes to flowering stage) – control period From Year 1 to Year 4, at least two control events per year. Ongoing maintenance, minimum of one control event per year.

Species	Photo	Class*	WON	Distribution	Control method	Control period and intensity
St John's Wort ( <i>Hypericum perforatum</i> )		4		Non-offset – top of escarpment - Not within monitoring plots	Spot spray, boomspray or aerial (UAV) spray with registered herbicide  Biological control ( <i>Chrysolina</i> beetles) when hypericin levels in the plant are low – generally May through to October (may vary with climatic conditions)	Spring to late autumn From Year 1 to Year 4, at least two control events per year. Ongoing maintenance, minimum of one control event per year.
Willows ( <i>Salix spp.</i> )		4	✓	MZ7	Stem injection, cut stump application or spot spray with registered herbicide  Hand pulling seedlings (and rooted branches) while they are still small.  Mechanical removal, ensuring that all of the root system is removed For more information visit <a href="http://www.dpi.nsw.gov.au/weeds">www.dpi.nsw.gov.au/weeds</a>	All year (dependent on treatment) From Year 1 to Year 4, at least two control events per year.
Variegated thistle ( <i>Silybum marianum</i> )		-	-	Non-offset areas, MZ2, MZ3, MZ6 and MZ7. BB cover abundance score 3 (5% - 25%)	Spot spray, boom spray or aerial (UAV) with registered herbicide  Hoeing or chipping to remove small infestations	All year (actively growing rosettes to flowering stage) – control period From Year 1 to Year 4, at least two control events per year. Ongoing maintenance, minimum of one control event per year.
Saffron Thistle ( <i>Carthamus lanatus</i> )		-	-	Non-offset areas, MZ2, MZ3, MZ6 and MZ7. BB cover abundance score 2 (>5% - common)	Spot spray, boom spray or aerial (UAV) with registered herbicide Control can be enhanced by slashing or pasture improvement	Autumn to winter All year (actively growing rosettes to flowering stage) – control period From Year 1 to Year 4, at least two control events per year. Ongoing maintenance, minimum of one control event per year.

\*



Species	Photo	Class*	WON	Distribution	Control method	Control period and intensity
Narrow-Leaf Cotton Bush ( <i>Gomphocarpus fruticosus</i> )				MZ2 - BB cover abundance score 1 (< 5% - rare)	Spot spray with registered herbicide Hand pulling individual plants	All year – control period. From Year 1 to Year 4, at least two control events per year. Ongoing maintenance, minimum of one control event per year.
Cobblers Peg/Farmers Friends ( <i>Bidens pilosa</i> )				Non –offset area	Spot spray with registered herbicide Chipping or hand pulling prior to the burrs forming. If removing seeding plants, bag them for burning or deep burial, to avoid spreading the seed.	Late winter to late summer – control period. From Year 1 to Year 4, at least two control events per year. Ongoing maintenance, minimum of one control event per year.
Scarlet Pimpernel ( <i>Anagallis arvensis</i> )				MZ2 and MZ4 – average BB cover abundance score 2 (>5% - common)	Spot spray with registered herbicide	From Year 1 to Year 4, at least one control events per year. Ongoing maintenance as required.

*Control Class	Weed type	Example control requirements
Class 1	Plants that pose a potentially serious threat to primary production or the environment and are not present in the state or are present only to a limited extent.	The plant must be eradicated from the land and the land must be kept free of the plant. The weeds are also 'notifiable' and a range of restrictions on their sale and movement exist.
Class 2	Plants that pose a potentially serious threat to primary production or the environment of a region to which the order applies and are not present in the region or are present only to a limited extent.	The plant must be eradicated from the land and the land must be kept free of the plant. The weeds are also 'notifiable' and a range of restrictions on their sale and movement exist.
Class 3	Plants that pose a serious threat to primary production or the environment of an area to which the order applies, are not widely distributed in the area and are likely to spread in the area or to another area.	The plant must be fully and continuously suppressed and destroyed.*
Class 4	Plants that pose a threat to primary production, the environment or human health, are widely distributed in an area to which the order applies and are likely to spread in the area or to another area.	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority.*
Class 5	Plants that are likely, by their sale or the sale of their seeds or movement within the State or an area of the State, to spread in the State or outside the State.	There are no requirements to control existing plants of Class 5 weeds. However, the weeds are 'notifiable' and a range of restrictions on their sale and movement exist.

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

#### 4.3.3 Performance and completion criteria

	Year 1 to Year 4	Year 5 to Year 10	Completion Criteria
Weed control	At least two weed control events each year for species listed in Table 14, and any other weeds recorded from monitoring activities. All actions recorded in the Annual Report.	At least one weed control event each year for species listed in Table 14, and any other weeds recorded from monitoring activities. All actions recorded in the Annual Report.	Ecological monitoring data indicates a trajectory for reduction in exotic plant cover over three consecutive assessments.
Monitoring	Complete Ecological Monitoring Section 5.3), (Rapid Condition Assessment and Property Inspections (Section 5.4)	Complete Ecological Monitoring Section 5.3), (Rapid Condition Assessment and Property Inspections (Section 5.4)	

#### 4.3.4 Trigger, Response and Action plan

Trigger	Response and Action
Weeds having detrimental impact - Ecological Monitoring results indicate low native plant recruitment and regeneration and / or no trajectory to benchmark values and increase in exotic plant cover.	Increase the number of weed control events. Suitably qualified and experienced person to review weed control action. Revise the Plan.
New noxious and/or environmental weed is identified within BA.	Notify Government Agency and neighbours of new noxious and/or environmental weed outbreak. Implement new hygiene controls. Review Plan. Follow all directions given by relevant government agency to assist in control.

### 4.4 Management of Fire for Conservation

Bushfire prevention is required under the *Rural Fires Act 1997* and a fire regime is required to maintain ecological condition and reduce the risk of damage from wildfire. The absence of fire and the reduction of livestock grazing may lead to a build-up of fire fuel and risk of high intensity bushfire. The land manager is required to take practicable steps to prevent the occurrence of bush fires on the land and minimise the spread of bushfire.

Yancoal, with assistance from the Hunter and Liverpool Range Rural Fire Services, has prepared a Regional BA Bushfire Management Plan, that covers the Goulburn River BA, it identifies fire risks, control measures and communication procedures. A copy of this plan is available on the Biodiversity Offsets Portal.

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

Key control measures include:

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

Key management and safety restrictions for total fire ban and very high fire danger days include:

- no working alone;
- travel plans on these days are to be communicated to staff or family member, so you can be located in the case of an emergency; and
- no contractor, consultant or visitor access or undertaking 'hot works', unless these activities are required for firefighting purposes.

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.

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.

The Goulburn River BA last experienced a prescribed burn (hazard reduction) conducted by National Parks and Wildlife Service (NPWS) across approximately 100ha in 2001/02. Within the neighbouring Goulburn River National Park prescribed burns (hazard reduction) were undertaken in 2008 (approximately 1,200ha) and 2013/14. Based on the Code recommendations an ecological burn should be completed across BA within the next 10 to 15 years, unless otherwise specified by the Biodiversity Auditor or requested by NPWS. Fire is to be excluded from supplementary planting areas in MZ3 and MZ7.

