Offset Management Plan

Mount Pleasant Project, NSW

Version 3

23 April 2015

This document has been prepared by:

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Coal & Allied Operations Limited would like to thank and acknowledge the contribution and the constructive review of the draft Offset Management Plan by all members of the Mount Pleasant Project Advisory Committee.

Document Title	Version	Date effective	Comment
Offset Management Plan	Draft May 2013		Draft submitted to Minister for approval.
Offset Management Plan	June 2014		Incorporation of DoE review comments
Offset Management Plan	April 2015		Incorporation of DoE review comments

Cover Photo: Box Gum Grassy Woodland, Black Rock, Merriwa East BMA (RTCA 2013)

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Abbreviations

Box Gum Grassy Woodlands	White Box–Yellow Box–Blakely's Red Gum Grassy Woodlands
BMA	Biodiversity Management Area
CEEC	Critically Endangered Ecological Community
DoE	Australian Government Department of the Environment
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
ha	Hectare
HSE	Health, Safety and Environment
Km	Kilometre
LLS	Local Land Services
LMU	Land Management Unit
MNES	Matter of National Environmental Significance
NSW	New South Wales
OEH	NSW Office of Environment and Heritage
OMP	Offset Management Plan
TSC Act	NSW *Threatened Species Conservation Act 1995*

1.0 Introduction

1.1 Project Background

The Mount Pleasant Project is an open cut coal mine, located in the Hunter Valley in New South Wales (NSW), approximately 4km northwest of Muswellbrook. Coal & Allied Operations Limited (Coal & Allied), which is managed by Rio Tinto Coal Australia, was granted approval by the Minister for the Environment (Minister) for the Mount Pleasant Project in February 2012, under the provisions of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), approval reference 2011/5795. The approval is administered by the Australian Government Department of the Environment (DoE).

Coal & Allied has been granted permission to clear no more than 2,591hectares (ha) of native vegetation from the proposed disturbance footprint for mining activities. This native vegetation includes 571.8ha of the Coastal Grey Box/White Box Intergrade Woodland and 2,019.1ha of Derived Native Grassland, which are considered to form an important part of the White Box–Yellow Box–Blakely's Red Gum Grassy Woodlands (Box Gum Grassy Woodlands) and Derived Native Grassland ecological communities. These ecological communities are listed under the EPBC Act as a critically endangered ecological community (CEEC).

To offset the impact of the vegetation clearing, 15,643ha of Biodiversity Management Areas (BMAs), comprising similar ecological communities and habitat quality, are to be managed for biodiversity offsets. At least 12,875ha of the BMAs is to be secured as an Offset Area, with a legally binding mechanism for enduring protection. This will significantly increase the area of Box Gum Grassy Woodlands within the protected area estate in Australia. It will provide the largest known area of contiguous Box Gum Grassy Woodlands managed principally for conservation in Australia. It will also contribute to regional strategies for improved catchment health and function administered by Local Land Services (LLS). The Offset Area must also protect at least 8,475ha of verifiable habitat for the Swift Parrot, Regent Honeyeater, Spotted-tail Quoll and Greater Long-eared Bat.

These Approval Conditions were negotiated under the 2007 draft *Use of environmental offsets under the EPBC Act* policy. In addition to the management of the BMAs, other elements of the offset Approval Conditions include:

- Woodland Re-establishment Project for 677ha;
- $1 million Weed Project;
- $2 million Woodland Bird Project; and
- Advisory Committee - to provide advice on the management of the BMAs and review the Offset Management Plan, Weed Project Plan, Woodland Bird Project Plan and Woodland Re-establishment Plan prior to submission the Minister.

The *Mount Pleasant Project - Public Environment Report* (2011) detailed the offset package, including descriptions of the BMAs and a Biodiversity Management Plan. To reflect the changes to the offset package made during final negotiations with DoE, the Biodiversity Management Plan has been updated and can be accessed from the Coal & Allied website. The Biodiversity Management Plan provides the background to the selection of the BMAs and details of their ecological condition, biodiversity values (such as habitat for Matter of National Environmental Significance (MNES)) and overarching principles for conservation restoration and monitoring.

The Woodland Re-establishment Project plan will detail the restoration of up to 1,540ha of currently agricultural land within the BMAs. This plan is required at least 3 years after commencement of construction.

The BMAs were productive farming properties and will continue to be managed as agricultural enterprises with conservation as the principle outcome. The intention is to demonstrate the ability to sustain a viable agricultural enterprise whilst protecting and

enhancing biodiversity values. The Offset Management Plan (OMP) will provide the framework for this integrated management approach.

The BMAs are located near the NSW townships of Merriwa and Cassilis in Upper Hunter Valley and near Gunnedah. **Figure 1** provides a location of the BMAs and proximity to the Mount Pleasant Project site.

1.1.1 Project Approval Conditions

This OMP has been prepared for the BMAs to satisfy the Mount Pleasant Project Approval Conditions. The Approval Conditions are shown in **Appendix A** with cross references to the relevant sections within the OMP to track the OMP compliance. The principal conditions outlining the requirements for the OMP are listed below. The Approval Conditions can also be found online at http://www.environment.gov.au/cgi-bin/epbc/epbc_ap.pl?name=current_referral_detail&proposal_id=5795, as conditions can vary the version at Appendix A may not be current.

Approval Condition 2

The person taking the action must register a legally binding conservation covenant over the Biodiversity Management Areas in the map at Appendix B no later than 6 months prior to commencement of construction. The mechanism must provide enduring protection of no less than:

a) 12,875ha of White Box – Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland Ecological Community

b) 8,475ha of suitable habitat for Anthochaera phrygia (regent honeyeater) and Lathamus discolour (swift parrot)

c) 8,475ha of suitable habitat for Dasyurus maculatus maculatus (spotted quoll)

d) 8,475ha of suitable habitat for Nyctophilus corbeni (greater long-eared bat).

Note: Offsetting requirements for some species' habitat may be accommodated within the White Box – Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland Ecological Community components it this habitat is verified as present and included specific habitat requirements for each relevant species.

Approval Condition 3

The person taking the action must submit to the Minister for approval an Offset Management Plan for the Biodiversity Management Areas by no later than 31 May 2013, or as otherwise agreed to in writing by the Minister. The Offset Management Plan must contain details of measures to offset the impacts to the White Box—Yellow Box—Blakely's Red Gum Grassy Woodland and Derived Native Grassland Ecological Community, and fauna species identified in condition 2.

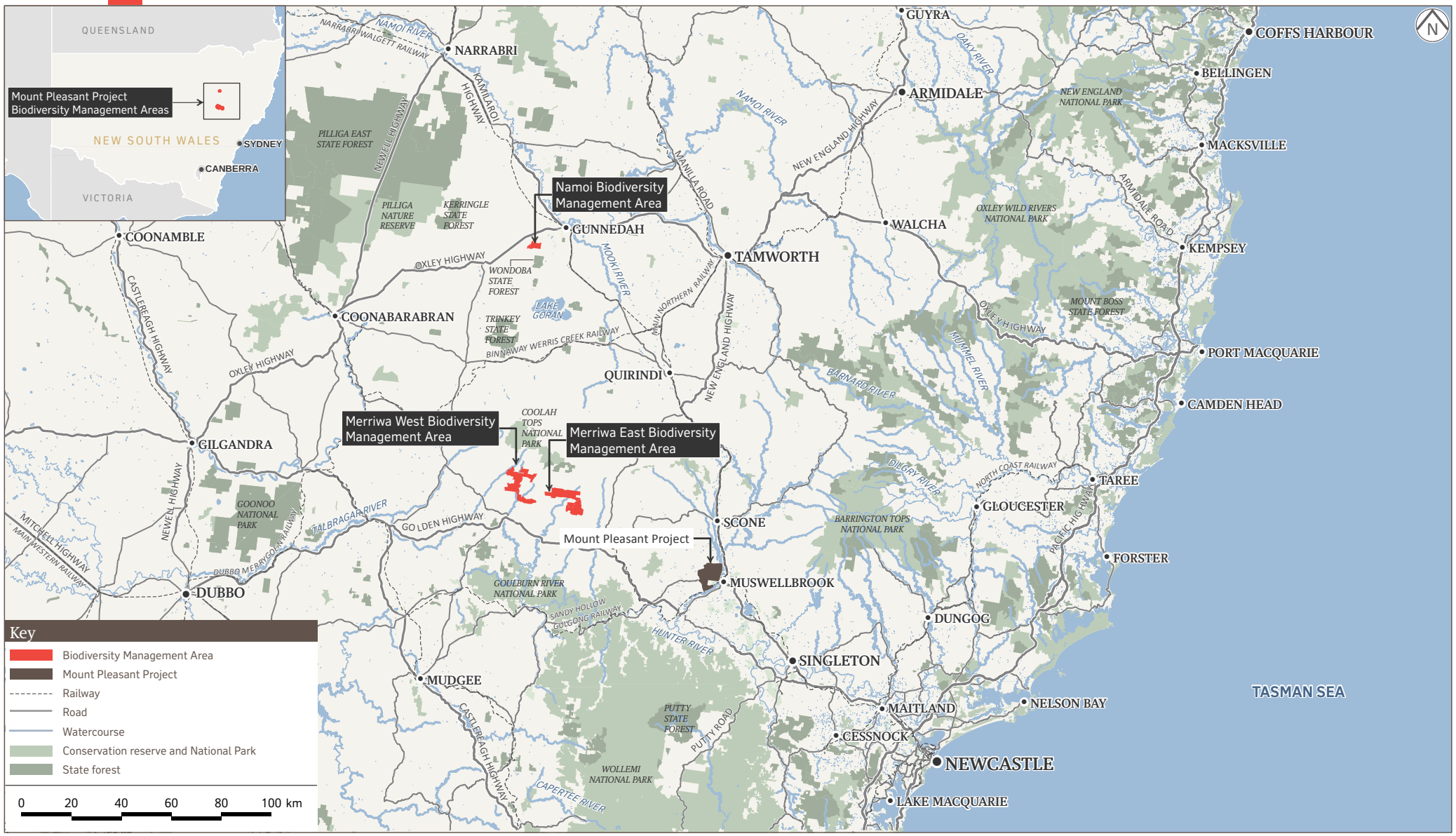
The approved Offset Management Plan must be implemented.

Photo: Box Gum Grassy Woodland, Clare Park at Merriwa East BMA (Cumberland Ecology 2013)

Location of the Biodiveristy Management Areas

Offset Management Plan

Figure 1



1.1.2 Offset Security

The Offset Area is to be secured using a legally binding mechanism, at least six months prior to commencement of construction, to provide enduring protection of Box Gum Grassy Woodlands, Derived Native Grassland and verifiable habitat for the Regent Honeyeater, Swift Parrot, Spotted-tail Quoll and Greater Long-eared Bat. The Offset Area is to protect at least 12,875ha. This OMP proposes an Offset Area of approximately 13,522ha, a detailed breakdown of these areas is provided at Section 2.4.1. Once the OMP is approved, the Offset Area will be surveyed and a final area provided to DoE.

1.2 Function of the Offset Management Plan

The OMP will provide the framework for integrated management of the BMAs to achieve balanced management outcomes for improved biodiversity, economic and social factors for the local rural communities. Principally, this will be achieved via the implementation of conservation management strategies that aim to improve biodiversity values. The use of strategic grazing will provide the opportunity to support an agricultural enterprise, while managing threats such as weeds and encouraging native species diversity.

The properties within the BMAs will be leased in 2014, once the OMP is approved. The implementation of the OMP will be a key condition of the lease agreements. Lease agreements will be issued on a long-term basis to foster a partnership approach between Coal & Allied and the Leaseholder and to protect and conserve the biodiversity values on the BMAs.

The Leaseholder responsibilities will encompass the day to day management of the properties, including grassland monitoring, livestock management and implementation of on-ground works. The presence of Leaseholders will ensure security for the properties and Offset Areas, providing a deterrent to illegal activities, including clearing for firewood or hunting. In addition, they can respond quickly to emergency events such as bushfires or floods. To enhance the Leaseholder's ability to protect the biodiversity values, training and support will be provided in native plant and animal identification, identification of weeds species and sustainable grazing management.

1.2.1 Structure

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

- Biodiversity Management Areas: This chapter describes the BMAs and Land Management Units (LMUs);
- Conservation Objectives and Key Performance Indicators: This chapter outlines the primary conservation objectives for the OMP as well as the biodiversity values, nested conservation values and key performance indicators that have guided the development of conservation management strategies and the monitoring programme;
- Conservation Management Strategies: This chapter outlines primary management strategies used to improve the extent, connectivity and condition of Box Gum Grassy Woodlands and Derived Native Grassland consistent with the "White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland National Recovery Plan" (DECCW, 2010) and "A Guide to Managing Box Gum Grassy Woodlands" (Rawlings, 2010);
- Monitoring: This chapter details programmes to measure short, medium and long term impacts of the OMP conservation management strategies. These assessments will provide quantitative data to guide adaptive management, monitor long term trends in biodiversity values and attainment of Key Performance Indicators; and
- Conclusion: This chapter describes the risk matrix to cross check activities against key risks to ensure the OMP is comprehensive.

1.2.2 Information Management

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

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

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

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

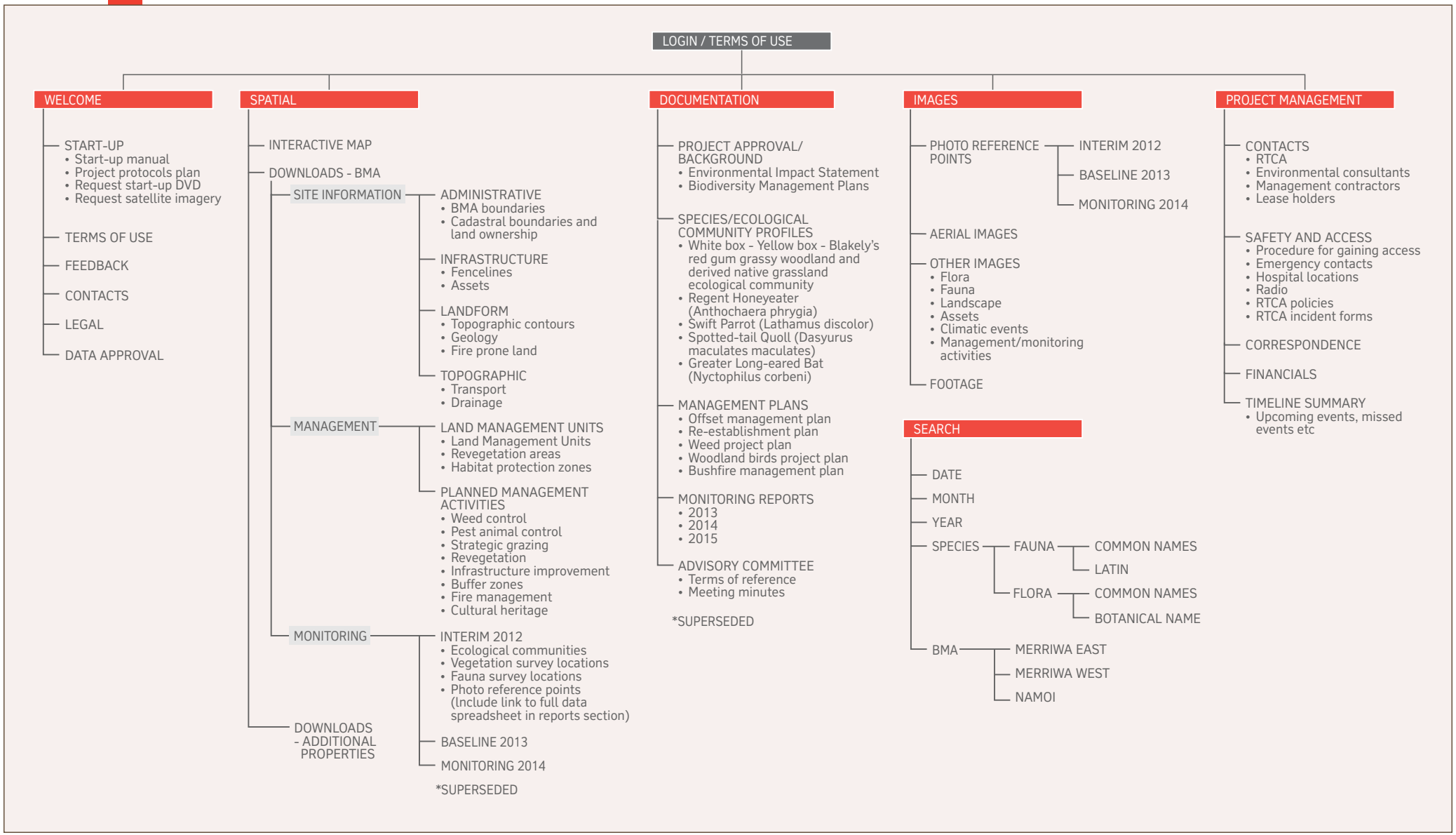
Key documents will also be available on the Coal & Allied website.

Photo: Koala in a Yellow box, Warrawoona, Namoi BMA (Cumberland Ecology 2013)

Portal Structure

Offset Management Plan

Figure 2



1.2.3 Key Project Stakeholders and Roles

The key project stakeholders are identified by their roles in **Table 1**.