All ecological burns are dependent upon suitable climatic conditions and appropriate level of risk. The advice of a suitably qualified person experienced in ecological fire management will be required to plan and implement the ecological fire management plan, including a post fire monitoring programme to specifically assess the impact of the ecological burn. Any burns are to be scheduled to occur when conditions are suitable for a low intensity burn. Typically this is winter or early spring. Burning should also be scheduled prior to a significant rain event to assist in extinguishing the fire.

Data is to be recorded for all ecological burns including the date and intensity of the fire, the area burnt (shown on a map) during fire, any canopy scorch and percentage of leaf litter remaining. Any additional damage, including fire breaks or new tracks, must also be recorded.

#### 4.4.1 Performance Criteria

	Year 1 to Year 4	Year 5 to Year 10	Completion Criteria
Regional BA Bushfire Management Plan (BFMP),	Actions implemented Review and revise if required.	Actions implemented Review and revise if required.	All required actions of BFMP have been implemented BFMP has been reviewed annually and revised if required.
Ecological burn	.	Completed ecological fire management plan.	
Monitoring	Complete Ecological Monitoring Section 5.3), (Rapid Condition Assessment and Property Inspections (Section 5.4)	Complete Ecological Monitoring Section 5.3), (Rapid Condition Assessment and Property Inspections (Section 5.4)	

#### 4.4.2 Trigger, Response and Action

Trigger	Response and Action
BA impacted by wildfire.	<p>Map fire damaged area. Prepare fire restoration plan to reinstate infrastructure and monitor post fire to evaluate regenerative capacity and regeneration.</p> <p>Suitably qualified and experienced person to review BFMP</p> <p>Revise the Plan to include actions from the fire restoration plan.</p>
Post fire monitoring results indicate a reduction in native plant cover and increase in exotic cover.	<p>Evaluate active regeneration, increase in weed control and implement supplementary planting.</p> <p>Revise Plan.</p>

## 4.5 Infrastructure improvement

Construction of new or maintenance of existing infrastructure (such as access tracks/ fire breaks, fences, off-stream watering points or pipes and removal of dam structures) will be required to maintain safe access to complete weed and feral animal control, fire management, and monitoring activities.

Infrastructure improvement action may cause localised site disturbance.

During the construction or maintenance of infrastructure the following guidelines apply:

- Vegetation clearing is only permissible for actions that are required to achieve the objectives of the Plan:
  - (a) permanent boundary fence - three metres either side;
  - (b) permanent internal fence - six metres total width of clearing;
  - (c) temporary fence - six metres total width of clearing; or
  - (d) road or track - six metres total width of clearing.
- constructed fences will be stockproof;
- fallen timber and any other obstructions can be removed to maintain access;
- standing timber that poses an unacceptable safety risk can be felled and retained on ground as habitat;
- 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 and rehabilitated within the offset area; and
- site disturbance will be required to facilitate certain revegetation activities, such as soil cultivation and slashing.

### 4.5.1 Performance Criteria

Annual Criteria from Year 1 to Year 10	
Infrastructure improvements	Completed GDP for all infrastructure improvement actions. Maintenance of tracks and fences completed at least every 3 years.
Monitoring	Property Inspections (Section 5.4)

### 4.5.2 Trigger, Response and Action plan

Trigger	Response and Action
Unauthorised clearing of vegetation	Report and review incident within 30 days. Complete significant residual impact assessment of the incident. For incidents with a significant residual impact a rehabilitation plan is to be prepared and implemented. Review the Plan.
Fencing continually damaged by flood waters.	Replace fence with floating fences or re align fence. Update the Plan.

## 4.6 Maintenance or reintroduction of natural flow regimes

Artificial structures on waterways or waterbodies restrict natural flows, however dams and habitat ponds support strategic grazing and other management actions. All dams were excluded from the mapping of the offset area as specified by BioBanking assessment guidelines.

The Goulburn River BA contains four dams as shown in Figure 5. The first dam surrounded by non-offset area will remain unchanged. The three dams surrounded by offset area are to be converted to habitat ponds, this work will involve earthworks and localised site rehabilitation. A dam conversion plan is to be prepared prior to commencement of work.



#### 4.6.1 Performance and Criteria

	Year 1 to Year 4	Year 5 to Year 10	Completion Criteria
Dam conversion and rehabilitation	Prepare dam conversion plan. Dam conversion complete and rehabilitation has stabilised the site.	Observed natural flow regime and no erosion.	All works completed.
Monitoring	Property Inspections (Section 5.4)	Property Inspections (Section 5.4)	

#### 4.6.2 Trigger, Response and Action plan

Trigger	Response and Action
Significant rainfall event causes erosion at dam rehabilitation area.	Install erosion control measures, within 30 days, undertake monitoring of the area for 12 months post event to ensure the site is stabilised. Report and review incident, within 30 days. Review the Plan.

### 4.7 Retention of regrowth and remnant native vegetation

Remnant native vegetation and regrowth is important as it is the key component of the BA. The retention of this native vegetation and its regrowth is important to maintain and enhance the conservation value of the offset area.

Natural regrowth of remnant vegetation will be preferentially retained to promote recovery of native vegetation. Dense patches of native regrowth will be allowed to self-thin unless new plantings require regulated control.

Exceptions to this rule include maintenance of fence lines and management tracks associated with the BA (Section 4.5).

#### 4.7.1 Encourage natural regeneration

The woodlands on the valley floor and floodplain have been impacted by agriculture and the native plant diversity, community structure and habitat values have been degraded. Consequently, re-instating/restoring these components will aim to:

- increase native mid-storey cover,
- increase native ground cover (herbs, ferns, lilies, rushes, sedges), and
- maintain woodland canopy cover.

The regenerative potential is substantial and natural regeneration is already evident in many areas, particularly where grazing pressure has been removed/substantially reduced. In the absence of disturbance, these areas are likely to regenerate with minimal assistance. Low to moderate management intervention is required in this region and will be implemented in accordance with the management actions outlined in this Section.

#### 4.7.2 Performance Criteria

	Year 1 to Year 10	Completion Criteria
Natural regeneration	Annual weed control, vertebrate pest and fire management actions implemented as per management plans	Ecological monitoring demonstrates a trajectory to benchmark values for all attributes measured over three consecutive assessments (the average of all plots).
Monitoring	Complete Ecological Monitoring Section 5.3), (Rapid Condition Assessment and Property Inspections (Section 5.4)	

### 4.7.3 Trigger, Response and Action plan

Trigger	Response and Action
No active regeneration and native plant recruitment within 5 years MZ3 and MZ7 recorded through the ecological monitoring, indicated by no trajectory towards benchmark ranges.	Consider planting actions and revise the Plan. Planting actions to be considered include direct seeding, tube stock planting of species selected from the description of the plant community type, details of the methodology and maintenance to be included in the revised Plan.
Single species and age class domination constraining species diversity observed by Ecological Monitoring (Section 5.3)	Prepare ecological thinning plan to increase species and age class diversity. Implement ecological thinning plan and revise this Plan.