Table 1 Key project roles and stakeholders

Roles	Responsible Entity	Details
Regulator –Approval Conditions for EPBC Act – approval reference 2011/5795. The Minister is to approve plans (OMP, Weed Project Plan, Woodland Birds Project Plan and Woodland Re-establishment Plan).	Australian Government Department of the Environment	PostApproval@environment.gov.au
Project proponent and land owner – prepare plans and operational documents. Supervise management of the BMAs, review monitoring reports and adapt management.	Coal & Allied	Manager, Offsets 1800 727 745 cnacommunityrelations@riotinto.com
Advisory Committee – the committee is required to provide advice on the management of the BMAs and review plans.	Coal & Allied	Refer to Coal & Allied website
Leaseholder – day to day management of the BMAs, adhere to OMP and preparation of monthly reports.	Appointed by Coal & Allied.	Leaseholders will be selected through a tender process managed by Coal & Allied. Demonstrated ability to implement the OMP will be a key selection criterion.
Biodiversity Auditor - monitor the MNES and improvement in extent and condition of the biodiversity values.	Person/s engaged by Coal & Allied to undertake monitoring programme.	Coal & Allied will engage suitably qualified person/s.
Agriculture Auditor – monitor the strategic grazing, other agricultural matters and prepare quarterly reports.	Person/s engaged by Coal & Allied to undertake monitoring programme.	Coal & Allied will engage suitably qualified person/s.
Regulate control of noxious weeds	Upper Hunter Weeds Authority Gunnedah Shire Council	Works Coordinator, Upper Hunter Weeds Authority Ph. 02 6549-3802 www.muswellbrook.nsw.gov.au/Council-services/Environment/Weeds/ uhwa@muswellbrook.nsw.gov.au Senior Weeds Officer, Gunnedah Shire Council. 02 6740 2225 www.gunnedah.nsw.gov.au council@infogunnedah.com.au
Regulate control of pest animals	Hunter Local Land Services North West Local Land Services	Hunter Local Land Services (Scone) 02 6545 1311 www.hunter.lls.gov.au North West Local Land Services (Gunnedah) 02 6742 9220 www.northwest.lls.nsw.gov.au

1.2.4 Review and Reporting

The OMP will be reviewed in 2020 to update information on the condition and extent of the ecological communities across the BMAs and refine conservation management strategies. The document may be updated on an irregular basis to amend changes to contact details, agency names or other secondary information. The revised documents will be available through the Portal and the Coal & Allied website.

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

The Annual reports will be included as part of the reporting requirements under Approval Condition 28, and supplied to key project stakeholders and published on the Portal and Coal & Allied website.

2.0 Biodiversity Management Areas

The BMAs are farming properties that are to be managed for conservation purposes, with remnant patches of Box Gum Grassy Woodlands, Derived Native Grassland and Other Woodland ecological communities of varying ecological condition. These ecological communities also provide habitat for the MNES fauna.

The BMAs were acquired by Coal & Allied as biodiversity offsets to mitigate the impacts of vegetation clearing at the Mount Pleasant Project site. The Biodiversity Management Plan provides a detailed description of the BMAs, which can be found on the Coal & Allied website.

2.1 Location

There are three BMAs. The two largest, Merriwa East and Merriwa West (14,501Ha) are located near the townships of Merriwa and Cassilis respectively, and are both accessible from the Golden Highway. Merriwa East is approximately 20km north-west of Merriwa and Merriwa West is approximately 5km north of Cassilis. The third and smallest BMA, Namoi (1,143ha), is situated approximately 20km south-west of the township of Gunnedah, and is accessible via the Oxley Highway. In total there are six separate properties within the BMAs. **Figure 3 (a)** to **(c)** indicates the location of these properties within the BMAs and the key infrastructure assets, such as house, sheds, and quarries. The quarries across the BMAs have historically been operated by the Upper Hunter Shire Council. Where appropriate these quarries may be excluded from the BMAs and operated by the council to assist in the maintenance of council owned roads.

All the BMAs are within the Brigalow Belt South bioregion, a bioregion that is under-represented in Australia's national reserve system. **Table 2** provides the locality details for each of the properties within the BMAs.

The Merriwa East and West BMAs form part of the Upper Hunter river catchment. These BMAs are intersected by north to south flowing rivers and creeks that drain into the Goulburn River. Remnant vegetation along these watercourses provide connectivity between the Goulburn River and Coolah Tops National Parks. Proposed management of these BMAs aims to improve this connectivity. The north-western corner of the Merriwa West BMA is located on the western side of the Great Dividing Range and drains into the Murray Darling Basin. The Namoi BMA is located within the Murray Darling Basin and forms a stepping stone for connectivity between Wondaba State Forest and the Pilliga Nature Reserve.

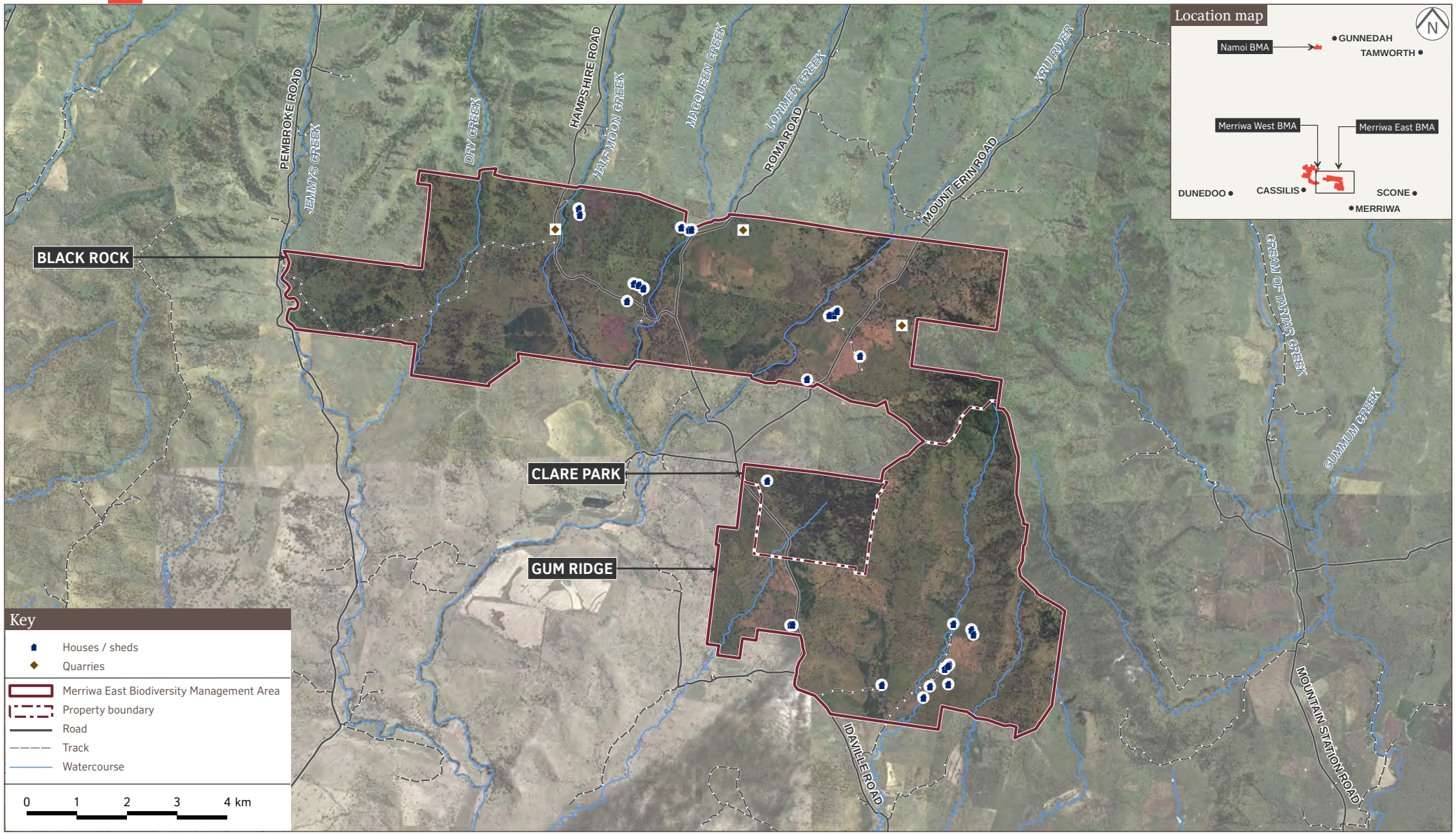
Appendix B provides further information on the biophysical characteristics of the BMAs.

Photo: Southern Rainbow-Skink at St Antoine, Merriwa West BMA (Cumberland Ecology 2013)

Merriwa East Biodiversity Management Area and Infrastructure

Offset Management Plan

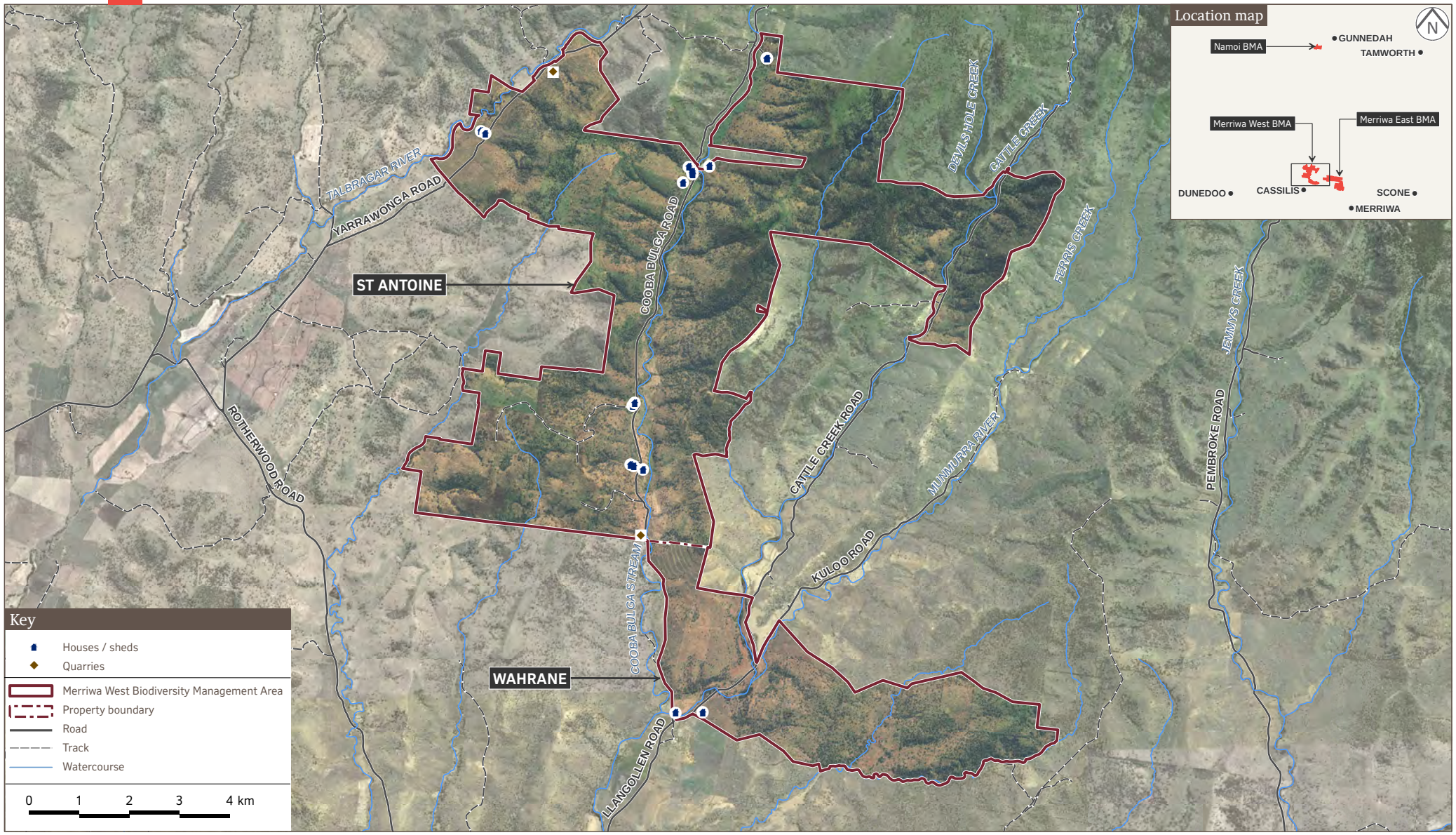
Figure 3a



Merriwa West Biodiversity Management Area and Infrastructure

Offset Management Plan

Figure 3b



Namoi Biodiversity Management Area and Infrastructure

Offset Management Plan

Figure 3c

Table 2 Biodiversity Management Areas Property details

BMA	Bioregion	Bioregion Sub region	Catchment Management Area	Local Government Area	Land Owner	Properties	Area (Ha)	Location
Merriwa East	Brigalow Belt South	Liverpool Range	Hunter LLS	Upper Hunter	Coal & Allied	Black Rock	4,243	25km northwest of Merriwa, via Mount Erin Rd and Golden Hwy.
						Clare Park	409	20km northwest of Merriwa, via Idaville Rd and Golden Hwy
						Gum Ridge	2,633	20km northwest of Merriwa, via Idaville Rd and Golden Hwy
Merriwa West	Brigalow Belt South	Liverpool Range	Hunter LLS	Upper Hunter	Coal & Allied	St Antoine	5,619	40km northwest of Merriwa, via Cooba Bulga Rd and Golden Hwy
						Wahrane (Llangollen)	1,598	35 km northwest Merriwa, via Llangollen Rd and Golden Hwy
Namoi	Brigalow Belt South	Liverpool Plains	North West LLS	Gunnedah	Coal & Allied	Warrawoona	1,143	20km southwest of Gunnedah, via Beisson Rd and Oxley Hwy

2.2 Ecological Communities

The ecological communities across the BMAs have been mapped as:

- Box Gum Grassy Woodlands (CEEC);
- Derived Native Grassland (CEEC);
- Low Diversity Derived Native Grassland; and
- Other Woodland.

These communities represent the primary biodiversity values within the BMAs and support a range of "nested" conservation values, including endangered flora and fauna species, habitat and cultural heritage. The remaining areas of land across the BMAs have been more intensively cleared and used for farming. They have been mapped as Agriculture and include exotic pastures and cropping areas. A small area (34ha) has been mapped as infrastructure and it includes areas around houses, roads and small parcels of land where the land title needs to be reviewed.

Figure 4 (a) to **(c)** shows the distribution of these ecological communities as at November 2012. These communities where delineated using data from vegetation surveys and sites visits collected between 2010 to 2012, in conjunction with aerial imagery captured from May to September 2012.

Table 3 provides the areas of ecological communities and the area of land allocated to agriculture.

Table 3 Biodiversity Management Areas

BMA	Box Gum Grassy Woodland (Ha)	Derived Native Grassland (Ha)	Low Diversity Derived Native Grassland (Ha)	Other Woodland (Ha)	Agriculture (Ha)	Total (Ha)
Merriwa East	3,998	1,701	154	74	1,356	7,284
Merriwa West	3,512	1,894	359	123	1,286	7,176
Namoi	524	211	0	45	369	1,149
Infrastructure					34	
Total	8,035	3,807	514	243	3,045	15,643

2.2.1 Box Gum Grassy Woodlands

The Box Gum Grassy Woodlands mapped across the BMAs currently satisfy the description of the listed CEEC under the EPBC Act and the NSW *Threatened Species Conservation Act 1995* (TSC Act).They are characterised by tree cover, containing a patch of five or more trees at a spacing of no greater than 75m apart, and a predominately native ground layer (or understorey). According to the guidelines for identification (DEH, 2006), patches of this woodland:

- contain at least 12 or more native species (excluding grasses) and at least one "important" species per 1,000 square metres; and/or
- are greater than two hectares in size, contain 20 or more mature trees (125cm diameter at breast height (dbh)) per hectare or there is natural regeneration of the dominant overstorey eucalypts.

This community comprises a complex combination of vegetation communities that occupy a range of landscape positions and are dominated or co-dominated by one or a combination of the following tree species: White Box *(Eucalyptus albens*) and Grey Box/White Box intergrades (*E. moluccana* / *E. albens* intergrades), Yellow Box (*E. melliodora*), and Blakely's Red Gum *(E. blakelyi*).

The condition of this community across the BMAs is variable due to land use history.

The Merriwa East and Merriwa West BMAs Box Gum Grassy Woodlands are dominated by the Grey Box/White Box intergrades, with transitions to a dominant Yellow Box canopy on the lower slopes and along drainages lines. Other associated species observed

include Blakely's Red Gum, Rough Barked Apple *(Angophora floribunda),* Kurrajong (*Brachychiton populneus*) and Silver Top Stringybark *(E. laevopinea).*

The Namoi BMA Box Gum Grassy Woodlands contain vegetation communities with the pure form of White Box including: White Box Grassy Woodland, White Box – White Cypress Pine Grassy Open Forest and associations with Yellow Box - Blakely's Red Gum Woodland.

It is important to note that DoE advised that ecologically, the Grey Box/White Box intergrades found across the Merriwa East and West BMAs are an important component of the Box Gum Grassy Woodlands.

2.2.2 Derived Native Grassland

The Derived Native Grassland mapped within the BMAs are derived from the clearing of woodland once dominated by White Box (or Grey Box/White Box intergrades), Yellow Box or Blakely's Red Gum trees. At present this community only meets the description of the Derived Native Grassland, and cannot be classified as Box Gum Grassy Woodlands due to absence of a tree cover. It contains at least 12 native non grassy understorey species (such as forbs, ferns, shrubs and sedges) within a 0.1ha plot, with at least one being a recognised "important" species.

The Derived Native Grassland across the BMAs are typically dominated in various proportions by: Purple Wiregrass (*Aristida ramosa),* Wallaby Grass (*Austrodanthonia spp.),* Plains Grass *(Austrostipa aristiglumis),* Pitted Bluegrass *(Bothriochloa decipiens),* Tall Windmill Grass *(Chloris ventricosa),* Couch *(Cynodon dactylon),* Queensland Bluegrass (*Dicanthium sericeum* subsp*. sericeum),* Coolabah Grass *(Panicum queenslandicum)* and Common Rat-tail Grass *(Sporobolus creb*er)*.* Common native forbs included: Common Woodruff (*Asperula conferta),* Common Everlasting Daisy (*Chrysocephalum apiculatum),* Kidney Weed *(Dicondra repens),* Twining Glycine (*Glycine clandestina),* Corrugated Sida *(Sida corrugata),* Climbing Saltbush (*Einadia* sp.), Grassland Woodsorrel *(Oxalis perennans)* and Rock Ferns (*Cheilanthes sieberi*).

2.2.3 Low Diversity Derived Native Grassland

Low Diversity Derived Native Grassland areas have been more extensively impacted by agriculture and contain a low diversity of native species. This community does not contain sufficient diversity of native species to meet the description for Derived Native Grassland or the grassland component of Box Gum Grassy Woodlands under the EPBC Act.

2.2.4 Other Woodland

A range of non-EPBC Act listed woodland communities also occur within the BMAs. The vegetation communities mapped as Other Woodland include: Narrow-leaved Ironbark (*Eucalyptus crebra)* Shrubby woodland and River Oak (*Casuarina cunninghamiana)* forests. The condition of these communities across the BMAs is variable due to land use history. These communities provide habitat for the MNES species; the Regent Honeyeater, Swift Parrot, Spotted-tail Quoll, and Greater Long-eared Bat.

Merriwa East and West BMAs have long linear strips of River Oak forest, which typically have a highly disturbed exotic understorey, but retain the capacity to form critical habitat corridors along the rivers and creeks. These riparian corridors generally run from the north to the south, and form natural linkages throughout the landscape, increase connectivity and support the migration of woodland birds.

The Narrow-leaved Ironbark Shrubby woodland at the Namoi BMA has the potential to provide high quality habitat for the Greater Long-eared Bat.

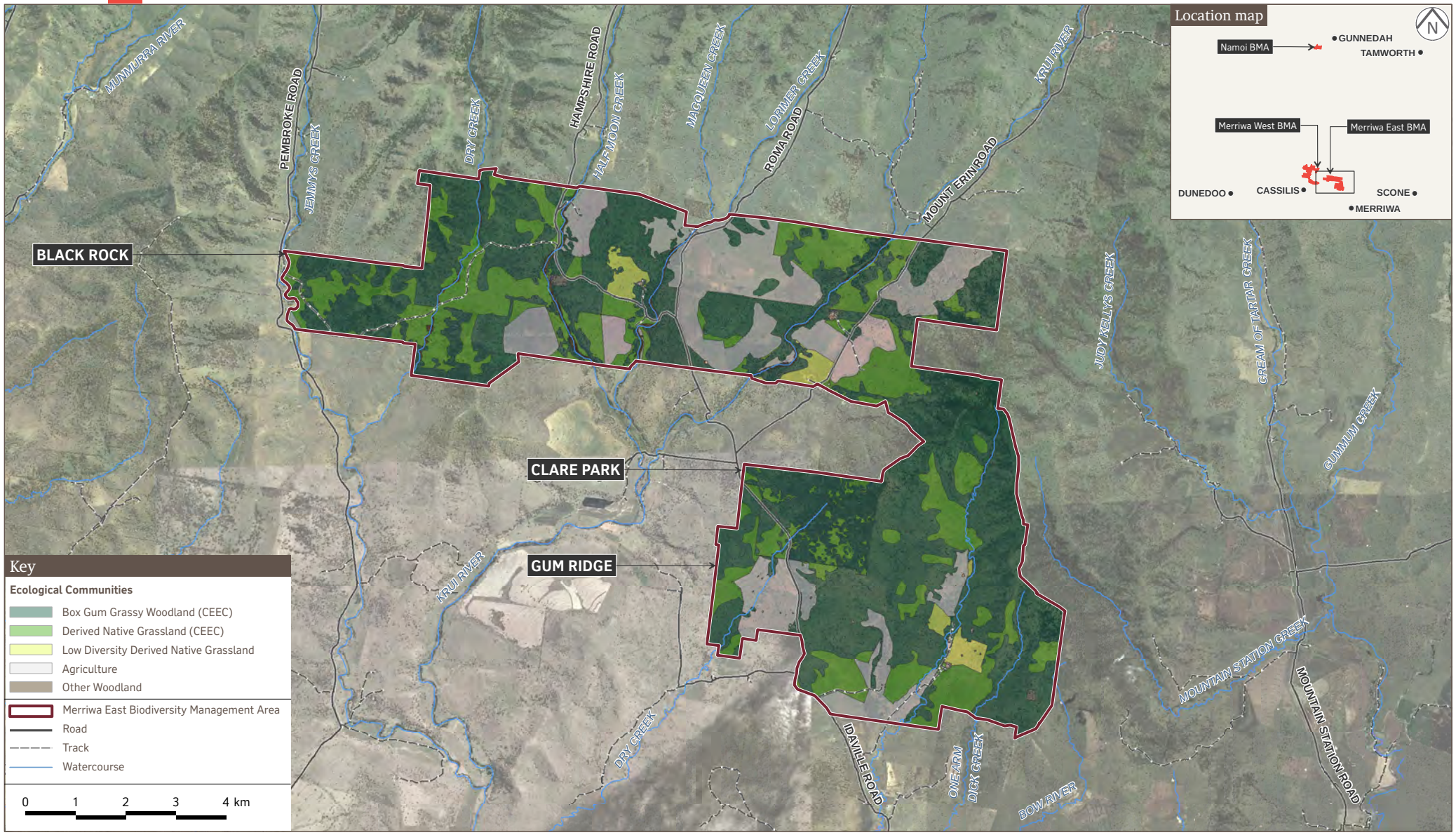
2.2.5 Agriculture

All BMAs have sustained long-term productive grazing enterprises, mostly cattle and sheep grazing. Some areas have been cultivated for cropping for fodder production.

Merriwa East Ecological Communities

Offset Management Plan

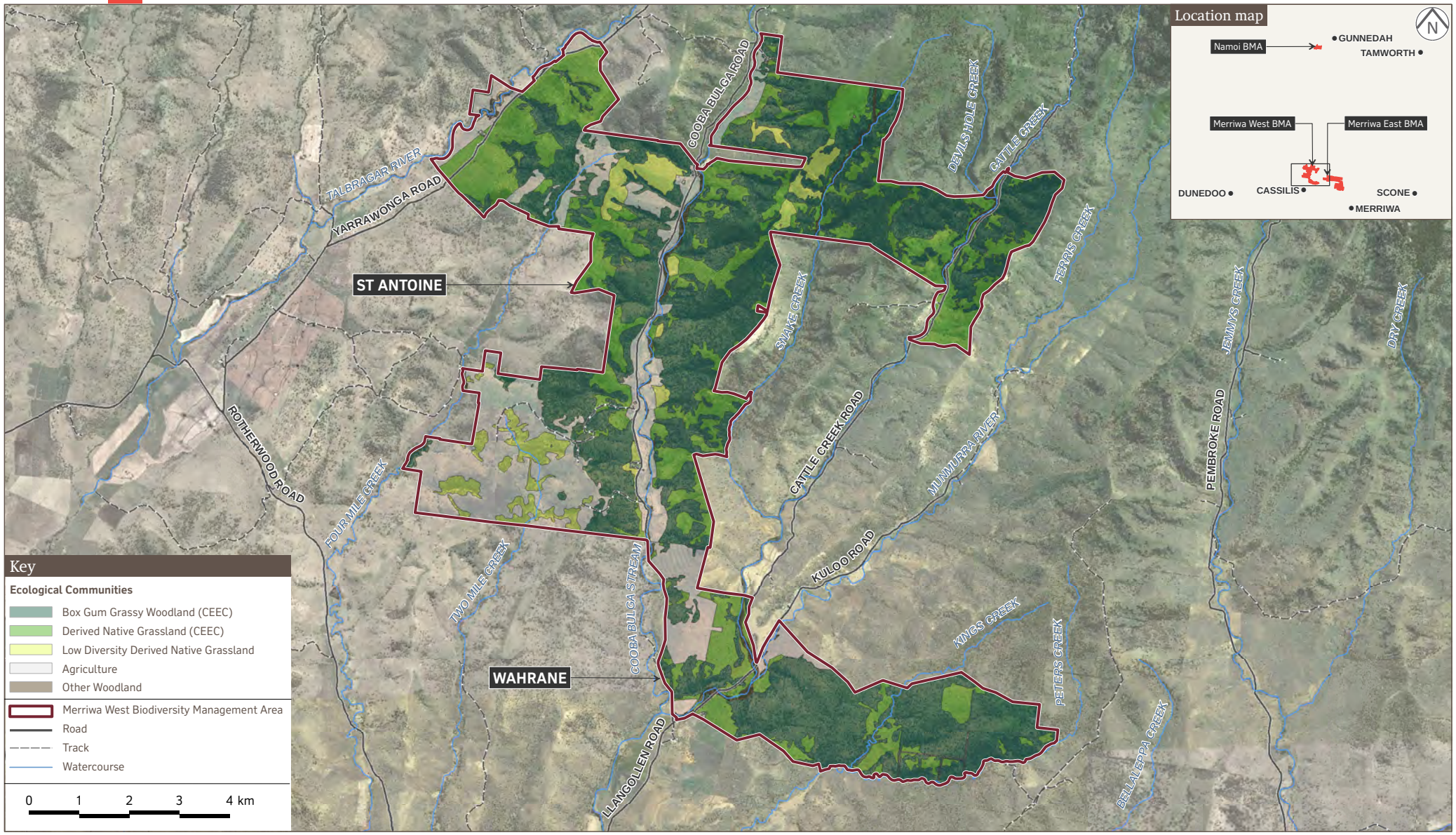
Figure 4a



Merriwa West Ecological Communities

Offset Management Plan

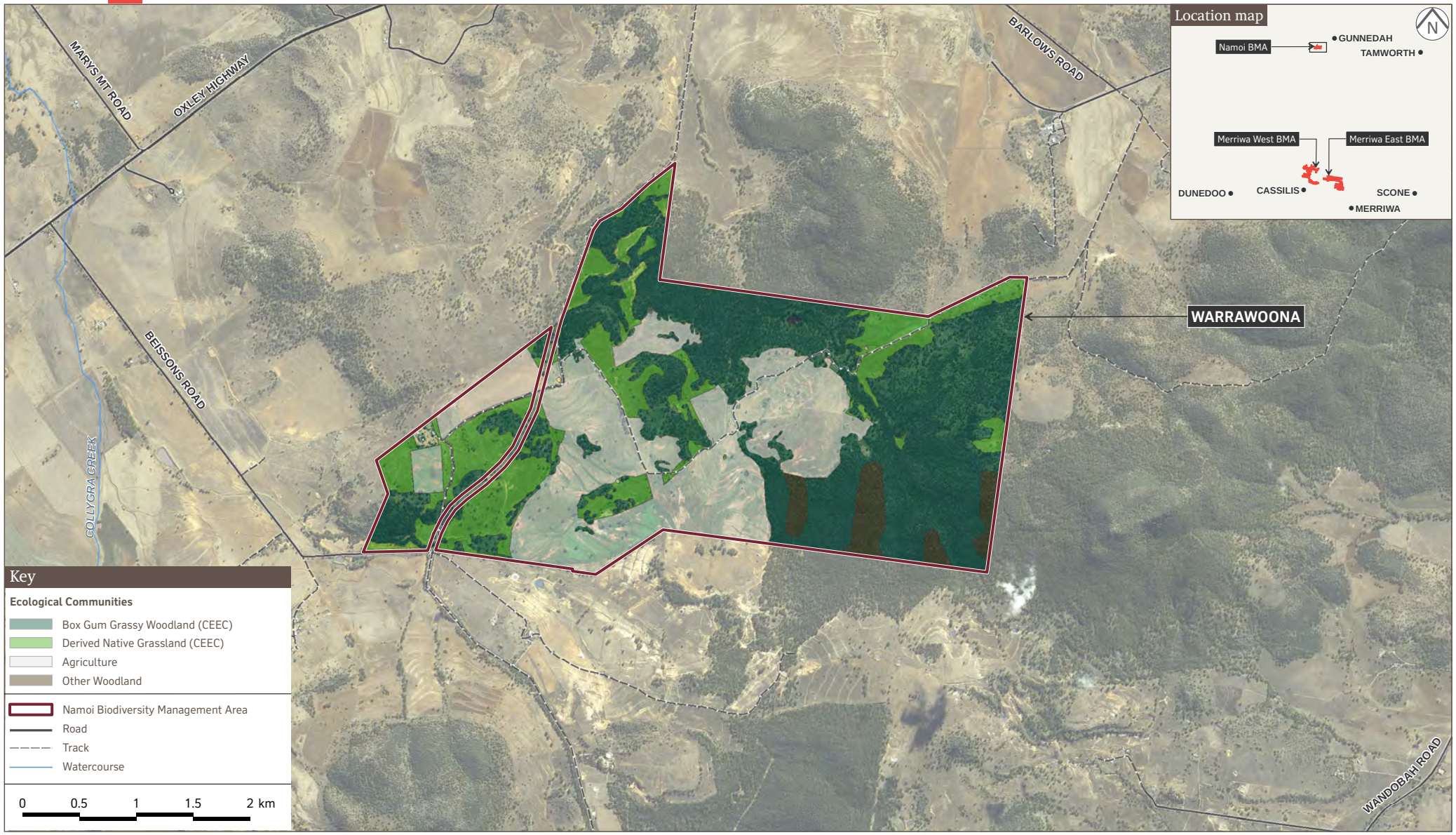
Figure 4b



Namoi Ecological Communities

Offset Management Plan

Figure 4c



2.3 Matters of National Environmental Significance Fauna

The Approval Conditions require the enhancement of the ecological communities across the BMAs to improve habitat for the Swift Parrot, Regent Honeyeater, Spotted-tail Quoll and Greater Long-eared Bat. To date, only the Spotted-tail Quoll and Greater Long-eared Bat have been observed within the BMAs. The future management of the BMAs intends to improve habitat condition and reconnect fragmented remnant vegetation to support species dispersal, foraging and in some cases breeding.

2.3.1 Swift Parrot

The Swift Parrot is small parrot about 25cm long. It is bright green with red around the bill, throat and forehead. It has a long (12cm), thin tail, which is dark red. The Swift Parrot is listed as Endangered under the EPBC Act.

The Swift Parrot is a migratory bird species (although not listed on the EPBC Act as migratory) that occurs in south-east Australia, between Tasmania and NSW. In NSW, this species occurs mainly on and to the east of the Great Dividing Range, in the Central and Southern Tableland regions and in coastal regions south of the Hunter Valley. Some rarer scattered occurrences have been recorded further north and further to the west.

On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany, Spotted Gum, Red Bloodwood, Mugga Ironbark and White Box. Also, the swift parrot commonly forages on lerp infested trees which include Western Grey Box, Coastal Grey Box and Blackbutt. The swift parrot returns to some foraging sites on a cyclical basis depending on food availability.

The National Recovery Plan for the Swift Parrot (Saunders, 2011) provides direction on the management actions for the long term protection and conservation of the species. The Swift Parrot is likely to frequent the BMAs during the winter months. The mature Yellow Box, Grey Box and White Box trees are key species across the BMAs for foraging opportunities.

Key management strategies for their protection and conservation include:

- no clearing of vegetation;
- revegetation to reconnect fragmented remnant vegetation;
- protection from high frequency fire events;
- control of predators, such as feral cats; and
- reduced competition from European bees.

Photo: Swift Parrot (Chris Tzaros)

2.3.2 Regent Honeyeater

The Regent Honeyeater is a medium-sized, black and yellow honeyeater with a sturdy, curved bill. Adults are between 20 and 24 cm long and have a wing-span of 30 cm. Its head, neck, throat, upper breast and bill are black and the back and lower breast are pale lemon in colour with a black scalloped pattern. The Regent Honeyeater is listed as Endangered and Migratory under the EPBC Act.

The Regent Honeyeater is nomadic and can undertake large-scale movements in the order of hundreds of kilometres. However, the exact nature of these movements is still poorly understood. It is likely that movements are dependent on the spatial and temporal distribution of flowering eucalypts, which are a major food source, and other resource patterns. There are only three known key breeding regions remaining: north east Victoria (Chiltern-Albury), Capertee Valley (NSW) and the Bundarra-Barraba region (NSW). In NSW, the distribution is very patchy and mainly confined to the two main breeding areas and surrounding fragmented woodland.

The Regent Honeyeater typically inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Oak, particularly those on wet, fertile soils such as along creek flats and broad river valleys. These woodlands have significantly large numbers of mature trees, high canopy cover and an abundance of mistletoes. The Regent Honeyeater is a generalist forager, which mainly feeds on the nectar from a wide range of eucalypts and mistletoes. Key eucalypt species include Yellow Box, Blakely's Red Gum, White Box and Swamp Mahogany. The species also utilises Coastal Grey Box, Narrow-leaved Ironbark, Silvertop Stringybark, Spotted Gum and Rough-barked Apple among many others. Nectar and fruit from the mistletoes *Amyema miquelii, Amyema pendula* and *Amyema cambagei* are also eaten during the breeding season.

The *Regent Honeyeater Recovery Plan 1999 – 2003* (Menkhorst, 1999) provides guidance on the management requirements and long term protection and conservation of the species. A new recovery plan is scheduled for release in 2013/14 and any new actions will be reviewed and incorporated where appropriate. There have been no sightings of Regent Honeyeater across the BMAs, however there are critical components of their habitat requirements. The key threatening processes are similar to those for the Swift Parrot and management strategies sympathetic to these will be adopted to protect and enhance their habitat.

Photo: Regents Honeyeater (Chris Tzaros)

2.3.3 Spotted-tail Quoll

The Spotted-tail Quoll is a cat sized carnivorous marsupial up to approximately 75 cm long and 3 kg in weight. It has rich red-brown to dark brown fur above, covered by white spots of varying size. The fur underneath is a pale brown to cream and it has characteristic spots on its tail. This species is listed as Endangered under the EPBC Act.

The Spotted-tail Quoll is a mostly nocturnal carnivore, although it will sometimes hunt during the day. It spends most of the time on the ground, but it is also an excellent climber and may raid possum and glider dens and prey on roosting birds. Prey items include gliders, possums, small wallabies, rats, birds, bandicoots, rabbits and insects, although it also eats carrion and takes domestic fowl opportunistically.

The Spotted-tail Quoll forages across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. The exact habitat requirements of the Spotted-tail Quoll are not known, however, habitat critical to the survival of this species has been described as land that contains large patches of forest with adequate denning resources and relative high densities of medium-sized mammalian prey.