## 4.8 Supplementary planting

To increase the extent and condition active restoration through planting is to be undertaken in:

- MZ3 Yellow Box – Grey Box – Red Gum grassy woodland (HU714 low); and
- MZ7: River Oak riparian woodland (HU712)

Areas of dense River Oak Forest (ROF) are the preferred habitat for Regent Honeyeater. However, the existing open fringe areas of River Oak Forest are the preferred habitat for the Noisy Miner, which are aggressive birds that can displace the Regent Honeyeater. Therefore planting of dense patches of River Oak (*Casuarina cunninghamiana*) will be established in these areas along the Goulburn River.

The re-establishment process will adopt a shelter belt approach, with planting confined to strips that run perpendicular to the prevailing wind direction or patches close to remnant woodland. This approach aims to create micro climates that will encourage and support natural regeneration between the strips / patches. It minimises site disturbance to avoid damage to existing regeneration and enables natural and sustainable regeneration to increase connectivity.

Figure 7 indicates the location of planting areas. All planting is to occur when suitable climatic conditions prevail. The following describe the key actions for re-establishment of these vegetation communities.

### 4.8.1 Seed Collection

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.

#### 4.8.2 Species mix and tubestock numbers

Table 15 lists the species to be targeted for seed collection and planting. This includes known feed trees for Regent Honeyeater.

**Table 15 Native species for planting in cleared areas**

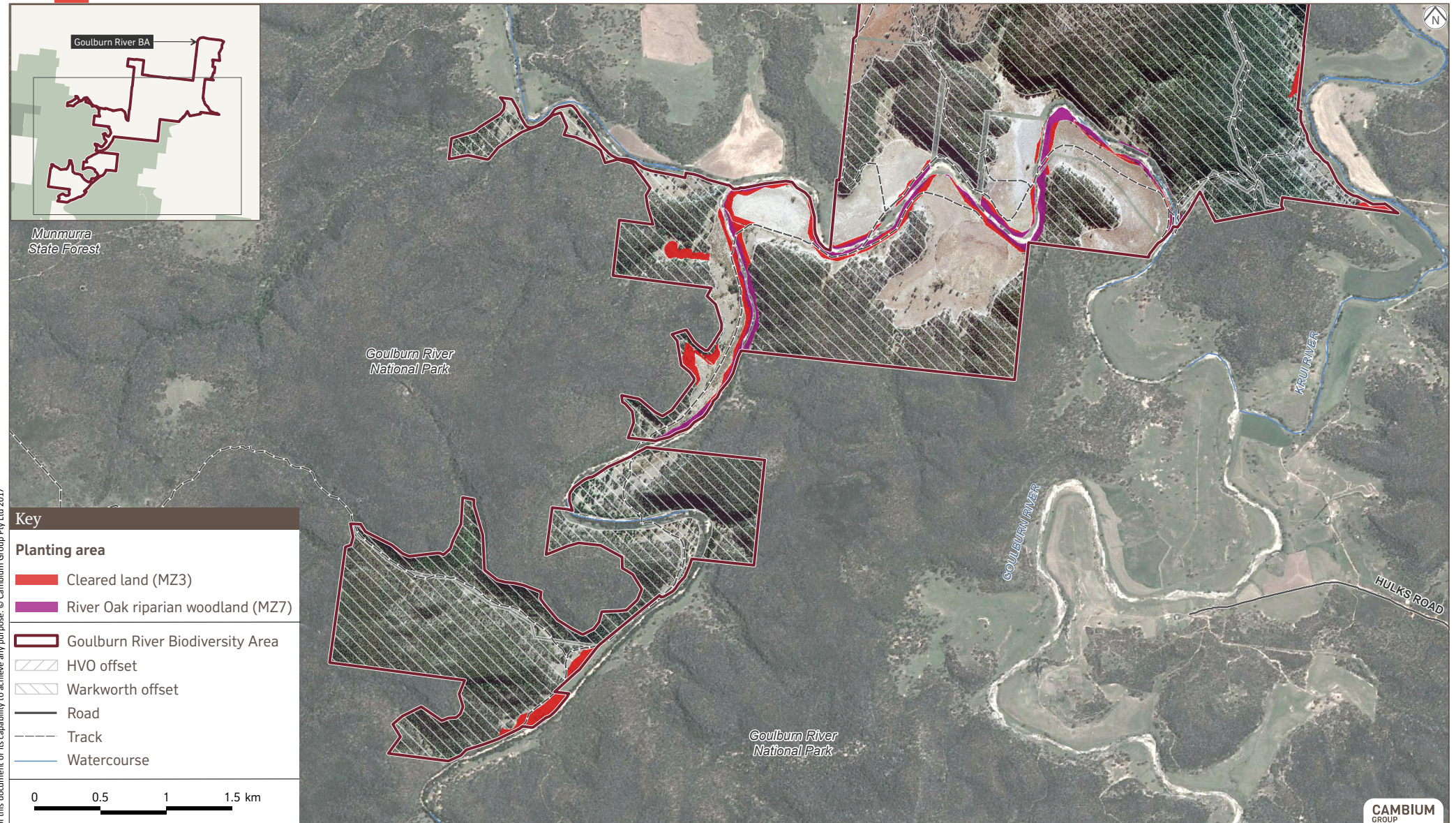
Species' common name	Species' scientific name	Management Zone	Estimated number of tubestock to be planted
River Oak	<i>Casuarina cunninghamiana</i>	MZ7	9,000
Blakely's Red Gum*	<i>Eucalyptus blakelyi</i>	MZ3	3,000
Yellow Box*	<i>Eucalyptus melliodora</i>	MZ3	1,500
White Box	<i>Eucalyptus albens</i>	MZ3	1,500
Hickory Wattle	<i>Acacia implexa</i>	MZ3	700
	<i>Dodonaea viscosa</i>	MZ3	700
Native Blackthorn	<i>Bursaria spinosa</i>	MZ3	700
Hoary Guinea Flower	<i>Hibbertia obtusifolia</i>	MZ3	700
<b>Total</b>			<b>17,800</b>



## Planting areas at the Goulburn River Biodiversity Area

Management Plan 2017

Figure 7





### 4.8.3 Planting method

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

**Table 16 Planting criteria**

Activity	Minimum requirement
Soil test	Complete soil test across planting site to identify soil deficiencies or impediments for plant growth
Species selection	Species selected are species 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 1 week 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 will 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.
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.
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 18 months.
Replanting	Where the survival of tubestock is less than 70% the area will be replanted.

### 4.8.4 Timing

Tubestock are to be planted in autumn, with good soil moisture, all site preparation activities are to be completed at the appropriate time to facilitate planting in autumn. All activities are dependent upon suitable climatic condition and may be postponed. If this occurs, weather records will be reported to support any delay in activities.

### 4.8.5 Survival assessments

Survival assessments are to be completed at 3 and 6 month post planting to assess the success of tubestock planting. Details of the monitoring programme are provided in Section 5.

### 4.8.6 Performance and completion criteria

	Year 1 to Year 5	Completion Criteria
Planting in MZ3: Yellow Box – Grey Box – Red Gum grassy woodland (21.5ha)	Collection of seed. Plant propagation. Tubestock planted. Completed survival assessment	Planting achieves above 70% survival.
Planting MZ7: River Oak riparian woodland (24.2ha)	Collection of seed. Plant propagation. Tubestock planted. Completed survival assessment	Planting achieves above 70% survival.

### 4.8.7 Trigger, Response and Action plan

Trigger	Response
Average survival assessment less than 70%	Review planting activities, including soil test results, determine if poor survival is due to climatic conditions or operational matters. Complete further site assessments if cause cannot be identified. Review Plan in light of findings and replant the area.

## 4.9 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.

There is some potential for erosion to occur within the BA. Management options for erosion control include excluding grazing, controlling vehicle access, maintenance of tracks and rehabilitation of drainage lines, watercourses and riparian areas where erosion impacts are identified.

Erosion within the BA will be monitored through biannual inspections by Yancoal, as well as other observations recorded during the ecological monitoring programme. Appropriate erosion remediation measures will be undertaken in consultation with the HLLS and NSW OEH.

### 4.9.1 Performance Criteria

	Year 1 to Year 10	Completion Criteria
Monitoring inspections and reports	Complete Ecological Monitoring Section 5.3), (Rapid Condition Assessment and Property Inspections (Section 5.4)	

### 4.9.2 Trigger, Response and Action plan

Trigger	Response and Action
Active erosion observed through monitoring.	Install erosion control measures, within 30 days of detection of active erosion, undertake monitoring of the area over 12 months post event to ensure the site is stabilised. Repeat area inspections annually to monitor stability. Report and review incident, within 30 days. Review the Plan.

## 4.10 Vertebrate Pest and Overabundant Native Animal Control

Vertebrate pest species and overabundant native herbivores can pose a threat to native flora and fauna through degradation of habitat, competition for habitat resources, and direct predation.

The recovery plans for Swift Parrot and Regent Honeyeater list the following key threatening processes, which are relevant to the pest animal control across the BA:

- 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 Noisy Miners / starlings.

This Plan will target the control of declared vertebrate pests and those causing environmental degradation at a regional and local level, and the opportunistic control of the species listed in Table 17. Other vertebrate pests, overabundant native herbivores, or noisy miners will be managed as required under a specific management plan prepared prior to their control. If the control event is not required or conditions are unsuitable then evidence will be presented in the Annual Report.

Under the *Local Land Services Act 2013* (LLS Act), species that are currently declared pests in NSW include rabbits, feral pigs and wild dogs. Pest Control Orders can be issued by the regulator to legally enforce land managers to control the species on their land. Land managers are defined as either owners or occupiers of the land. Occupiers of land in NSW are not obliged to control other vertebrate pest animals. However, these species

may have significant negative impacts on the environment and agricultural production in many areas.

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

This Plan acknowledges that populations of vertebrate pests are determined by several factors such as topography, shelter, territorial behaviour and food availability. Property fences do not restrict pests, and control actions will not therefore be limited to artificial boundaries. Most vertebrate pests are highly mobile and can readily replace those that are killed on individual properties. A variety of control methods can 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.

Control programmes are likely to be far more effective when coordinated with multiple landholdings. Yancoal will endeavour to work with the HLLS on regional control programmes and supported by local on ground control actions. Neighbours are to be notified on local onground actions to facilitate coordination of efforts and deliver more effective control.

Design and implementation of local controls will be guided by the National Codes of Practice (COPs) and Standard Operating Procedures (SOPs) produced by the Commonwealth Department of the Environment (available at [www.feral.org.au](http://www.feral.org.au)). The COPs for each of the key pest animal species provides general information on best practice management, control strategies, species biology and impact, and the humaneness of current control methods. The SOPs describe management techniques and their application for these pest animal species, including a discussion of animal welfare impacts for target and non-target species. They also cover the health and safety aspects of management techniques.

**Table 17 Identified Vertebrate Pests control methods, timing and intensity**

Pest	Declared	Control methods	Control timing and intensity
European rabbit ( <i>Oryctolagus cuniculus</i> )	Yes	Baiting: 1080 / Pindone Trapping: cage trap Shooting: ground based Biological: Myxomatosis and / or Rabbit Haemorrhagic Disease(RHD) Other: Exclusion fencing / Warren fumigation / Warren ripping	Control event in Autumn and /or Spring From Year 1 to Year 4, at least two control events per year. Ongoing maintenance, minimum of one control event per year.
Feral Deer ( <i>Cervus timorensis</i> ) ( <i>Dama dama</i> ) ( <i>Cervus elaphus</i> )	Yes	Shooting: ground based	Control event in Autumn and /or Spring From Year 1 to Year 4, at least two control events per year. Ongoing maintenance, minimum of one control event per year.
Feral cat ( <i>Felis catus</i> )		Trapping: Wire mesh cage trap / Soft net trap/ Padded-jaw trap Shooting – ground based	Control event in Autumn and /or Spring From Year 1 to Year 4, at least two control events per year. Ongoing maintenance, minimum of one control event per year.
Feral cattle ( <i>Bos taurus</i> )		Other - Exclusion fencing / Mustering	As required.
Feral Goat ( <i>Capra hircus</i> )		Shooting – ground / aerial based Other - Exclusion fencing / Mustering	Control event in Autumn and /or Spring From Year 1 to Year 4, at least two control events per year. Ongoing maintenance, minimum of

Pest	Declared	Control methods	Control timing and intensity
			one control event per year.
Feral pig ( <i>Sus scrofa</i> )	Yes	Baiting – 1080 Trapping - Silo, panel or box traps Shooting – ground / aerial based Other - Exclusion fencing	Control event in Autumn and /or Spring From Year 1 to Year 4, at least two control events per year. Ongoing maintenance, minimum of one control event per year.
Hares ( <i>Lepus europaeus</i> )		Trapping – cage trap Shooting – ground based Other - Exclusion fencing / Habitat modification / Repellents	Control event in Autumn and /or Spring From Year 1 to Year 4, at least two control events per year. Ongoing maintenance, minimum of one control event per year.
Red fox ( <i>Vulpes vulpes</i> )		Baiting – 1080 Trapping - Wire mesh cage trap / Soft jaw leg hold trap Shooting – ground based Other - Den fumigation / Exclusion fencing / Ejectors / Habitat modification	Control event in Autumn and /or Spring From Year 1 to Year 4, at least two control events per year. Ongoing maintenance, minimum of one control event per year.
Wild dog ( <i>Canis lupus spp.</i> )	Yes	Baiting – 1080 / PAPP Trapping - Soft jaw leg hold trap Shooting – ground based Other - Exclusion fencing/ Ejectors	Control event in Autumn and /or Spring From Year 1 to Year 4, at least two control events per year. Ongoing maintenance, minimum of one control event per year.

### Local control

Local on ground control measures including trapping, baiting and shooting (as appropriate) are to occur across the BA in Autumn and Spring, to coincide with breeding seasons of many of the vertebrate pest species. Reactive control may be undertaken at other times in response to reports of threatened species and/or livestock predation.

All control actions will be undertaken by appropriately qualified personnel and are required to complete a comprehensive job safety assessment prior to commencement of actions. Control actions must follow the Model Codes of Practice (COPs) and Standard Operating procedures (SOPs) for the humane control of pest animal (available online <http://www.pestsmart.org.au/animal-welfare/humane-codes/>).

### Regional control

Yancoal will continue to participate in regional aerial and ground control programmes for feral pigs and wild dogs, managed and coordinated by the HLLS and/or National Parks and Wildlife Service (NPWS). It will apply across all MZs in the BA.