The *Draft National Recovery Plan for the Spotted-tail Quoll* (Long, 2010) provides a list of known threats including:

- loss, fragmentation and degradation of habitat through clearing of native vegetation and subsequent development;
- loss of large hollow logs and other potential den sites;
- accidental poisoning during wild dog and fox control programmes;
- competition for food with introduced predators such as cats and foxes;
- predation by introduced predators such as foxes and cats;
- spread of diseases, such as a parasitic protozoan, by cats; and
- persecution by humans following perceived predation on stock and poultry.

These will be considered in the implementation and development of management strategies. There have been sightings recorded at St Antoine and Black Rock properties by previous landholders.

Photo: Spotted-tailed Quoll (Michael Snedic)

2.3.4 Greater Long-eared Bat

The Greater Long-eared Bat is a uniformly dark grey-brown bat. The ears are about 3cm long and larger than the head. It has a low ridge of skin running between the eyes and across the nose. It has a head and body length of 5 - 7cm and weighs about 14g. This species is listed as Vulnerable under the EPBC Act.

The Greater Long-eared Bat occurs in south-central Queensland, central western NSW, north-western Victoria and South Australia. Overall, the distribution of the south-eastern form coincides approximately with the Murray Darling Basin, with the Pilliga Scrub region being the major stronghold for this species.

The Greater Long-eared Bat inhabits a variety of vegetation types. It is most commonly found in closed eucalypt woodland, but also occurs in open forest, savannas and mallee-type habitats in arid and semi-arid areas. It has been recorded from a range of species associations including mallee, Bulloak and Box Eucalypt dominated communities, but it is distinctly more common in the extensive areas of structurally complex box/ironbark/cypress-pine vegetation that occurs in a north-south belt along the western slopes and plains of NSW and southern Queensland. In NSW, this species is restricted to larger remnants of native vegetation.

The *Draft National Recovery Plan for the South-eastern Long-eared Bat (Nyctophilus corbeni)* (Schulz, 2010) highlights the main threats as:

- loss of remnant semi-arid woodland and mallee habitat;
- loss of hollow-bearing trees;
- changes in fire regimes;
- grazing; and
- application of pesticides in or adjacent to foraging areas.

These will be considered when implementing and developing management strategies. There has been a recorded sighting by Cumberland Ecology in autumn 2012.

Photo: Greater Long-eared Bat (Pavel German)

2.4 Land Management Units

Land Management Units (LMUs) are units of land that support ecological communities of relatively consistent condition for the purpose of land management. LMUs are generally bounded by fence lines, roads or other infrastructure, facilitating the design and implementation of management strategies at this scale.

Each LMU within the BMAs has been assigned one of four condition categories with consideration of:

- the level of disturbance of the ecological communities;
- the extent and connectivity of the ecological communities;
- the "state" as classified by the "State and Transition Model" described in A Guide to Managing Box Gum Grassy Woodlands (Rawlings, 2010); and
- management infrastructure.

The level of disturbance of the ecological communities was broadly assessed using aerial photo interpretation, and an ecosystem health and habitat condition score. This score was derived from rapid vegetation condition assessments undertaken during initial property inspections. The assessment consisted of a series of observations relating to the presence/absence of key habitat components and threatening processes for woodland communities. Site scores of 16 – 20 are generally considered to be areas of healthy woodland that are sustainable under current management. Site scores of 10 – 15 are generally considered to be areas of moderately disturbed woodland that have key elements missing and need improved management. Scores under 10 are highly disturbed, missing many key elements and are generally unsustainable under current management. The assessment is described in more detail in the *Biodiversity Management Plan* and **Appendix C**.

The "State and Transition Model" (**Figure 5**) describes typical characteristics of five states of Box Gum Grassy Woodlands, ranging from low-quality/highly disturbed states to high quality/minimally disturbed states. The model also identifies land management activities that drive transitions among these states and can be used as a guide to select management activities to promote the transition of Box Gum Grassy Woodlands to higher quality states.

Table 4 provides a broad definition of the four LMU categories and includes their correlation to the relevant state within the "State and Transition Model", and their ecosystem health and habitat condition score.

In summary, LMU1 represents the highest quality and most naturally functioning ecological condition. Consequentially, management of LMU1 will focus on excluding agricultural activity and this category will attract little management invention. LMU2 and LMU3 will attract a higher level of management intervention to enhance the ecological condition. The lowest category, LMU 4, represents areas that have been highly disturbed by agriculture and are of the lowest ecological condition.

Table 4 Land Management Units definitions

LMU	Definition
LMU 1	Very high quality Box Gum Grassy Woodlands, Derived Native Grassland and Other Woodland (Rawlings State 1 and Ecosystem Health and Habitat Condition Score 16 to 20) These areas can be described as being close to pristine ecological condition and require the lowest level of management intervention. The focus is minimal disturbance and exclusion. This LMU currently only occurs on the Namoi BMA and includes the pure form of White Box and Ironbark Shrubby Woodland vegetation communities that are known habitat for the Greater Long-eared Bat.
LMU 2	Medium to high quality Box Gum Grassy Woodlands and Derived Native Grassland (Rawlings State 1 or State 2 and Ecosystem Health and Habitat Condition Score 10 to 15) These areas include the essential elements of the Box Gum Grassy Woodlands and Derived Native Grasslands, however the quality of has been impacted by clearing and farming disturbances. They are generally deficient in native species diversity and mature trees. These areas will require a low level of management intervention to encourage and support natural regeneration processes.

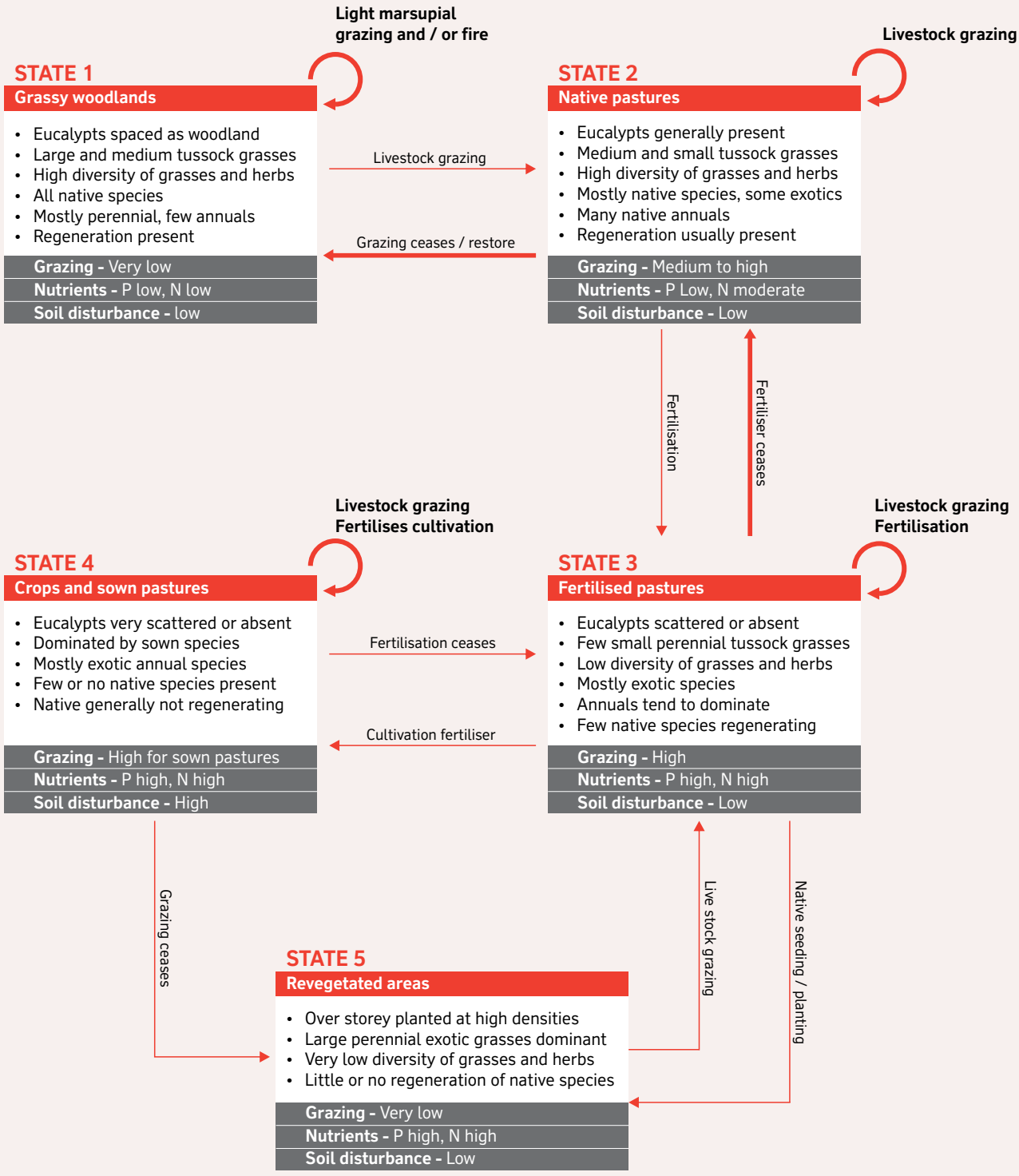
LMU	Definition
LMU 3	Low quality Box Gum Grassy Woodlands, Derived Native Grassland and Other Woodland (Rawlings State 3 or State 5 and Ecosystem Health and Habitat Condition Score 5 to 10) These areas include the lowest condition examples of these communities. They are generally deficient in tree canopy species and weeds are prominent in the grasslands. These areas will require ongoing management intervention for effective control of weeds and revegetation. This LMU includes the 677ha of revegeation areas which are mostly State 5. The revegetation areas will target the highly degraded River Oak forests along the rivers and creeks at the Merriwa East and West BMAs to improve the north - south connectivity. The revegetation areas are a requirement of Approval Condition 12 and a Woodland Re-establishment Plan is to be prepared to describe the establishment of these areas into "self-sustaining" functional ecological communities.
LMU 4	Agriculture (Rawlings State 4) These areas have been significantly disturbed by farming activities. Small proportions of Box Gum Grassy Woodlands and individual trees are located within this LMU. Buffer zones will apply to protect them and adjoining Offset Areas (LMU1 to 3). Grazing management must maintain a minimum of sward height of 10cm and 70% groundcover on at least 50% of the area to be grazed.

Photo: Rocky gorge, Blackrock, Merriwa East BMA (DnA Environmental 2011)

State and Transition Model for Box Gum Grassy Woodland

Offset Management Plan

Figure 5



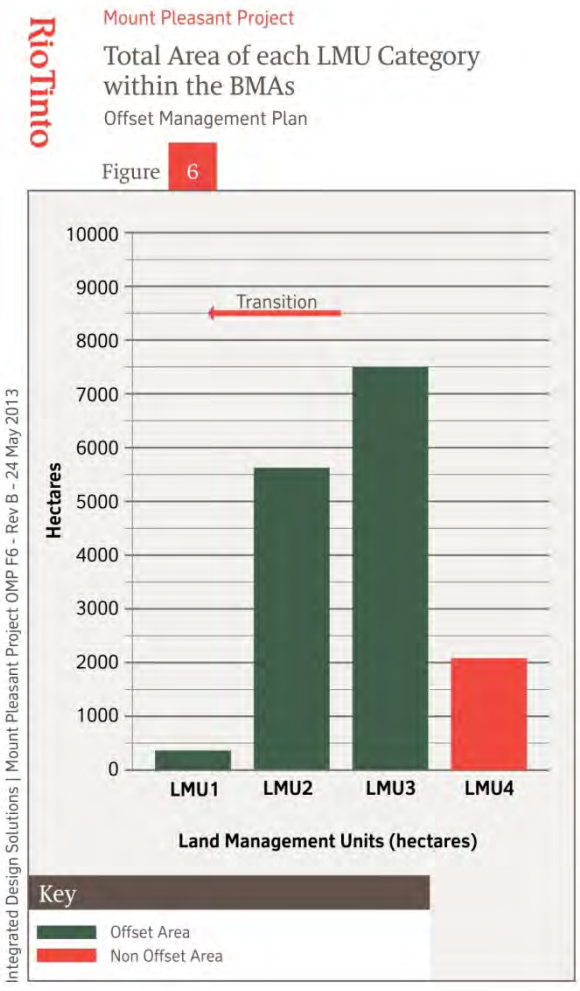
The model has five states, each listing the characteristics typical for that state. Arrows between boxes represent the transition or change between states and the management activities that cause the transition. Thick arrows represent a more difficult transition. Circular arrows describe the mechanisms for maintaining a given state.

Source: Rawlings et al. (2010)

Figure 6 shows the total area of each LMU category within the BMAs as at November 2012. Overtime it is expected that implementation of the proposed management activities will result in an increase in the areas mapped as LMU1 and LMU2 and decrease in LMU3.

Figure 7 (a) to **(f)** shows the distribution of LMUs on each property and their condition category. All of the land within LMU1 to LMU3 is to be protected as the Offset Area to provide enduring protection of Box Gum Grassy Woodlands, Derived Native Grassland and verifiable habitat for the Regent Honeyeater, Swift Parrot, Spotted-tail Quoll and Greater Long-eared Bat, as per Approval Condition 2. These figures also show the proposed revegetation areas located within the Offset Area. The revegetation areas are currently agricultural areas that will be re-established to 'self-sustaining' ecological communities to provide a 'net gain' in Box Gum Grassy Woodlands and suitable habitat. The location of the revegetation areas will also contribute to improving connectivity across the BMAs. The Woodland Re-establishment Project plan, required 3 years after commencement of construction, will detail the re-establishment methods and monitoring programme.

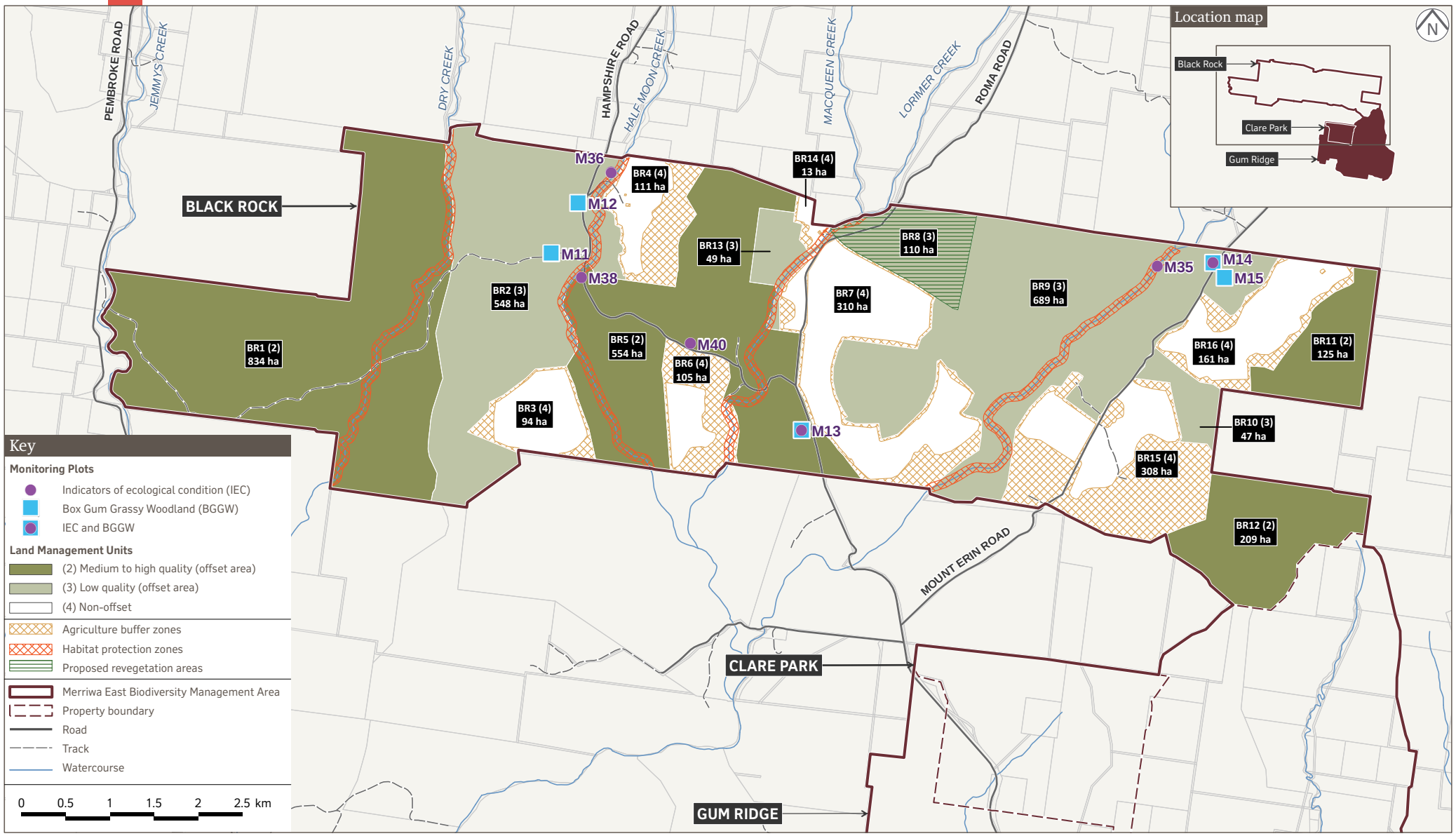
To assist in identification of LMUs within each property, a LMU compartment identifier has been allocated. The LMU compartment identifier represents the first initial of the property, followed by a compartment number, and the number in brackets indicates the LMU class. For example W1 (2) represents W1 (Warrawoona Compartment 1) and (2) is LMU2. These compartment areas may be sub-divided by fences into paddock to assist in the management of the property. **Appendix D** provides the full list of LMU compartments on each property including the area of ecological communities within each LMU. Habitat Protection Zones indicate areas for specialised management and these areas are also shown in the **Figure 7** series.