Regional control programmes are managed and co-ordinated by the HLLS. The HLLS will be responsible for advising the community of the control action, while Yancoal will notify Leaseholders. The HLLS will provide a report detailing the timing, number of animal culled and the GPS output from the aircraft to Yancoal.



#### 4.10.1 Performance Criteria

	Year 1 to Year 4	Year 5 to Year 10	Completion Criteria
Vertebrate pest local control	At least two control events each year for species listed in Table 17, and any other species recorded from monitoring activities. All actions recorded in the Annual Report.	At least one control events each year for species listed in Table 17, and any other species recorded from monitoring activities. All actions recorded in the Annual Report.	No observed vertebrate pest or damage. Ecological monitoring demonstrates a trajectory to benchmark values for all attributes measured over three consecutive assessments (the average of all plots).
Vertebrate pest regional control	Active participation in programme coordinated by HLLS, this may include local control actions.	Active participation in programme coordinated by HLLS, this may include local control actions.	
Monitoring	Complete Ecological Monitoring Section 5.3), (Rapid Condition Assessment and Property Inspections (Section 5.4)	Complete Ecological Monitoring Section 5.3), (Rapid Condition Assessment and Property Inspections (Section 5.4)	

#### 4.10.2 Trigger, Response and Action plan

Trigger	Response and Action
Vertebrate pest having detrimental impact - Ecological Monitoring results indicate no trajectory towards benchmark and management monitoring observes evidence of vertebrate pests. .	Increase the number of control events. Suitably qualified and experienced person to review control action. Revise the Plan.
New vertebrate pest is identified within BA.	Targeted vertebrate pest control. Notify Government Agency and neighbours, if required. Revise the Plan. Follow all directions given by relevant government agency to assist in control.

## 5 Monitoring

This Section outlines the monitoring programme designed to assess changes in the habitats of the offset areas at three different scales:

- landscape monitoring: to assess vegetation changes and habitat connectivity at the landscape scale in the long-term (10 - 15 years);
- ecological monitoring: to assess habitat restoration and bird assemblages by quantifying changes in vegetation structure, key fauna habitat features and bird assemblages in the short to medium-term (2 years); and
- management monitoring: to assess woodland condition and identify emerging threats in the short-term (biannually/annually).

### 5.1 Monitoring objectives

The objectives of this monitoring programme are to detect whether the conservation objectives of the Plan are being achieved, and that the Plan is being effectively implemented.

The variables to be monitored are therefore comprised of:

- the key performance and completion criteria, as listed in Table 12;
- the performance criteria and the trigger events, as specified in Section 4; and
- scenarios that represent risk to the attainment of the plans objectives, as assessed in Table 19, Section 6.

It is anticipated that effective monitoring of ecological condition, and management will demonstrate that implementation of the Plan is achieving the conservation objectives. The monitoring is designed to measure the key performance indicators/completion criteria, and identify where corrective actions are required. In this way it is intended that monitoring activities will have a clear relationship to operational decision-making such that:

- if the landscape (Section 5.2), ecological (Section 5.3), and the management (Section 5.4) monitoring demonstrate an increase in woodland extent and enhanced habitat condition then the Plan is achieving the desired outcomes and should proceed without modification;
- if the monitoring indicates no increase in extent of woodland and enhancement of ecological condition then the corrective actions listed in risk assessment at Table 19 should be implemented; and
- if the monitoring indicates that the performance criteria for the conservation management actions are not achieved, then the Trigger, Response and Action plan should be enacted.

The Annual Reports will provide ongoing review of the monitoring results; this includes the annual management monitoring and the biennial ecological monitoring reports. These reports may include recommendations to amend the monitoring programme and any recommendations will be considered and incorporated as part of the review of the Plan or immediately provided it does not diminish the monitoring effort.

The frequency of monitoring activities will vary according to the monitoring schedule provided in Table 18. To enhance understanding and knowledge of all key stakeholders in the management of the BA, Yancoal representatives, where feasible, will accompany the Biodiversity Auditors during the field based components of this monitoring programme.

Table 18 Monitoring Schedule

	2016	2017	2018	2019	2020	2021 to 2025	2026
<b>Landscape</b>							
Aerial photo interpretation							X
<b>Ecological</b>							
Habitat Restoration	Sept - Nov		Sept - Nov		Sept - Nov		
Bird Assemblage	July-Aug		July-Aug		July-Aug		
<b>Management</b>							
Rapid Condition Assessment	Sept - Nov	Sept - Nov	Sept - Nov	Sept - Nov	Sept - Nov	Sept - Nov	Sept - Nov
Property inspection	April / Nov	April / Nov	April / Nov	April / Nov	April / Nov	April / Nov	April / Nov

## 5.2 Landscape Monitoring

Aerial photographic imagery baseline photography captured 2013 will be updated in up to 15 years. This imagery will be analysed and the findings ground-truthed to assess the extent of canopy regeneration within the BA.

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 Ecological 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

The objectives of the habitat restoration monitoring are to demonstrate:

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

Twelve Habitat Restoration Monitoring Plots are established across the Goulburn River BA, nine of these are located within MZ2, MZ3, MZ6 and MZ7. Three monitoring sites are located within the non-offset grassland area on the flood plain, as control sites to observe the effectiveness of the conservation management actions.

The location of the Habitat Restoration Monitoring Plots is shown in Figure 3. All monitoring results will be stored on the Biodiversity Offsets Portal.

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.

The first survey of all plots was completed in 2014 and subsequent surveys will be biennial (every two years) during late spring/early summer. A summary of results was provided in Section 2.

### Field Methods

The field methods follow the 'Field methodology for measuring condition variables for Site Value and at Reference Sites' according to the BioMetric 3.1 methods (Department of Environment, Climate Change and Water, 2011). In addition, more detailed data are

collected on species composition and cover abundance, canopy regeneration and health, and habitat features as outlined below.

The plots are 50m x 20m and are established such that the plot runs downslope. A 20m x 20m quadrat is positioned within this larger plot and three 50m transects run its length (Figure 8). Marker pegs are positioned at the top-middle of the plot to establish a permanent plot position. GPS coordinates have been taken to ensure monitoring plots can be relocated over time.

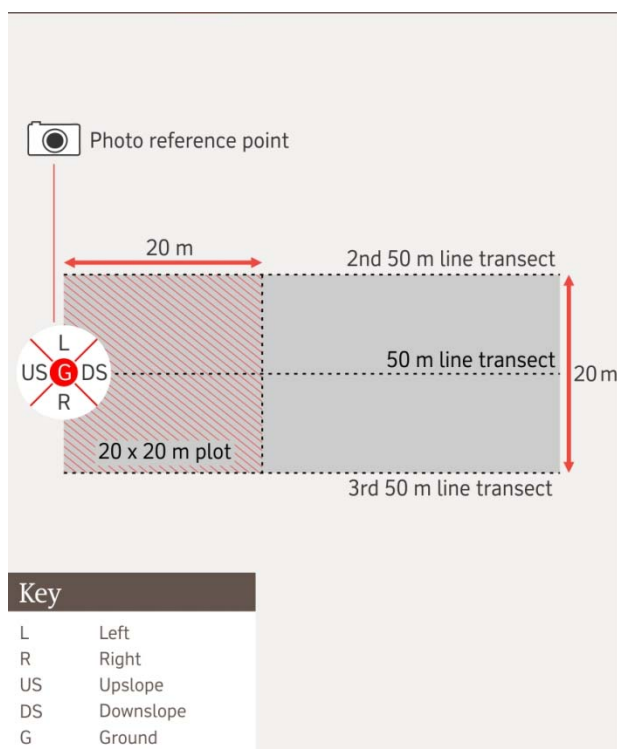
The 50m x 20m plot is used to record details of the over-storey (canopy) layer including species richness, canopy regeneration and canopy health. Specific habitat features, such as the abundance of tree hollows, flowers/fruit, mistletoe and fallen logs are also recorded at this scale

The 20m x 20m quadrat is 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 are also recorded at this scale.

Three 50m transects are used to assess the % foliage cover of the over-storey. This data is 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 are recorded, their unit of measurement and the sampling unit are provided in **Appendix B**.

**Figure 8 Monitoring plot for habitat restoration monitoring**



### Photo Reference Points

Photo reference points are also established and permanently marked within each habitat monitoring plot. Photo reference points are established at the top of the middle 50m transect at each monitoring site. During each monitoring event, a series of photos are 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/fruiting species); and
- changes in identified threatening processes (e.g. weed infestations, erosion).



- At each photo reference point, a minimum of five photos are 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 are displayed on the Biodiversity Offsets Portal such that monitoring photos can be viewed against the baseline 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 focuses on areas of existing woodland habitat.

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 are being 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 region so that habitat and bird assemblage surveys are 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 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, bird assemblage monitoring started in winter/spring 2014 to collect baseline data and subsequent monitoring will occur in 2018 and 2020 (Table 18). Birds Australia may 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.

#### Field Methods

Habitat area searches are conducted in accordance with Birds Australia Atlas search methodology 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 is surveyed for 20 minutes by two observers. Broadcast surveys are to be included in the methodology in 2018 at the same location as the monitoring plots.

At the Goulburn River BA, eleven monitoring plots are established across the BA according to the following distribution and their locations are shown in Figure 3:

- 4 plots in woodland on the escarpment ridges (identified by A in the monitoring site label),
- 4 plots in woodland on the valley floor and floodplain (identified by B in the monitoring site label); and
- 4 plots in woodland in the riparian zone (identified by D in the monitoring site label).

Incidental and opportunistic surveys are also 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 are recorded. General notes and important habitat resources such as tree hollows, flowering trees and nests are recorded incidentally and photographed, as well as any notable bird activities such as specific forage behaviour or signs of breeding activity.

### 5.3.3 Data Analysis and Interpretation

To assess the success of the management activities in meeting the Key Performance Indicators, data on vegetation, fauna habitats and bird assemblages is analysed against the predicted changes in these groups associated with implementation of the management strategies.

Univariate and multivariate techniques will be used to analyse and visualise patterns in the data and will include one or more of the following techniques:

- Analysis of Variance (ANOVA): to test for changes in univariate data including species richness, abundance of specific habitat features, % cover vegetation structural layers;
- distance-based permutational Analysis of Variance based on Bray-Curtis dissimilarities: to test for changes in multivariate data including fauna and plant community composition;
- graphs and charts: to summarise patterns in univariate data and visualise changes in variables relative to the reference condition (medium-high quality woodland); and
- non-metric Multidimensional scaling and SIMPER analyses: to summarise patterns in multivariate data, visualize changes in the data relative to the reference condition and assist in ecological interpretation of the results.

The ecological data will be analysed to assess the nature and extent of change through time, relative to the benchmark values. It is expected that in subsequent years, with the progressive improvement in habitat condition, the ecological data analysis will eventually show a convergence of ecological variables to that of the woodland benchmark. This is expected to be a medium to long-term upward trend that will reflect the enhancement of woodland and the development and availability of critical fauna habitat features such as hollows, ground debris and forage resources. By demonstrating this convergence through time, it will be inferred that the proposed conservation management actions have been successful in enhancing the extent and condition of the vegetation communities and restoring the lower quality vegetation and fauna habitats (in particular for Regent Honeyeater and Swift Parrot) towards the benchmark condition.

## 5.4 Management Monitoring

### 5.4.1 Rapid Condition Assessment

The RCA technique is used as a preliminary assessment of woodland condition within the BA. **Appendix A** provides details on the RCA methodology, the location of the plots is shown in Figure 3. Each year, RCA sites in mature and regrowth vegetation are revisited to record the presence or absence of key habitat components and threatening processes. The results of the RCA, together with property inspections and photo reference points will be used to monitor woodland condition and identify emerging threats.

### 5.4.2 Property inspections

Regular property inspections are undertaken to ensure that there is a systematic monitoring of the offset area, to ensure its protection and to ensure early detection of potential threats or failures. A Yancoal representative will undertake biannual inspections, to ensure regular visual inspections of the offset area to detect:

- physical condition of fencing and gates;
- disturbance factors including fire and unauthorised access e.g. hunting, fire wood collection;
- condition of erosion;
- evidence of waste dumping;

- presence/activity of feral pest species;
- grazing pressure from over-abundant native herbivores;
- presence of exotic weed species; and
- assessment of fire fuel loads in winter.

#### **5.4.3 Survival Assessment**

To assess the survival of planted tubestock and observe regeneration a 50m line transect will be used and 2m x 2m quadrats will be placed every 10m along the transect. One transect will be established to assess every 10ha of re-establishment.

Along the 50m transect, the number of dead and living tubestock will be recorded. Within the 2m x 2m quadrats at every 10m the following is to be recorded:

- number of native plants regenerating;
- number of weed species; and
- record any erosion.

The starting point and end point of each transect is to be recorded by GPS.

## 6 Risk assessment

Table 19 identifies the key risks to this Plan. The risk assessment is undertaken in accordance with the following risk framework having regard for the likelihood and consequence definitions used below.

		Consequence				
		Minor	Moderate	High	Major	Critical
Likelihood	Highly Likely	Medium	High	High	Severe	Severe
	Likely	Low	Medium	High	High	Severe
	Possible	Low	Medium	Medium	High	Severe
	Unlikely	Low	Low	Medium	High	High
	Rare	Low	Low	Low	Medium	High

### Qualitative measure of likelihood (how likely is it that this event/circumstances will occur after management actions have been put in place/are being implemented)

Highly likely Is expected to occur in most circumstances

Likely Will probably occur during the life of the project

Possible Might occur during the life of the project

Unlikely Could occur but considered unlikely or doubtful

Rare May occur in exceptional circumstances

### Qualitative measure of consequences (what will be the consequence/result if the issue does occur)

Minor Minor risk of failure to achieve the plan's objectives. Results in short term delays to achieving plan objectives, implementing low cost, well characterised corrective actions.

Moderate Moderate risk of failure to achieve the plan's objectives. Results in short term delays to achieving plan objectives, implementing well characterised, high cost/effort corrective actions.

High High risk of failure to achieve the plan's objectives. Results in medium-long term delays to achieving plan objectives, implementing uncertain, high cost/effort corrective actions.

Major The plan's objectives are unable to be achieved, with significant legislative, technical, ecological and/or administrative barriers to attainment that have no evidenced mitigation strategies.

Critical The plan's objectives are unable to be achieved, may include widespread and severe environmental harm, with no evidenced mitigation strategies.