Black Rock Land Management Units, Habitat Protection Zones, Proposed Re-vegetation Areas and Monitoring Plots

Offset Management Plan

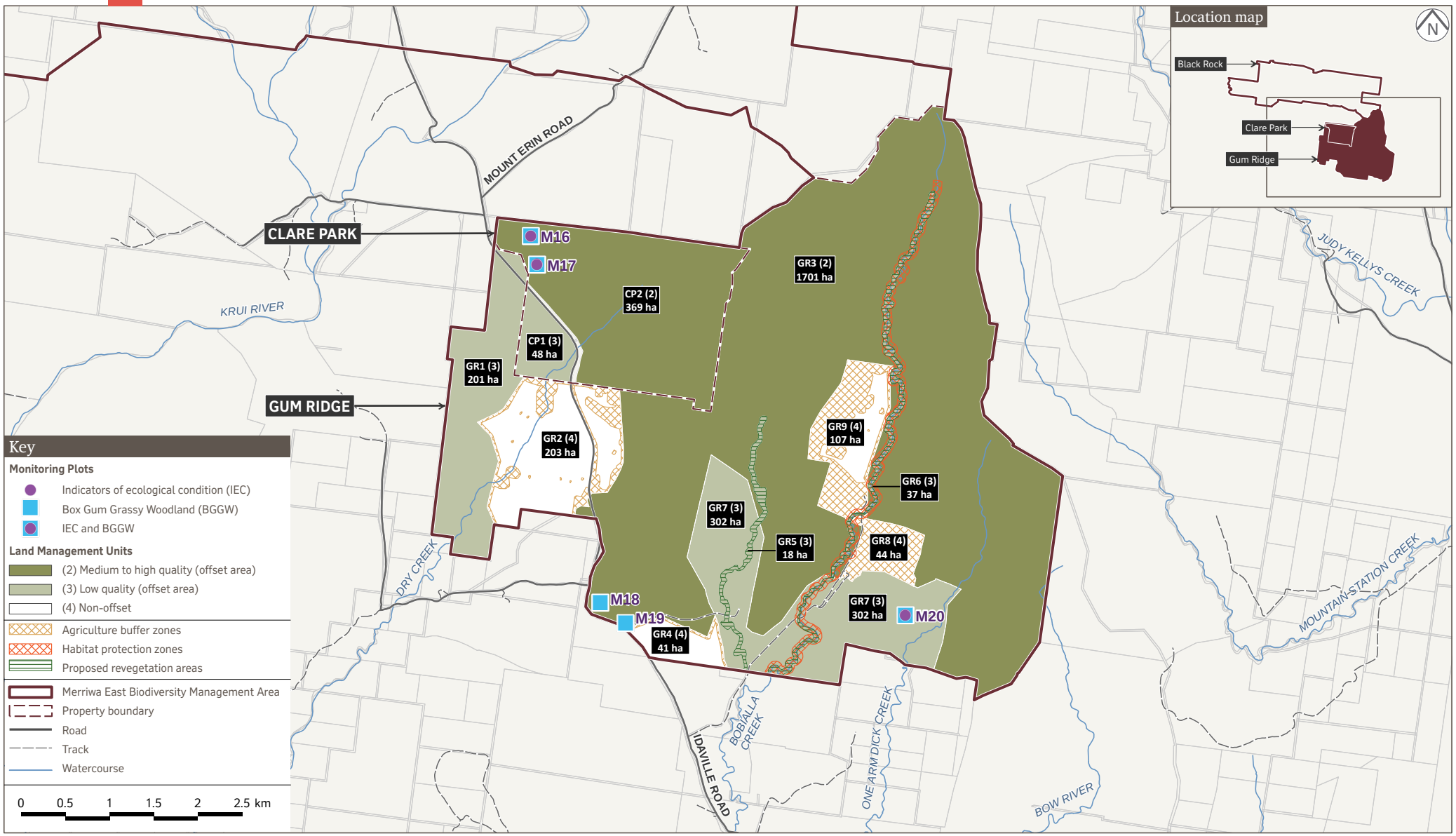
Figure 7a



Clare Park and Gum Ridge Land Management Units, Habitat Protection Zones, Proposed Re-vegetation Areas and Monitoring Plots

Offset Management Plan

Figure 7b

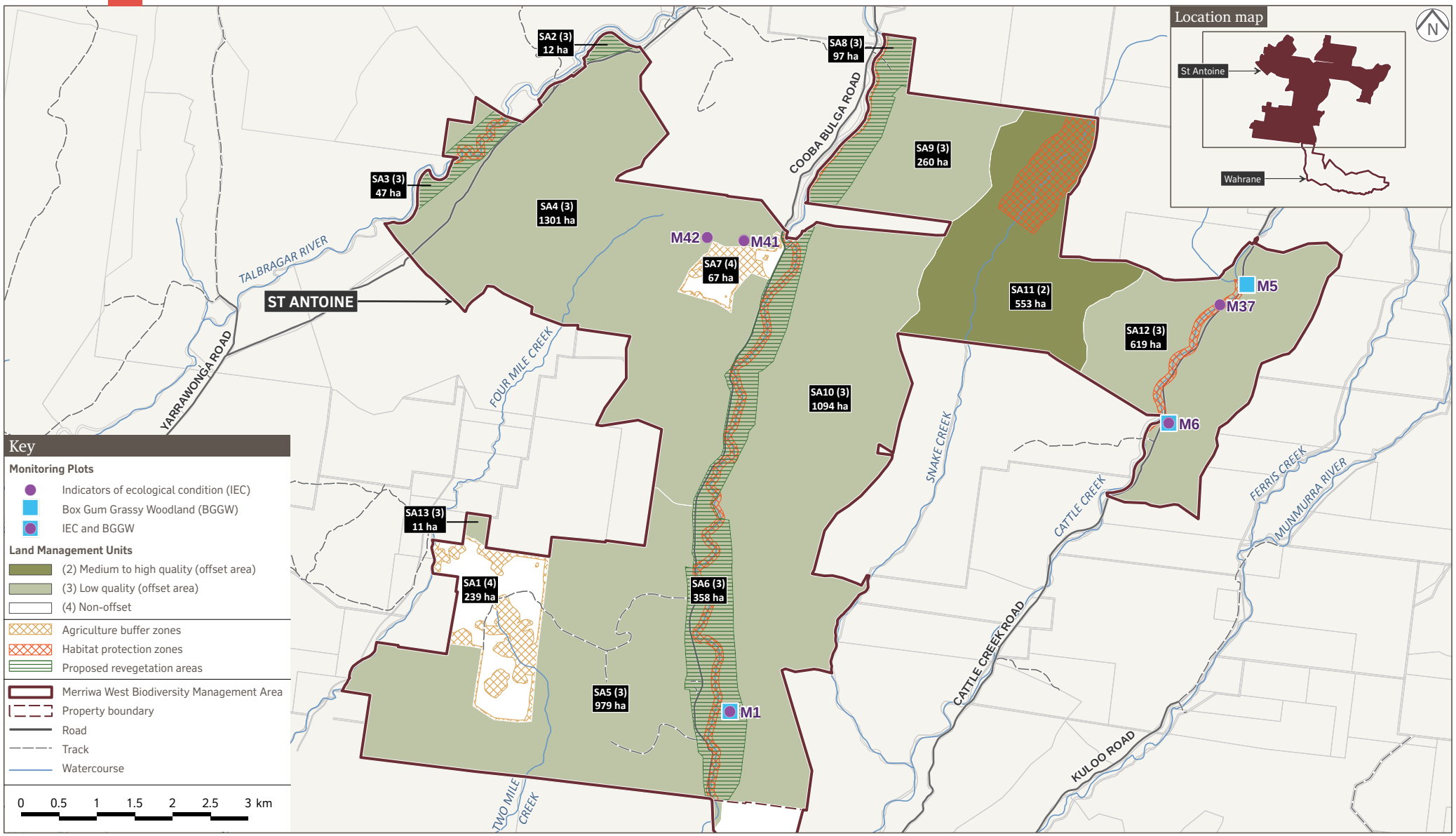


Mount Pleasant Project

St Antoine Land Management Units, Habitat Protection Zones, Proposed Re-vegetation Areas and Monitoring Plots

Offset Management Plan

Figure 7c



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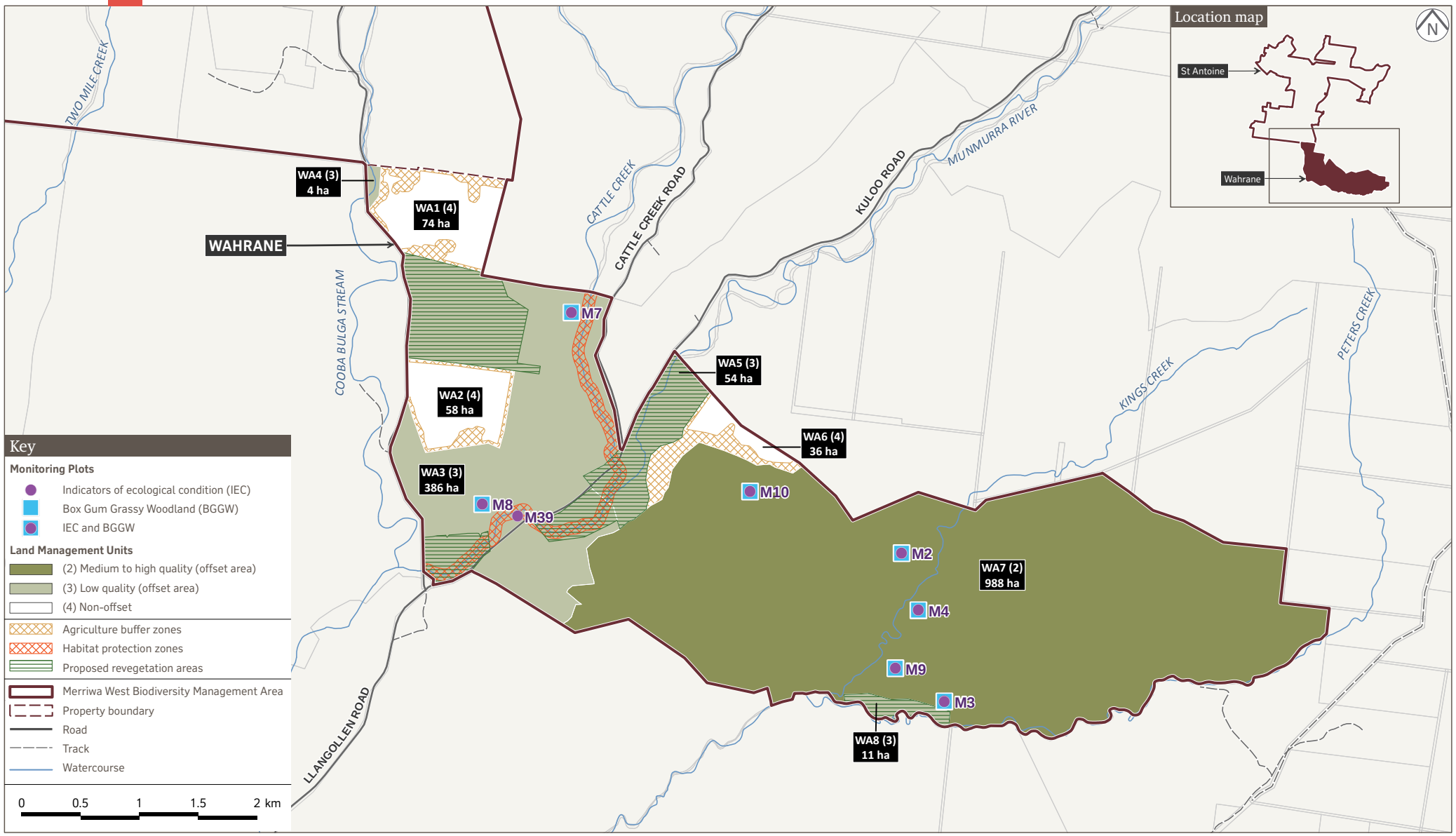
Mount Pleasant Project

Wahrane Land Management Units, Habitat Protection Zones, Proposed Re-vegetation Areas and Monitoring Plots

Offset Management Plan

Figure 7d



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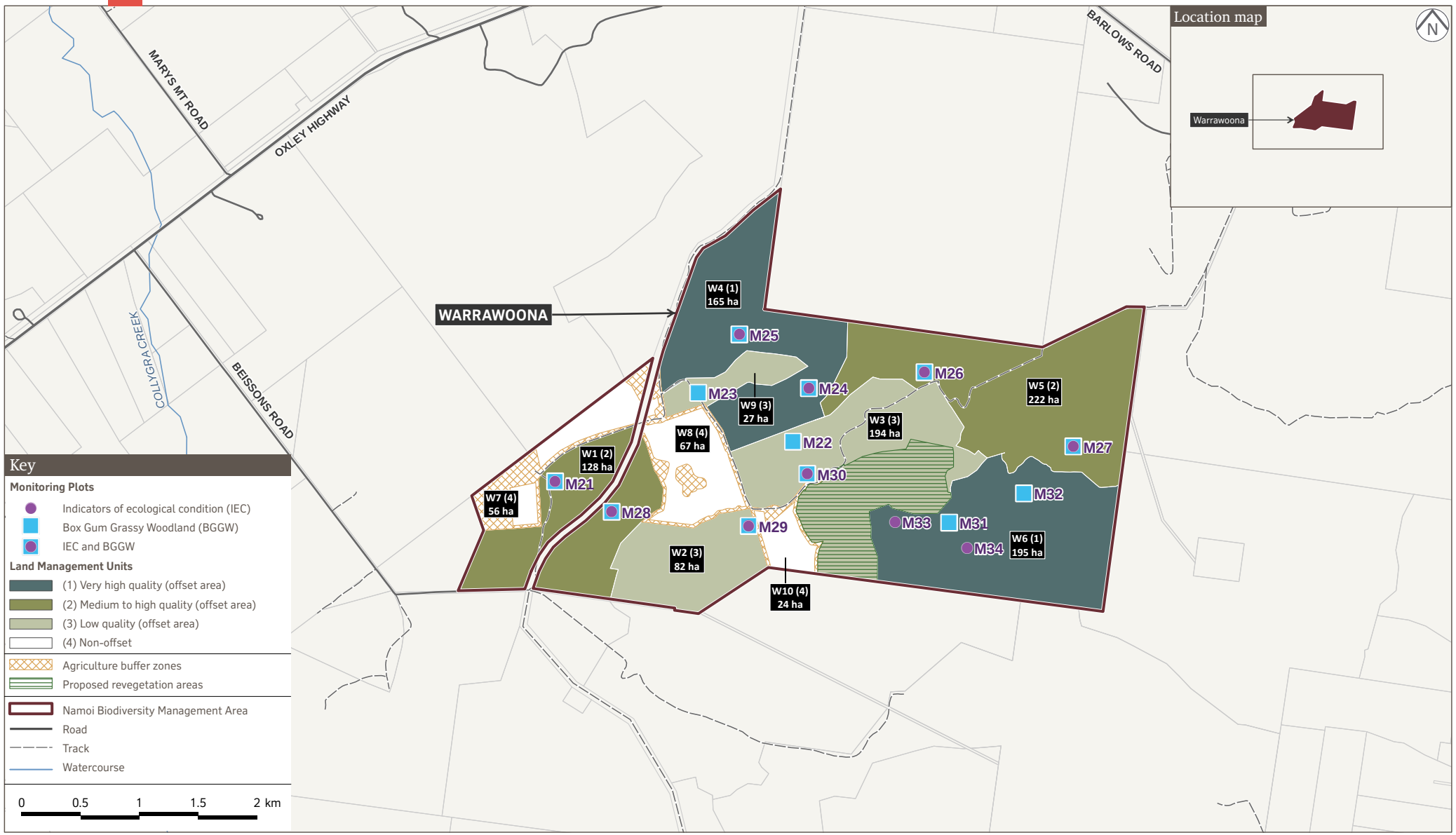
Warrawoona Land Management Units, Proposed Re-vegetation Areas and Monitoring Plots

Offset Management Plan

Figure 7e



2.4.1 Ecological Communities within Land Management Units

On a practical level, these broad LMU categories contain varying proportions of the five ecological communities. However, LMU1 will always contain the highest proportion of very high quality Box Gum Grassy Woodlands and LMU4 will always contain the greatest proportion utilised for Agriculture. **Table 5** shows the area of each ecological community within each LMU category and within the Offset Area, based on the survey data collected in 2012. **Figure 8** summarises this data providing a baseline of the percentage of each ecological community within each LMU category at 2012. It is anticipated that overtime the through the implementation of the conservation strategies detailed in this OMP and the proposed restoration of 1,540ha of agricultural areas, there will be a net increase in Box Gum Grassy Woodland through the recruitment of ecological communities currently mapped as Derived Native Grassland, Low Quality Derived Native grassland and agriculture. This same process is anticipated to increase the area of Other Woodland, which is primary riparian forest along the creeks within the BMAs. The monitoring programme detailed in Section 5 aims to collect data to verify this trend. The Woodland Re-establishment Project plan will detail the active restoration of the agriculture areas to "self-sustaining" function ecological communities, the plan will detail the restoration activities and the monitoring programme. Tables 6 and 7 identify the areas to be protected within the Offset Area to satisfy the requirements of Approval Condition 2. The implementation of the OMP and the Woodland Re-establishment Project plan, as proposed, will provide a 'net gain' in the area of Box Gum Grassy Woodlands and suitable habitat for the Regent honeyeater, Swift parrot, Spotted-tail quoll and Greater longeared bat.

In the 2014, AECOM completed the MNES survey for the birds and mammals; although the survey did not locate these species across the BMAs, they identified the areas contained suitable habitat and indicated the proposed management of the areas under OMP would increase the habitat suitability. The following excerpts from the AECOM reports discussion summary, supports the premise that the all three BMAs include suitable habitat and the implementation of the OMP should improve the condition and extent of suitable habitat.

Summary discussion- Regent Honeyeater and Swift Parrots

The monitored grasslands supported a lower diversity of bird species than the woodland sites. The grassland sites were generally degraded and there was a stark absence of grassland specialists including larks, pipits, partridges and birds of prey usually associated with such open habitats. Many of these species are ground nesting birds and it is unclear why they were not observed. It is possible that previous disturbance and predators, such as the Red Fox have impacted on these grassland specialists.