Table 19 Risk and Contingency Assessment Matrix

Objective	Scenario <sup>1</sup>	Likelihood	Consequence	Risk level	Trigger	Corrective Action
To protect the conservation values of the offset area within 10 years at the BA.	Delay in securing the offset area under a legally binding mechanism	Likely	Minor	Low	NSW biodiversity reforms not providing a fit for purpose mechanism to legally secure offset area.	Additional consultation with DoEE and OEH.
	Unable to attach the Plan to the land title.	Likely	Minor	Low	NSW government requires different plan to be attached to the land title.	Ensure that a new plan is equivalent to this Plan.
	Illegal access to offset area causing significant residual impact.	Unlikely	Moderate	Low	Failure in access control (Section 4.1.3) captured in management monitoring (Section 5.4.2) and reported in the Annual Report.	Review access control and improve security measures. Consider relocation of offset area.
	Uncontrolled bushfire impact offset area.	Possible	High	Medium	Bushfire on extreme or catastrophic fire danger day impacts offset area.	Implement Post Fire Event recovery with NSW Rural Fire Service. Complete post fire survey, map fire damaged areas, and revise the Plan.
To enhance the condition of conservation values of the offset area within 10 years at the BA.	No enhancement of condition in the conservation values measured by the Habitat Restoration Monitoring (Section 5.3.1) and Rapid Condition Assessment (Section 5.4.1).	Possible	Moderate	Medium	Review of Annual Reports and Monitoring data.	Review external factors (climate) and monitoring effort. Revise Plan and consider new Conservation Management Action. Assess influence on success from other factors such as extreme climatic conditions. Consider relocation of offset area.
	No increase in extent of woodland from the active restoration of grassland as measured by the Landscape (Section 5.2) and Habitat Restoration Monitoring (Section 5.3.1).	Possible	Moderate	Medium	Review of Annual Reports and Monitoring data.	Review external factors (climate) and monitoring effort. Revise Plan and consider new Conservation Management Action. Assess influence on success from other factors such as extreme climatic conditions. Consider relocation of offset area.
To enhance and maintain the habitat values of the offset areas within 10 years at the BA	Observed decrease in species richness and usage of the offset area as measured by the Bird Assemblage Monitoring (Section 5.3.2)	Possible	Moderate	Medium	Review of Annual Reports and Monitoring data.	Review external factors (climate / disease) and monitoring effort. Revise Plan and consider new Conservation Management Action.

Note 1 Assumes effective implementation of management actions as described in the Plan

## 7 Compliance table

**Table 20 Compliance with relevant conditions of EPBC2002/629**

Approval Condition	EPBC 2002/629	Reference
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> <ul style="list-style-type: none"> <li>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</li> <li>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</li> <li>c. the timing, responsibilities and performance criteria for management actions</li> <li>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</li> <li>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</li> <li>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</li> <li>g. details of parties responsible for management, monitoring and implementing the plan, including their position or status as a separate contractor.</li> </ul> <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><i>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.</i></p>	<p>Section 2.1 Location and description</p> <p>Section 3 Objectives, Key Performance Indicators and Completion Criteria</p> <p>Section 4 Conservation Management Actions</p> <p>Section 4 Conservation Management Actions</p> <p>Section 5 Monitoring</p> <p>Section 1.3 Function of the Management Plan</p> <p>Section 4 Conservation Management Actions</p> <p>Section 6 Risk assessment</p> <p>Section 1.3.2 Key Stakeholders and Roles</p>

**Table 21 Compliance with relevant conditions of NSW PA 06\_0261**

Approval Condition	PA 06_0261, Schedule 3	Reference						
29	<p>REHABILITATION AND LANDSCAPE</p> <p>Biodiversity Offset Strategy</p> <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> <tr> <th>Area</th><th>Offset Type</th><th>Minimum Size (hectares)</th></tr> <tr> <td>Goulburn River Biodiversity Area</td><td>Existing vegetation to be enhanced (Narrow leaved</td><td>140</td></tr> </table>	Area	Offset Type	Minimum Size (hectares)	Goulburn River Biodiversity Area	Existing vegetation to be enhanced (Narrow leaved	140	Figure 2 – indicates location of HVO offset area
Area	Offset Type	Minimum Size (hectares)						
Goulburn River Biodiversity Area	Existing vegetation to be enhanced (Narrow leaved	140						

Approval Condition	PA 06_0261, Schedule 3	Reference
	ironbark woodland)	
	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.	
29A	Long Term Security of Offset	
	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 <i>National Parks and Wildlife Act 1974</i> 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 <i>National Parks and Wildlife Act 1974</i> . The conservation agreement/s must remain in force in perpetuity.  This conservation agreement may be combined with any similar agreement required under the project approval for the Warkworth Extension Project (09_0202).	This Plan will form part of the conservation agreement.
36	Rehabilitation and Biodiversity Management Plan	This Plan relates only the offset area, all onsite rehabilitation and biodiversity management is addressed within the Mine Operations Plan
	The Rehabilitation and Biodiversity Management Plan must include:	
	(a) the objectives for rehabilitation of the site and offset area;	Section 3 Objectives, Key Performance Indicators and Completion Criteria
	(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, 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;	Figure 1 Section 2 Biodiversity Area
	(c) a description of the short, medium, and long term measures that would be implemented to:	
	implement the Biodiversity Offset Strategy;	Section 4 Conservation Management
	rehabilitate the site;	
	manage the remnant vegetation and habitat on the site;	
	maximise effective habitat linkages to surrounding vegetated lands;	
	conserve and reuse topsoil;	
	control weeds, feral pests and access; and	
	manage any potential conflicts between the rehabilitation works and Aboriginal cultural heritage;	
	(d) detailed performance and completion criteria for the rehabilitation of the site and implementation of the biodiversity offset strategy;	Section 3 Objectives, Key Performance Indicators and 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;	Section 5 Monitoring
	(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;	Section 4 Conservation Management
	(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;	Section 6 Risk assessment

Approval Condition	PA 06_0261, Schedule 3	Reference
	and	
	(h) details of who (by person and/or position) is responsible for monitoring, reviewing, and implementing the plan.	Section 1.3.2 Key Stakeholders and Roles
	<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>	

**Table 22 Compliance with relevant conditions of NSW SSD-6464**

Approval  
Condition

Development Consent SSD-6464, Schedule 3

Reference

28

Retirement of Offsets

Within 3 years of the date of commencement of development under this consent, the Applicant shall retire biodiversity credits of a number and class specified in Tables 9 and 10 below to the satisfaction of OEH.

The retirement of these credits must be carried out in accordance with the NSW Biodiversity Offsets Policy for Major Projects and can be achieved by :

(a) acquiring or retiring credits under the Biobanking Scheme in the TSC Act;

(b) making payments into an offset fund that has been developed by the NSW Government; or

(c) providing supplementary measures.

The credits reported in this document and the BioBanking Assessment Report will be retired to meet this condition.

Table 9: Ecosystem credit requirements

Vegetation Community	Code (BVT)	Biometric Vegetation Type	Area (ha)	Endangered Ecological Community (EEC)	*Credits required
Warkworth Sands Woodland	HU872	Rough-barked Apple - Narrow-leaved Ironbark - Blakely's Red Gum - Bull Oak - Coast Banksia woodland on sands of the Warkworth area	72.12	Warkworth Sands Woodland in the Sydney Basin Bioregion EEC	3,043
Warkworth Sands Grassland	HU872	Rough-barked Apple - Narrow-leaved Ironbark - Blakely's Red Gum - Bull Oak - Coast Banksia woodland on sands of the Warkworth area	0.67	N/A	16
Central Hunter Grey Box - Ironbark Woodland	HU817	Narrow-leaved Ironbark - Bull Oak - Grey Box shrub - grass open forest of the central and lower Hunter	614.64	Central Hunter Grey Box-Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions EEC	<sup>b</sup> 12,180
Regenerating Central Hunter Grey Box - Ironbark Woodland	HU817	Narrow-leaved Ironbark - Bull Oak - Grey Box shrub - grass open forest of the central and lower Hunter	6.43	Central Hunter Grey Box-Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions EEC	108
Central Hunter Grey Box - Ironbark Derived Grassland	HU817	Narrow-leaved Ironbark - Bull Oak - Grey Box shrub - grass open forest of the central and lower Hunter	378.6	N/A	4,516
Central Hunter Ironbark - Spotted Gum - Grey Box Forest	HU818	Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter	16.61	Central Hunter Ironbark-Spotted Gum-Grey Box Forest in the New South Wales North Coast and Sydney Basin Bioregions EEC	633

Notes:

- <sup>a</sup> Or as otherwise determined by OEH as part of its detailed consideration of credits retirement.
- <sup>b</sup> This must be read in conjunction with the similar figure in Table 11. It reflects the fact that some of these credits may be retired through mine rehabilitation.

Table 10: Species credit requirements

Species	*Credits Required
Regent Honeyeater	18,929
Southern Myotis	18,222
Large-eared Pied Bat	139

Note:

- <sup>a</sup> Or as otherwise determined by OEH as part of its detailed consideration of credits retirement.

30	Direct Land-Based Offsets	
	<p>Within 3 years of the date of commencement of the development under this consent, the Applicant shall secure offset areas listed in Table 12 under an in perpetuity conservation mechanism such as entering into a biobank agreement, in accordance with the relevant provisions of the TSC Act. The direct land-based offsets may be used as offsets for any approval required under the EPBC Act for this development.</p>	<p>This Plan will form part of the conservation agreement.</p>



Approval Condition	Development Consent SSD-6464, Schedule 3	Reference																
<p>Table 12: Direct Land-based Offsets</p> <table><tr><th>Offset Area</th><th>Minimum Size (hectares)</th></tr><tr><td>Northern Biodiversity Area</td><td>303</td></tr><tr><td>Southern Biodiversity Area</td><td>705</td></tr><tr><td>Goulburn River Biodiversity Area</td><td>1,063</td></tr><tr><td>Bowditch Biodiversity Area</td><td>520</td></tr><tr><td>Putty Road Biodiversity Area</td><td>94</td></tr><tr><td>2003 Warkworth Sands Woodland Area</td><td>155.8</td></tr><tr><td>North Rothbury Biodiversity Area (Hanwood Estate)</td><td>40</td></tr></table> <p>Note: To identify the areas referred to in Table 12 see the applicable figures in Appendix 4.</p>			Offset Area	Minimum Size (hectares)	Northern Biodiversity Area	303	Southern Biodiversity Area	705	Goulburn River Biodiversity Area	1,063	Bowditch Biodiversity Area	520	Putty Road Biodiversity Area	94	2003 Warkworth Sands Woodland Area	155.8	North Rothbury Biodiversity Area (Hanwood Estate)	40
Offset Area	Minimum Size (hectares)																	
Northern Biodiversity Area	303																	
Southern Biodiversity Area	705																	
Goulburn River Biodiversity Area	1,063																	
Bowditch Biodiversity Area	520																	
Putty Road Biodiversity Area	94																	
2003 Warkworth Sands Woodland Area	155.8																	
North Rothbury Biodiversity Area (Hanwood Estate)	40																	
36	<p><b>Biodiversity Management Plan</b></p> <p>The Applicant shall prepare a Biodiversity Management Plan for the development to the satisfaction of the Secretary, and carry out the development in accordance with this plan. This Plan must:</p> <p>(a) be prepared in consultation with OEH and submitted to the Secretary for approval prior to the commencement of any development under this consent;</p> <p>(b) describe the short, medium, and long term measures that would be implemented to:</p> <ul style="list-style-type: none"><li>• manage the remnant vegetation and fauna habitat on the site;</li><li>• implement the biodiversity offset strategy described in the EIS;</li><li>• regenerate and conserve Warkworth Sands Woodland EEC in the biodiversity areas;</li><li>• integrate the implementation of the biodiversity offset strategy to the greatest extent practicable with the rehabilitation of the site;</li></ul> <p>(c) include detailed performance and completion criteria for evaluating the performance of the biodiversity offset strategy (including the regeneration of Warkworth Sands Woodland). and triggering remedial action (if necessary);</p> <p>(d) include a detailed description of the measures that would be implemented over the next 3 years for:</p> <ul style="list-style-type: none"><li>• regenerating Warkworth Sands Woodland in the biodiversity offset areas;</li><li>• protecting vegetation and fauna habitat outside the approved disturbance area on-site;</li><li>• enhancing the quality of existing vegetation and fauna habitat on the site and in the biodiversity offset areas;</li><li>• minimising clearing and avoid unnecessary disturbance;</li><li>• maximising the salvage of resources within the approved disturbance area - including vegetative and soil resources - for beneficial reuse in the enhancement of any land-based offsets or the rehabilitation of the site;</li><li>• collecting and propagate seed;</li><li>• minimising the impacts on fauna on site, including undertaking pre-clearance surveys;</li><li>• managing salinity using best practice dryland salinity management revegetation measures;</li><li>• controlling weeds and feral pests;</li><li>• controlling erosion;</li><li>• managing grazing and agriculture on site;</li><li>• controlling access; and</li><li>• bushfire management;</li></ul> <p>(e) include a seasonally-based program to monitor and report on the effectiveness of these measures, and progress against the detailed performance and completion criteria;</p> <p>(f) identify the potential risks to the successful implementation of the biodiversity offset strategy (including the regeneration of Warkworth Sands Woodland) and include a description of the contingency measures that would be implemented to mitigate against these risks; and</p> <p>(g) include details of who would be responsible for monitoring, reviewing, and implementing the plan.</p> <p>Note: Management measures relating to the biodiversity offset strategy may be addressed via equivalent measures required by OEH as part of a BioBanking Agreement or similar conservation agreement.</p>	<p>Completed – this Plan satisfies the requirements of the Biodiversity Management Plan approved in January 2016. Conditions (c) and (d) see Section 3 Objectives, Key Performance Indicators and Completion Criteria and Section 4 Conservation Management .</p> <p>Condition (e) see Section 5 Monitoring.</p> <p>Condition(f) see Section 6 Risk assessment.</p> <p>Condition (g) see Section 1.3.2 Key Stakeholders and Roles.</p>																

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## Appendix A – Rapid Condition Assessment

The Rapid Condition Assessment (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.

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 A1 with an example score for relatively undisturbed woodland.

**Table A1 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>



## Appendix B – 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 B1.

- **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 B1 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