Whilst Regent Honeyeater and Swift Parrot were not recorded at any of the three BMAs, each contains areas of suitable habitat. Habitat management and enhancement through planting and weed control will further increase the suitability of sites for these species and general bird assemblages.

Summary discussion- Spotted-tail Quoll

Whilst the species was not recorded from the 20 monitoring points across the two Merriwa BMAs, results provided a good insight to the level of feral animals requiring control, as targeted in the sites OMP. Sites where cameras were set were considered to be the most likely habitat where Spotted-tail Quoll would utilise if present on the site, in terms of resources for foraging, cover and shelter. The continuation of camera trapping over longer periods of time, as recommended in the OMP, in association with habitat and feral animal control, especially foxes and cats, will provide more information on the status of the species at the two BMAs. Surveyors were told of anecdotal evidence by a local of a sighting of the species to the east of the Merriwa West BMA and it is possible that this was a positive sighting, based on location and the dense forested hill habitats where it is alleged to have been seen. If this is correct, ongoing management of the BMAs will increase their suitability for the species in the future.

Summary discussion- Greater Long-eared Bat (GLEB)

Nyctophilus bat species were detected at four monitoring locations (three at Namoi and one at Merriwa East) and potentially at another two located in the Merriwa BMAs. All these locations were situated in areas of extensive forest/woodland which is a preferred

habitat for many of the Long-eared bat species for roosting and foraging. The presence of *Nyctophilus* bat species could indicate the presence of the rare GLEB. The Cypress Pine woodland is a known favoured habitat of the species and this was abundant at the Namoi BMA. This BMA was considered to be the most likely BMA of the three to support GLEB based on habitat type and condition. The forest and woodland habitat at Namoi supported a good structural diversity of vegetation that provides cover for roosting and hunting bats and their prey. The proposed enhancement of the shrub and understorey layers at the woodlands and forests in Merriwa East and West BMAs in the OMPs will improve the suitability of the habitats for Long-eared bats and other microbat species.

Table 5 Area of each ecological community within each Land Management Unit and Offset Area

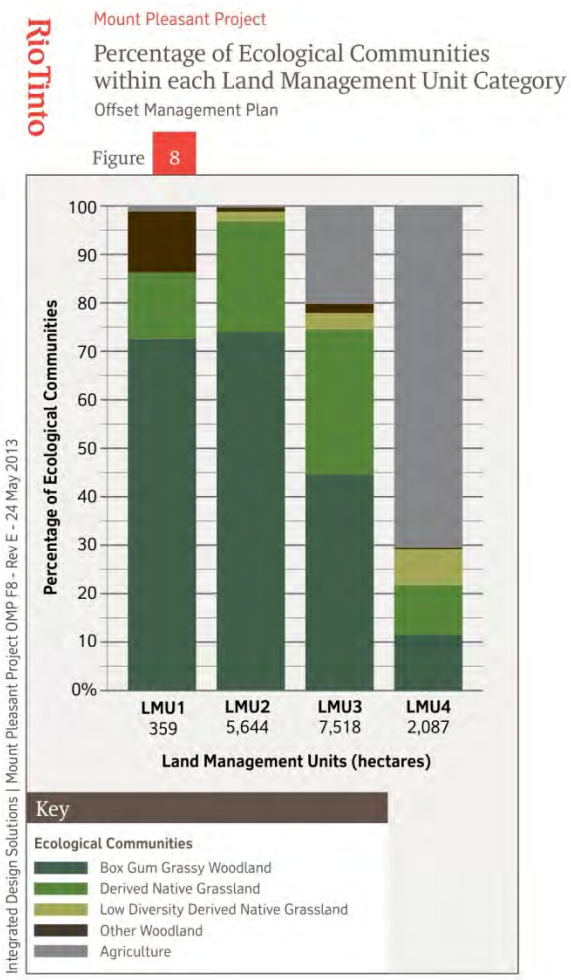
Ecological Community	LMU1 (ha)	LMU2 (ha)	LMU3 (ha)	Total within Offset Area	LMU4 (ha)	Total (ha)
Box Gum Grassy Woodland (CEEC)	261	4,173	3,359	7,793	242	8,035
Derived Native Grassland (CEEC)	49	1,296	2,249	3,594	213	3,807
Low Diversity Derived Native Grassland		107	251	358	155	514
Other Woodland	45	50	141	236	7	243
Revegetation Area (Agriculture)	4	18	1,518	1,540		
Agriculture					1,471	3,011
Infrastructure						34
Total	359	5,645	7,518	13,522	2,087	15,643

Table 6 Area of Ecological Community to be protected within Offset Area

Ecological Community	Area required (ha)	Box Gum Grassy Woodland (ha)	Derived Native Grassland (ha)	Low Diversity Derived Native Grassland (ha)	Total (ha)	Revegetation Area (ha)	Future Area (ha)
White Box – Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland	12,875	7,793	3,594	358	11,745	1,540	13,285

Table 7 Area of Suitable habitat to be protected within Offset Area

Species	Area Suitable habitat required (ha)	Habitat preferred	Box Gum Grassy Woodland (ha)	Derived Native Grassland (ha)	Other Woodland (ha)	Total (ha)	Revegetation Area (ha)	Future Area of Suitable habitat (ha)
Regent honeyeater	8,475	Box-Ironbark Forest and Woodland; Drainage lines	7,793	3,594	236	11,623	1,540	13,163
Swift parrot	8,475	Box-Ironbark Forest and Woodland; Drainage lines	7,793	3,594	236	11,623	1,540	13,163
Spotted-tail quoll	8,475	Den sites in hollow logs, tree hollows, latrine sites – rocky creek beds, base of cliffs	7,793	3,594	236	11,623	1,540	13,163
Greater long-eared bat	8,475	Woodland or moist forest	7,793		236	8,029	1,540	9,569



2.5 Baseline ecological condition

Baseline ecological monitoring surveys for Indicators of Ecosystem Condition (IEC) and MNES – Box Gum Grassy Woodlands were completed in October and November 2013, in accordance with the methods described in Chapter 5. Thirty-two IEC and MNES plots were established across the BMAs. The locations of these plots are shown in **Figure 7 (a)** to **(e)**. The monitoring plots were established in capture data on all habitat types in the BMAs and strategically located to best represent the condition class and habitat type. The data collection techniques have been designed to be repeatable and allow statistical analysis of the future data to measure the key performance criteria described in the following Section.

The complete *Baseline Flora, Fauna and Soil Assessment* report prepared by Cumberland Ecology (2013) can be accessed on the Biodiversity Offset Portal and is summarised below. Further baseline monitoring for MNES – Birds and MNES – Mammals will be undertaken in Winter 2014.

2.5.1 Summary of baseline ecological monitoring 2013 results

The seasonal climatic conditions at the time of the survey were dry and, despite widespread rain showers during the third week of the survey, the region had below average rainfall for the preceding four months. On Saturday 9 November 2013, post survey, a large proportion of the Namoi BMA was impacted by a 2,000ha scrub fire. Of the 14 monitoring plots established at the Namoi BMA, only one site was not affected.

The data collected for the baseline monitoring of IEC and Box Gum Grassy Woodlands provides a snapshot of the current condition of the BMAs, indicates the likely impacts of prior land management practices on fauna assemblages, habitat features and vegetation structure/floristics, and support the proposed management strategies as appropriate strategies for restoration.

Indicators of Ecological Condition

Fauna habitat features differed among habitats as expected with habitat features such at tree hollows and fallen logs being present within woodland habitats (Box Gum Grassy Woodland, Callistris-Ironbark Woodland and Riparian) and absent or in lower abundance in grassland habitats (Derived Native Grassland and low diversity Derived Native Grassland). There was a higher percentage cover of leaf litter in LMU1 woodlands, compared with lower LMU woodland categories, primarily driven by the high percentage cover litter in the Callitris-Ironbark Woodland at the Namoi BMA.

Ninety-four bird species were observed including four species currently listed as Vulnerable under the TSC Act, namely:

- Speckled Warbler (*Chthonicola sagittata*);
- Painted Honeyeater (*Grantiella picta*);
- Grey-crowned Babbler (*Pomatostomus temporalis*); and
- Diamond Firetail (*Stagonopleura guttata*).

Bird assemblages were similar across BMAs and LMUs. Riparian habitats tended to support higher species richness, which may reflect the dry conditions prior to surveys and the limited availability of flowing /feed trees outside the riparian zone.

Nine species of reptile were recorded during the surveys, which are all common throughout the region. The low diversity of reptile species may be attributable to the dry conditions prior to the surveys. There were no differences in reptile assemblages among habitats or LMU categories.

Box Gum Grassy Woodlands

As expected, Box Gum Grassy Woodland and Derived Native Grasslands were easily distinguished by the presence or absence of structural elements (canopy cover) and habitat features (logs and trees with hollows) in woodland and grassland respectively. Native plant species richness (total) was also higher in Box Gum Grassy Woodland compared with Derived Native Grasslands. This is a clear reflection of the impact of clearing and long-term grazing on these habitats.

The percentage cover of the canopy in Box Gum Grassy Woodland decreased in line with the LMU categories such that the highest percentage canopy cover was recorded in LMU1, and the lowest in LMU3. This pattern was also observed for the mid-storey, although less pronounced in the species richness of the mid-storey, this was higher in LMU1 than LMU 2 and LMU3 categories. The percentage cover of shrubs in the ground cover was higher in LMU1 compared with the lower LMU categories while exotic species were less abundant in the LMU1. The total length of fallen logs was low in LMU3 compared with LMU2 and LMU1. These findings are consistent with the State and Transition model descriptions of States 1-3 which have been assigned to LMUs 1-3 respectively.

Analysis of soil characteristics showed a distinct separation of the Namoi BMA from the Merriwa BMAs which is likely due to a difference in the previous farming practices and the spatial separation of the BMAs.

2.5.2 Monitoring transition from Grassland to Woodland habitats

The data collected demonstrate existing and measureable differences among habitats (grassland, woodland, riparian) for a suite of habitat features and floristic variables. These variables are therefore appropriate for demonstrating transition of the grassland habitats to woodland in accordance with the State and Transition Model. Furthermore, the nature and extent of current differences in vegetation condition between habitats has been quantified as the baseline condition. Future monitoring can now be interpreted against this baseline condition to assess the rate and direction of this transition through time.

2.5.3 Monitoring restoration within habitats (transition up LMU categories)

The baseline monitoring data did not provide a clear and consistent distinction between LMUs 2 and 3. This result is not unexpected given the large area of the BMAs and the incorporation of existing management infrastructure into this process of assigning LMUs categories. The suitability of LMU2 as a reference condition for restoration of LMU3

vegetation/habitats as initially proposed will become clearer with subsequent monitoring events.

Some differences between LMU1 and the lower quality LMU categories were detected in the data. LMU1 could therefore be used as a description of the reference condition to track improvement in quality of the lower LMU categories. However, LMU1 vegetation only occurs on the Namoi BMA and environmental differences exist between Namoi and the Merriwa BMAs (as have been demonstrated e.g. in soil characteristics). It is therefore possible that these intrinsic differences between the Namoi and Merriwa landscapes reduce the usefulness of LMU1 as a reference condition for Merriwa vegetation/habitats. In addition, the Beeson's Rd fire that occurred at the Namoi BMA after the monitoring event further limits the suitability of the LMU1 vegetation as a reference condition for the Merriwa BMAs. It is therefore proposed that ongoing monitoring also refer to the published reference condition for Box Gum Grassy Woodlands and Derived Native Grassland, in particular the Biometrics Vegetation Condition Benchmarks (OEH, 2008).

An analysis of the baseline data against the benchmark values is provided in **Appendix E**. This analysis demonstrates that the Box Gum Grassy Woodlands are within or close to the benchmark values and this is most consistently the case for LMU1. For all LMU categories, the abundance of native grasses in the ground layer is at the high end of, or exceeding, the benchmark range. However the other structural layers which are at the low end of, or below, the benchmark range such as native ground cover (shrubs), native ground cover (other) and native mid-storey cover. The length of fallen logs also drops off well below the benchmark value within LMU3.

The Derived Native Grasslands are, as expected, missing some key structural layers and habitat features (canopy cover, trees with hollows and fallen logs) and therefore are below benchmark values for these features. Native plant species richness also remains below the benchmark value while the percentage cover of native grasses is high. Native mid-storey and native ground cover (shrubs) is absent in LMU3 but present (although low) in LMU2.

These benchmark values will provide a useful reference condition to assess changes in vegetation structure, floristics and habitat features as the conservation management strategies are implemented. Future monitoring results will be interpreted against this baseline condition to assess the extent of change and against the benchmark values to assess direction of change (towards benchmark) through time.

Photo: Grassland before and after the fire, Warrawoona, Namoi BMA (Cumberland Ecology 2013)

3.0 Conservation Objectives and Key Performance Indicators

3.1 Conservation Objectives

The primary conservation objectives for this OMP are to:

- improve biodiversity values across the BMAs;
- protect the Offset Area (LMU1, LMU2 and LMU3) under a legally binding conservation covenant;
- increase the total area, connectivity and condition of remnant patches of Box Gum Grassy Woodland, Derived Native Grassland and Other Woodland; and
- enhance habitat and foraging opportunities for the Regent Honeyeater, Swift Parrot Spotted-tailed Quoll and Greater Long-eared bat.

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

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

3.2 Key Performance Indicators

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

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

Table 8 to **Table 10** list the key biodiversity values and the nested conservation values for each BMA, with their corresponding interim baseline description and key performance indicators. Note that the interim baseline metric has been developed using the rapid condition assessment, fauna surveys and vegetation surveys undertaken from 2010 to 2012, as well as the aerial images captured from May to September 2012. The first year of the ecological monitoring programme, outlined in **Section 5.2**, compiled the baseline ecological data sets and descriptions of baseline biodiversity values.

Table 8 Merriwa East BMA: Biodiversity Values and Key Performance Indicators

Biodiversity Value	Nested Conservation Values	Description and interim baseline metric November 2012	Key Performance Indicator
Box Gum Grassy Woodlands		Total area: 3,998Ha. LMU2: 2,800Ha / LMU3: 1,009Ha / LMU4: 190Ha	Observe a significant increase in area, connectivity and habitat condition over 15 years.
	Fauna Habitat	Low to Medium quality potential habitat for: Spotted-tailed Quoll (no observation); Swift Parrot (no observation); and Regent Honeyeater (no observation).	Increase the condition and extent of habitat over 15 years.
Derived Native Grassland		Total area: 1,701Ha LMU2: 863Ha / LMU3: 646Ha / LMU4: 5Ha	Observe a transition from Derived Native Grassland and Low Diversity Derived Native Grassland to Box Gum Grassy Woodlands.
	Fauna Habitat	Low quality potential habitat for: Spotted-tailed Quoll (no observation); Swift Parrot (no observation); and Regent Honeyeater (no observation).	Increase the condition and extent of habitat over 15 years.
Other Woodland (River Oak forest)		Total area: 74Ha LMU2: 35Ha / LMU3: 35Ha / LMU4: 4Ha	Observe a significant increase in habitat area, condition and connectivity over 15 years.
	Fauna Habitat	Low quality and fragmented potential habitat for: Spotted-tailed Quoll (sighting at Black Rock); Swift Parrot (no observation); Regent Honeyeater (no observation); and Greater Long-eared Bat (no observation).	Increase the condition and extent of habitat over 15 years.
	Watercourse	No protection zone along: Krui River, Black Rock; Lorimer Creek, Black Rock; Half Moon Creek, Black Rock; Dry Creek, Black Rock; or Bobialla Creek, Gum Ridge.	Establish habitat protection zone to enhance the vegetation and stream bank stability within five years, through the exclusion of livestock grazing. Increase habitat connectivity by reconnecting existing areas of habitat along watercourses.

Table 9 Merriwa West BMA: Biodiversity Values and Key Performance Indicators

Biodiversity Value	Nested Conservation Values	Description and interim baseline metric November 2012.	Key Performance Indicator
Box Gum Grassy Woodlands		Total area: 3,512Ha LMU2: 1,155Ha / LMU3: 2,311Ha / LMU4: 47Ha	Observe a significant increase in area, connectivity and habitat condition over 15 years.
	Fauna Habitat	Low quality potential habitat for: Spotted-tailed Quoll (sighting at St Antoine); Swift Parrot (no observation); and Regent Honeyeater (no observation).	Increase the condition and extent of habitat over 15 years.
	Rocky Outcrop / Caves	No protection zone around rocky outcrops, potential habitat for endangered fauna and flora	Establish habitat protection zone to enhance habitat within five years, through the exclusion of livestock grazing.
	Llangollen woolshed – European heritage	No protection zone	Establish habitat protection zone to reduce risks of damage from fire within five years.
Derived Native Grassland		Total area:1,894Ha LMU2: 309Ha / LMU3: 1,582Ha / LMU4: 3Ha	Observe a transition from Derived Native Grassland and Low Diversity Derived Native Grassland to Box Gum Grassy.
	Fauna Habitat	Low quality potential habitat for: Spotted-tailed Quoll (no observation); Swift Parrot (no observation); and Regent Honeyeater (no observation).	Increase the condition and extent of habitat over 15 years.
Other Woodland (River Oak forest)		Total area:123Ha LMU2: 15Ha / LMU3: 106Ha / LMU4: 2Ha	Observe a significant increase in habitat area, condition and connectivity over 15 years.
	Fauna Habitat	Low quality potential habitat for: Spotted-tailed Quoll (no observation); Swift Parrot (no observation); Regent Honeyeater (no observation); and Greater Long-eared Bat (no observation).	Increase the condition and extent of habitat over 15 years.
	Watercourse	No protection zone along: Cooba Bulga Stream, St Antoine; Cattle Creek, St Antoine and Wahrane; or Talbragar River, St Antoine.	Establish habitat protection zone to enhance the vegetation and stream bank stability within five years, through the exclusion of livestock grazing. Increase habitat connectivity by reconnecting existing areas of habitat along watercourses.

Table 10 Namoi BMA: Biodiversity Values and Key Performance Indicators

Biodiversity Value	Nested Conservation Values	Description and interim baseline metric November 2012	Key Performance Indicator
Box Gum Grassy Woodlands		Total area: 524Ha LMU1: 261Ha / LMU2: 219Ha / LMU3: 39Ha / LMU4: 5Ha	Observe a significant increase in area, connectivity and habitat condition over 15 years. Increase connectivity between high quality vegetation within LMU1.
	Fauna Habitat	Medium quality potential habitat for: Spotted-tailed Quoll (no observation); Swift Parrot (no observation); Regent Honeyeater (no observation); and Greater Long-eared Bat (no observation).	Increase the condition and extent of habitat over 15 years. Observe or collect evidence of Greater Long-eared Bat presence.
Derived Native Grassland		Total area: 211Ha LMU1: 49Ha / LMU2: 124Ha / LMU3: 22Ha / LMU4: 17Ha	Observe a transition from Derived Native Grassland and Low Diversity Derived Native Grassland to Box Gum Grassy.
	Fauna Habitat	Low quality potential habitat for: Spotted-tailed Quoll (no observation); Swift Parrot (no observation); Regent Honeyeater (no observation); and Greater Long-eared Bat (no observation).	Increase the condition and extent of habitat over 15 years.
Other Woodlands		Total area: 45Ha LMU1: 45Ha	Observe a significant increase in habitat area, condition and connectivity over 15 years.
	Fauna Habitat	Low to Medium quality potential habitat for: Spotted-tailed Quoll (no observation); Swift Parrot (no observation); Regent Honeyeater (no observation); and Greater Long-eared Bat (no observation).	Increase the condition and extent of habitat over 15 years..

4.0 Conservation Management Strategies

This chapter outlines the management activities and methods to protect and enhance the biodiversity values of the BMAs. It will focus on addressing the key threatening processes identified in the following recovery plans:

- "White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland National Recovery Plan" (DECCW, 2011);
- "National Recovery Plan for the Swift Parrot" (Saunders, 2011);
- "Regent Honeyeater Recovery Plan 1999 – 2003" (Menkhorst, 1999);
- "Draft National Recovery Plan for the Spotted-tailed Quoll" (Long, 2010); and
- "Draft National Recovery Plan for the South-eastern Long-eared Bat" (*Nyctophilus corbeni*) (Schulz, 2010).

More specialised advice on the practical implementation of the management strategies may be sought from "A Guide to Managing Box Gum Grassy Woodlands" (Rawlings, 2010).

4.1 Controlled activities

The Offset Area (land within LMU1 to LMU3) will be protected under a conservation agreement. The Offset Area includes areas with the highest biodiversity and conservation values and will have legal protection. All Leaseholders, contractors, consultants and visitors must be aware of their responsibilities when entering the BMAs and Offset Areas.

Under no circumstances are the following activities permitted within the Offset Area:

- littering or dumping;
- removal of firewood, native plants or animals;
- removal of rocks, sand or gravel;
- clearing or destruction of native vegetation (some exemptions for construction and maintenance of infrastructure (see **Section 4.6**);
- hunting;
- baiting (unless permission is granted for control of pest animals);
- trapping or shooting (unless controlling pest animals);
- use of fertilisers;
- aerial application of herbicide from planes or helicopters (includes LMU4);
- continuous grazing in LMU1, LMU2 and Habitat Protection Zones;
- use of livestock feed;
- keeping of European bee hives and domestic cats; or
- camp fires.

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

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

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

4.2 Weed control

Control of weed species is critical to restoring the natural composition, diversity and structure of the ecological communities across the BMAs. Weeds are typically non-indigenous plants which invade areas after significant disturbance, such as land clearing or over grazing. They exclude native species from the landscape, leading to a change in the composition and structure of plant communities and degrade the condition and functionality of the ecosystems.

The significant impact of weeds on the Box Gum Grassy Woodlands has been recognised by the commitment to fund a $1 million Weed Project.

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. Priority will be given to declared noxious weed species under the *Noxious Weeds Act 1993* and environmental weeds listed in **Table 11**.

Table 11 Target Weed Species

Common Name	Scientific name	Type
St. John's Wort	*Hypericum perforatum*	Class 3 * Class 4 **
African Boxthorn	*Lycium ferocissimum*	Class 3 ** Class 4 *
Blackberry	*Rubus fruticosus (spp. agg.) except named culitvars*	Class 4
Sweet Briar	*Rosa rubiginosa*	Class 4 **
Bathurst Burr	*Xanthium spinosum*	Class 4 *
Noogoora Burr	*Xanthium occidentale*	Class 4 *
Prickly Pear	*Opuntia species* except *O. ficus-indica*	Class 4
Willows	*Salix spp.* except *S. babylonica, S. x calodendron, S. x reichardtii*	Class 4
Cobblers Peg	*Bidens pilosa*	Environmental
Fleabane	*Conyza sp.*	Environmental
Saffron Thistle	*Carthamus lanatus*	Environmental
Star Thistle	*Centaurea calcitrapa*	Environmental
Spear Thistle	*Cirsium vulgare*	Environmental
Stinking Roger	*Tagetes minuta*	Environmental
Tree-of-Heaven	*Ailanthus altissima*	Environmental

*Namoi BMA **Merriwa East BMA and Merriwa West BMA

Definition of the class type and the required action for the noxious weed control classes can be found at **Appendix F**.

4.4.1 Management Objective

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

4.4.2 Method

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

It is important to keep un-infested areas clear of weeds. Outbreaks in these areas will be a priority for intensive eradication and will be closely monitored to identify re-infestation or spread. Containment zones will be established around areas with high levels of infestation. Containment zones of 50m in width are to be maintained along roadsides, property boundaries and watercourses (where appropriate) to prevent dispersal.

The preferred control methods are described in **Table 12**. The detailed prescription for implementation will be developed in consultation with the Leaseholder and the relevant agency responsible for administering the *Noxious Weeds Act 1993*. For the Merriwa East and West BMA, this is the Upper Hunter Weeds Authority and the Gunnedah Shire Council for the Namoi BMA.

Table 12 Weed Control Methods

Control Method	Potential use in control regime
Biological Control – is a long term control technique and may require several years to become effective. This is a complementary strategy and alone it may not eradicate the weed.	At Merriwa West and East BMA the use of: Chrysolina beetles or St John's Wort mite for control of St John's Wort and Blackberry Rust for blackberries. Namoi BMA use of Cochineal and Cactoblastis for Pricky Pear.
Herbicide Control – is the application of chemical to kill the weed by interfering in the plants growth processes.	Land based control only: Spot application of herbicide is the preferred method of application. Boom spray application is permissible in LMU3 as part of ground preparation for revegetation and in LMU4 for pasture establishment. Herbicides: Only registered herbicides should be used for the control of the weed species and used in accordance with the directions on the label. Users have a legal obligation to read and follow the instructions on the label. Where appropriate, selective herbicides will be used to minimise impacts on native vegetation. Handling and application: Herbicides must be handled and applied with consideration of their toxic nature and potentially harmful effects on human health, livestock and the environment. Only accredited and trained operators are permitted to apply herbicides. During application weather condition, nozzles, equipment and operator are to be closely monitored throughout application to reduce the risk of drift and subsequent off- target damage. Coarse to very coarse nozzles should be used to increase droplets size. Suitable weather conditions for spraying are extremely important. Weather guidelines • Read the product label and follow all label instructions. • Spray when wind is steady and ideally 3–15 km/h. • Avoid variable or gusty wind conditions. • Avoid calm conditions - small droplets may remain suspended for long periods. • Spray when wind blows away from sensitive areas. • Avoid spraying in temperatures above 28 °C. • Aim to spray when Delta T is between 2 and 8 and not greater than 10. • Do not spray when inversion conditions exist. • Aim to spray when the atmosphere is neutrally stable. • Most chemicals require a rain free period – check the label. • Be aware of local topographic and convective influences on wind speed and direction. • Record on-site weather conditions at spray time. For more detail please refer to www.bom.gov.au/info/leaflets/Pesticide-Spraying.pdf. Reporting: The Pesticides Regulation 2009 requires all commercial pesticide users (that includes farmers, leaseholders and spray contractors) to keep records on their pesticide application.
Land Management – good land management practices can reduce the incidence and impact of weeds.	Grazing Management: Across all LMUs strategic grazing will be used to encourage desirable native grass and forb species. Annual weed establishment can be reduced by maintaining high groundcover levels and strong perennial plant cover. Over grazing is to be avoided through the implementation of monthly reporting by leaseholders and the biodiversity and agriculture auditors reporting.

Control Method	Potential use in control regime
	Pasture Management: In LMU3 and LMU4, weeds can be controlled through encouraging vigorous pastures to out compete weed species. The use of selective herbicide may be required to further suppress weed competition. Weed hygiene: All machinery is to be cleaned and washed down to reduce the spread of weed seed. Control traffic and drive on formed tracks and quarantine areas to control the spread of weeds. Any sources of infestation around a weed free site will be removed. Only weed-free seed is to be sown. New livestock being introduced to a property will be quarantined for several days, so any potential weed seeds can pass through their system in a known area and be treated later. Weed Identification: Leaseholders and other key stakeholders visiting the BMAs will be required to report any new infestation of weeds.
Manual removal – removal of the weed plant and roots from the site.	Physical removal of new weeds in LMU1, unearthing of root systems and containment and removal of seed.

Additional technical information can be found in the *Noxious and environmental weed control hand book* (NSW DPI 2011) (http://www.dpi.nsw.gov.au/agriculture/pests-weeds/weeds/publications/noxious-enviro-weed-control) and *Best management practice guide for environmental weeds: St John's wort* (CRC Weed Management 2008) (http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0010/347995/bpmg-stjohn-wort.pdf).

4.4.3 Implementation and Reporting

Control of noxious and environmental weeds will be the responsibility of the Leaseholder and Coal & Allied. Coal & Allied is responsible for the development of the Weed Project, which will focus on research into control measures. This project will be developed in close consultation with relevant stakeholders.

Weed control activities have commenced and will continue to control noxious and environmental weeds across all BMAs, including maintaining containment zones.

Annual weed control programmes will be developed in conjunction with the leaseholder and will detail prescriptions, such as the introduction of biological controls and location of containment zones. Leaseholders are required to report all new instances of declared weeds and control these using the appropriate method.

All control activities are to be reported to Coal & Allied, including locations, method, date, duration and type and quantity of herbicide applied. This information will be stored and accessed by the online Mount Pleasant Project -Biodiversity Management Areas Portal.

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

4.3 Pest animal control

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

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

- predation by the feral cat; and
- competition from starlings.

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

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

The *Game and Feral Animal Control Act 2002* requires the control of feral deer, which are known to occur in the Merriwa West and East BMA's.

4.3.1 Management Objective

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

4.3.2 Method

An annual pest animal control programme is to be developed by Coal & Allied in conjunction with the Leaseholder and the LLS for all properties across the BMAs. The target pest species will include feral: pigs, goats, dogs, deer, cats and rabbits.

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.

4.3.3 Implementation and Reporting

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

Pest animal control management activities will commence immediately, including participation in regional control programmes coordinated by the LLS and control by current tenants.

All control activities are to be reported to Coal & Allied, including locations, method, date, duration and estimate of number of target pest animal controlled. This information will be stored and accessed by the online Mount Pleasant Project -Biodiversity Management Areas Portal.

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

4.4 Strategic Grazing

Strategic grazing will be used as a powerful management tool to enhance Box Gum Grassy Woodlands and Derived Native Grassland by promoting regeneration, controlling weeds and erosion, and reducing excessive fire fuel loads. Strategic grazing is preferred because the short duration and intensive regimes prevent or minimise selective grazing and thereby ensure that overall gains in biodiversity can be achieved. Approval Condition 9 requires a minimum sward height of 10cm and 70% ground cover to be maintained at all times on at least 50% of the BMAs.

The strategic grazing principles to guide grazing across the BMAs include:

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

- periods of grazing should be as short as practical; and
- aims to increase species diversity amongst plants, animal and soil biology.

The BMAs have an extensive grazing history and will require careful management to avoid negative impacts on biodiversity values. Strategic grazing regimes will be matched to the site conditions and management outcomes, and will use trigger points to commence and cease grazing. The trigger points will be based on estimates of grassland condition and ground cover, which will be assessed on a monthly basis by the Leaseholder. The ecological monitoring programme (in **Section 5.2**) will observe, in detail, the impact on indicators such as native plant recruitment and weed abundance. In addition, quarterly agriculture audits will help monitor the impacts of the grazing regimes.

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

In LMU3 and LMU4 continuous grazing of paddocks must be avoided, as it results in the elimination of the more palatable species of native grasses and forbs, including lilies and orchids. No continuous grazing is permitted in LMU1, LMU2 or Habitat Protection Zones.

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

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

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

4.4.1 Management Objective

To observe an increase in native species diversity and regeneration over a five year period and maintain groundcover to control weeds and prevent erosion across the BMAs.

4.4.2 Method

Strategic grazing will only be permitted in LMU1 to control biomass for fire fuel reduction.

In LMU2 and LMU3 the LMU decision tree (**Figure 9**) will be followed to match the strategic grazing regime to the site conditions. As mentioned above the implementation of strategic grazing will be supported by Leaseholder observations and information from the monitoring programmes.

The intention of the LMU decision tree is to provide Leaseholders direction on grazing constraints and assist them in estimating potential carrying capacities. The total area of each LMU by property is shown in **Appendix D**. Within the LMU, the strategic grazing regime will be applied on a paddock by paddock basis, creating patchiness and subsequent diversity.

To use the LMU decision tree, a field assessment of natural tree regeneration and composition of grassland will be required to assign the appropriate targeted strategic grazing regime. This assessment will be undertaken by the Agriculture Auditor and Leaseholder, as described in **Section 5.3**.

Where the regime has excluded grazing or where there is a Habitat Protection Zone, biomass may increase to levels that create an unacceptable fire risk. In these circumstances grazing may be considered to reduce risk.

4.4.3 Targeted strategic grazing regimes

Three targeted regimes have been identified (represented by the green boxes in the LMU decision tree – **Figure 9**, and described in **Table 13**). The regimes define the:

- management outcomes;
- location i.e. which LMUs;
- trigger points to indicate when the paddock can be stocked and when it must be destocked; and
- seasonal growth factors.

Trigger points are defined by an estimate of ground cover and grassland condition. The method to assess ground cover is provided in **Section 5.3.1**. Ground cover is an estimate of the proportion of the ground that is not bare soil and includes the area covered by the plant base, stem and leaf material that is spreading from the base, dead leaf litter, manure, branches, cryptogams and rocks that are lying on the soil surface. The amount of groundcover has an important role in soil protection, by reducing raindrop impact, reducing the speed of water flow over soils and increasing water infiltration, and is an important indicator of site condition.

Grassland condition is to be estimated by kilograms of Dry Matter per hectare using the *Meat and Livestock Australia Pasture Ruler* (Lodge, 2011).

These regimes are based on the current condition of the BMAs and are to be reviewed in 2 years to reflect the predicted improvements in grassland condition.

Photo: Cooba bulga Stream, rock formations, St Antoine, Merriwa West (RTCA 2013)

Land Management Unit Decision Tree

Offset Management Plan

Figure 9

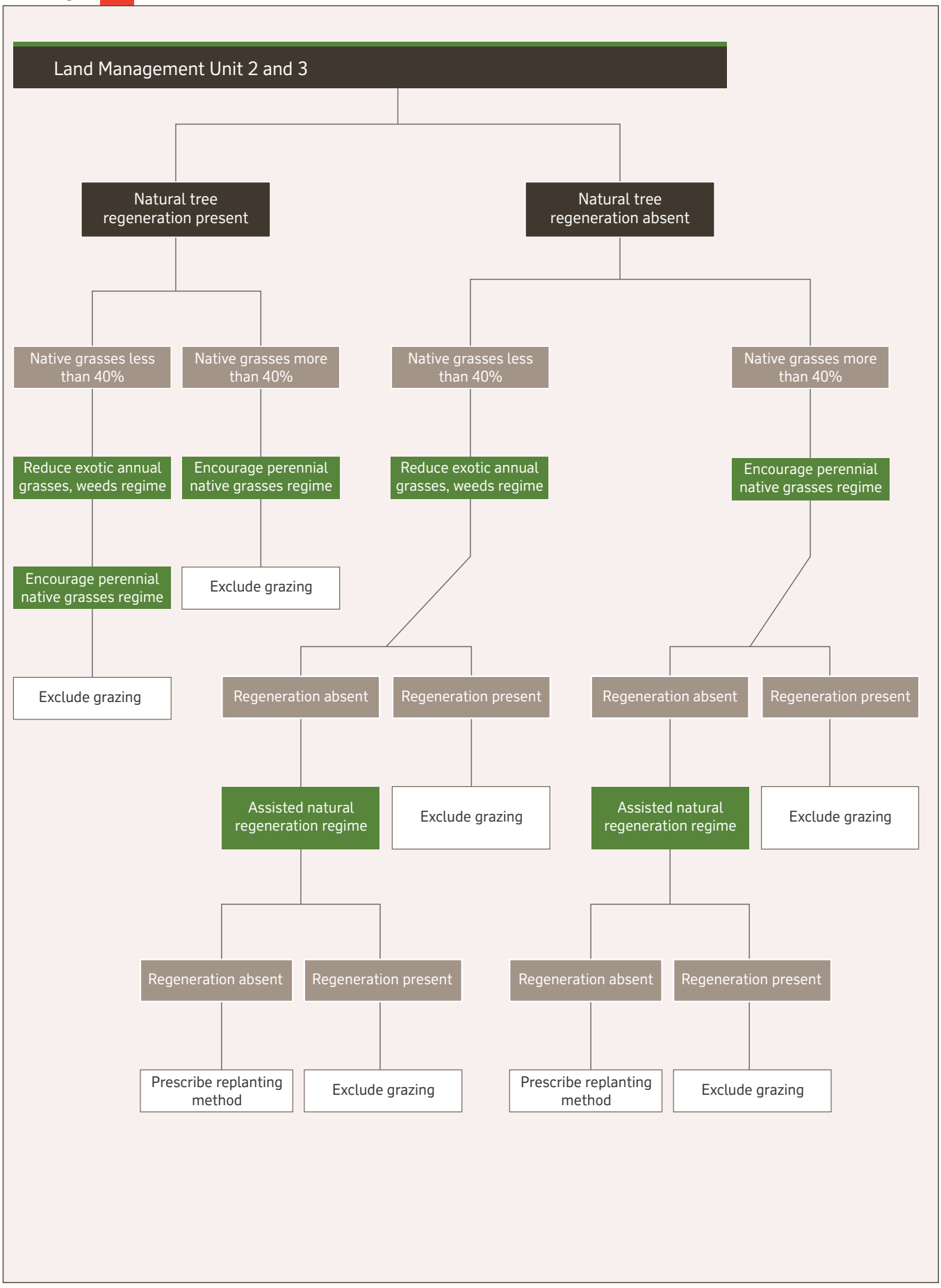


Table 13 Targeted strategic grazing regimes

Management outcomes	Targeted strategic grazing regime
Reduce Exotic Grasses and Weeds	LMU2 and LMU3 Trigger point: Observed pasture condition in spring has an annual exotic grass or weed component greater than15% of ground cover and perennial native grass component less than 40% of ground cover. Summer Maintain 2,000-4,000kg Dry Matter/ha (sward height 10-20cm). Encourage high plant litter levels to minimise the bare ground that favours annual grass/weed germination. Aim for 90 to 100% ground cover. Autumn Keep grazing pressure low or defer grazing until late winter/spring to crowd out germinating annual grasses/weeds. Winter Increase frequency of grazing. Do not reduce groundcover below 90%. Note: during winter St John's Wort is less toxic to livestock. Spring Use short–term high density grazing to control annual grass/weed growth and restrict seed set. Graze to 1,500 -2000kg Dry Matter/ha (sward height 5-10cm). Reduce grazing pressure before stem elongation of native grasses.
Encourage Perennial Native Grasses	LMU2 and LMU3 Trigger point: Observed pasture condition of perennial native grass component greater than 40% of ground cover and desired native species presence less than 7 plants per square metre (low diversity). Summer Maintain a minimum of 90-100% ground cover, with plant residue levels of between 2,000 and 3,000kg Dry Matter/ha (sward height 10-20cm). Late Summer Retain high plant litter levels to minimise the bare ground that favours annual grass/weed germination. Late Summer/Early Autumn Retain minimum of 90% ground cover, including dry standing residue and litter. Good ground cover is needed to reduce the risk of erosion from high intensity storms. Allow a minimum 8 week recovery (no grazing) to allow setting of grass seeds at least every second year. After Autumn Break Monitor and assess establishment of native grass seedlings. Graze to residue of 2,000kg Dry Matter/ha (sward height 10 cm) to protect seedlings. Winter Reduce grazing interval (increase recovery period) to match plant growth. Spring Shorten grazing intervals to match growth rates. Additional grazing pressure may be needed where exotic annuals dominate. Graze to 2,000kg Dry Matter/ha (sward height 10cm).Prevent annual weeds from seeding during spring. If adequate native grass seed heads emerge in the late spring, rest to increase seed production of the native species, as well as replenishing energy reserves prior to summer.
Assisted Natural Regeneration	LMU3 Trigger point: Observed absence of native regeneration after application of the "Encourage Perennial Native Grasses" grazing regime. Late Summer/Autumn "Crash" grazing to 60-70% ground cover. Reduce to 1,000 kg Dry Matter/ha (sward height 5 cm). Promote regeneration of eucalypts and other native forbs. Autumn/Winter Limit grazing to allow seedling establishment for 6 months. Spring/Early Summer Monitor seedling recruitment. If recruitment is adequate; exclude grazing for an extended period. If recruitment inadequate, graze to retain 1,500 -2,000kg Dry Matter/ha, and repeat "crash" grazing in following autumn. If recruitment is adequate, exclude grazing for an extended period. If recruitment inadequate, prescribe replanting method.

New infrastructure

Stock aggregation into larger mobs for 'crash' grazing may be needed seasonally (e.g. in spring to suppress annual weeds and grasses such as annual ryegrass and soft brome). Subdivision of larger paddocks may be required to enable high enough stock densities to control ground cover. When high stocking densities are required temporary electric fencing may be required.

New livestock watering systems may be required to protect the riparian vegetation and stream banks within the habitat protection zones.

Pasture improvements

Artificial fertiliser will be prohibited in LMU1, LMU2 and LMU3. Soil tests will be used to monitor soil fertility and determine fertiliser requirements for pastures and crops in LMU4.

Livestock feeding

Livestock can be fed supplements to address nutritional deficiencies. They may be required to encourage livestock to graze unpalatable plants to reduce fire hazard or to control weeds. Supplements will need to be approved by the Coal & Allied representative prior to use.

Livestock feed, such as hay, may only be used and/or stored within LMU4.

4.4.4 Implementation and Reporting

New five year lease arrangements are to be openly tendered after the approval of the OMP. Selection of the successful Leaseholders will be based upon their understanding of the management requirements and their ability to assist in delivering the conservation objectives of the OMP.

Any new infrastructure for sub division of paddocks or installation of Habitat Protection Zones will be developed in conjunction with the Leaseholder. A five year infrastructure improvement plan will be developed for each property across the BMAs.

Leaseholders will be required to submit monthly property reports, as detailed in the Strategic Grazing Monitoring **Section 5.3.1**. In conjunction with data from the ecological monitoring programmes, the effects of the strategic grazing regimes will be closely monitored and adapted where required. This information will be stored and accessed by the online Biodiversity Offsets Portal.

4.5 Revegetation

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

Targeted revegetation areas have been identified across the BMAs to increase connectivity. These areas are located within LMU3 with the indicative area totalling 945ha (**Figure 7**). A Woodland Re-establishment Plan is to detail the methods to revegetate these areas, which may include replanting.

4.4.1 Management Objective

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

4.5.2 Method

Assisted natural regeneration

To encourage assisted natural regeneration across the BMAs a strategic grazing regime will be used that is suited to the site requirements, as described in the previous section.

Planting and Seed Collection

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

More details will be included in the Woodland Re-establishment Plan, such as pre-plant weed control and soil cultivation. The following activities described in **Table 14** are a minimum requirement to ensure successful planting.

Table 14 Planting activities

Activity	Minimum requirement
Species selection	Species selected are to be listed on the description of the vegetation communities issued by the NSW Scientific Committee or NSW government description. Seed can be collected from site or regionally from equivalent vegetation communities.
Cultivation	Cultivation for tube stock planting should be to a depth of 500-600mm at least 6 months prior to planting and when soil moisture is low to improve sub surface soil shatter. Cultivation for direct seeding may include light soil scarification.
Preplant weed control	Chemical control of weeds at least 1week prior to planting or seeding. An area of at least 1m diameter around each tree or seeding patch is to be sprayed to remove all competition for site resources.
Tube stock planting	Planting must only occur when there is suitable soil moisture, typically 1 -2 days after 25mm of rainfall, in spring or autumn. Tube stock is to be at least 25mm in height, with a well-established root system and in good condition. The tube stock root plug is to be saturated at the time of planting. Soil conditioner is to be applied into the planting hole and all plants should be planted deep, with their root plug at least 50mm below ground and gently firmed in to remove any air pockets in the soil.
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. Ants are to be controlled at the time of seeding.
Mulching / weed mat	Tube stocks are to have weed mats installed at the time of planting to provide longer term control of competition.
Watering	Watering is to occur at the time of planting or seeding, and if required for 6 months post planting.
Maintenance	Maintenance period should apply for at least 18months.

It is preferable that seed for planting and seeding activities is from local or endemic provenances. Therefore, it will be permissible to collect seed from remnant patches of ecological communities across the BMAs. 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), or subsequent equivalent, and the following limitations and permissions apply:

- Collect seed in the BMA 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 BMA;
- 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.

A seed collection programme is expected to commence in 2014 to provide the seed bank for the planting.

Regrowth management

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

similar structure, function and composition to the medium to high quality woodlands occurring within the BMAs.

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

4.5.3 Implementation and Reporting

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

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

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

4.6 Infrastructure improvement

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

4.6.1 Management Objective

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

4.6.2 Method

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

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

4.6.3 Implementation and Reporting

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

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

The GDP checklist considers the impact of the disturbance on:

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

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

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

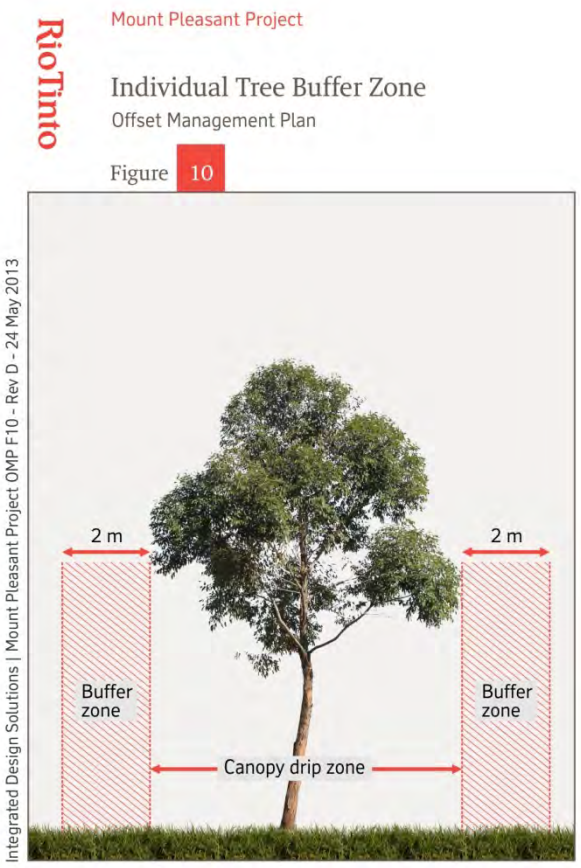
4.7 Sustainable agriculture

Parts of the Agriculture areas located on the Black Rock and Gum Ridge properties have been cropped on an annual basis to grow pasture crops, mainly oats. The Approval Conditions propose a minimum buffer zone of 150m surrounding any cropping activity, which effectively excludes cropping activities within the BMAs. The existing cropping areas are highly modified due to their long history of cropping and have a limited capacity to naturally regenerate. Consequently, if not managed effectively, these areas are likely to be colonised by weeds, which pose a risk of weed infestation to the surrounding Box Gum Grassy Woodland as well as other land management issues.

This OMP therefore proposes to actively manage these areas, converting them into perennial pastures with the following conservation outcomes:

- maintenance of groundcover all year to reduce the risk of soil erosion and salinity;
- weed control to reduce the risk of infestation to surrounding Box Gum Grassy Woodland;
- increased diversity and resilience of ground cover to better manage soil health (increased soil organic matter) and reduce the impacts of drought; and
- creation of additional pasture to support a grazing herd that will be used for strategic grazing (perennial pastures are more sustainable and productive than annual pastures because of their deeper root system and year-round ground cover (Industry and Investment NSW, 2009))

The OMP will apply adequate buffer zones to protect Offset Areas and MNES from activities undertaken in Agricultural areas (LMU4). A buffer zone of 25m in width to apply along all Offset Area boundaries and any patch of remnant vegetation within LMU4. To ensure individual trees of all sizes are protected in the cropping areas a 2m buffer zone radiating out from the canopy drip zone will apply (**Figure 10**), this appropriate should meet or exceed the 10m buffer stipulated in Approval Condition 6.



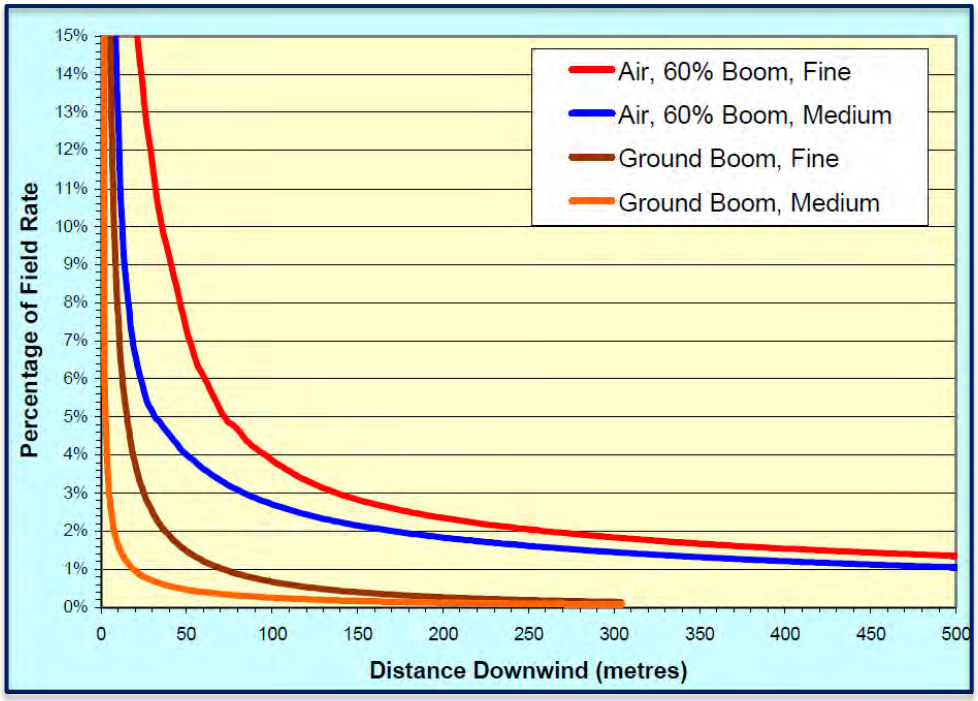
The proposed buffer zones have been developed in the context of the recommendations outlined the Box Gum Grassy Woodlands National Recovery Plan (DECCW, 2011). This plan does not exclude cropping activities from neighbouring areas, but states that adequate buffers should be established. The size of adequate buffers is not defined, however the Australian Pesticides and Veterinary Medicines Authority (APVMA) operating principles in relation to spray drift risk (APVMA 2008) provides a risk assessment and modelling to guide the width of appropriate buffer zones. **Figure 11** provides the examples of drift profiles from different application methods and illustrates that the deposit of active ingredient falls off rapidly downwind from the application, and more rapidly for medium droplet size. For example, for the ground boom with a medium droplet size (orange line), the curve indicates that less than 1% of the intended field rate is deposited at a distance of 25m downwind from the downwind end of the application area. Therefore, the use of a 25m buffer and the management controls detailed in Section 4.2 to monitor climatic conditions, operator and equipment is considered adequate protection for MNES and the Offset Areas, and reduce the percentage of field rate even further. In addition, inspection of these areas has shown that MNES are presently unaffected by neighbouring cropping activity that have been undertake for many years with no buffer zone protection.

The Box Gum Grassy Woodlands National Recovery Plan also supports the use of strategic grazing as management tool to enhance condition. **Table 15** provides excerpts from the recovery plan confirming the use of strategic grazing and adequate buffer zones as a best practice management regime.

Table 15 Box Gum Grassy Woodlands National Recovery Plan (DECCW, 2011) Best Management Practices

Current Best Practice Site Management Practices for the Continued Existence of Box-Gum Grassy Woodland	
Implement strategic grazing	Ensure remnant areas are rested at appropriate times, for example when perennial native ground cover species are flowering and seeding. Limit grazing during drought periods. Grazing levels should not be increased above historical levels. Where a site has never before been grazed by livestock, an alternative (e.g. fire, no intervention) should be used for management. Maintain a minimum of 80% ground cover at all times and biomass at an appropriate level to the region and season. Monitor outcomes to determine effectiveness and adapt management efforts.
Ensure adequate buffers are retained	Protect areas of Box-Gum Grassy Woodland from adjacent land use (e.g. urban and agricultural development) that may potentially impact on its integrity.

Figure 11Example of spray drift deposit profiles from computer modelling (APVMA 2008)



On this graph, zero on the horizontal axis represents the downwind edge of the application area. The wind is blowing from left to right. The vertical axis is scaled in percent of the intended field application rate.

4.7.1 Management Objective

Integrate agricultural and conservation management to support the rural community and deliver conservation outcomes by maintaining groundcover and increasing diversity of grass species.

4.7.2 Method

The location of the areas to be actively converted into perennial pastures, the 25m buffer zones and individual tree buffers have been identified in the **Figure 12 (a)** to **(d)**.

The conversion of these areas will be a transitional process to ensure success and provide adequate periods of exclusion. These areas will be prepared and sown with a seed mix to establish a perennial pasture with at least 40% native perennial. **Table 16** lists the areas to be converted to perennial pasture and the proposed timeframe.

Annual cropping activities may occur prior to the establishment of the perennial pastures to control the weeds and ensure the success of the establishment of the perennial pasture. The 25m and individual tree buffer zones will apply to any annual cropping activities to protect the Offset Areas and MNES. In addition to:

- Application of herbicide will adhere to the methods outlined Section 4.2, spraying of weeds within the buffer zones will permitted only by hand application;
- Minimum tillage practices will be used such as direct drilling of seed; and
- Leaseholder is required to seek approval prior to any cropping or perennial pasture establishment.

The following guidelines are to be followed as best practice in the establishment of perennial pastures (Industry and Investment NSW, 2009)

- Spray fallow using a non-selective herbicide in spring the year before sowing to kill annual grasses before they set seed (early October to early November).
- Keep the paddock well grazed through summer and autumn or use an herbicide to control summer weeds.
- Wait for good autumn rainfall (50-100mm) and allow time for annuals to germinate. Once annuals have germinated, spray again with non-selective herbicide.
- Wait for another rainfall event or up to 7 – 10 days and direct drill perennial pasture species, use the suitable sowing depth for the seed being sown.
- After sowing, check the paddock regularly for weed and pests.
- Avoid grazing until the newly sown pasture has set seed in the first year.
- Graze the pasture in late summer, leaving at least 1500kg DM/ha and then exclude grazing through autumn.
- Commence strategic grazing in winter.

Establishment of perennial pastures is dependent upon suitable climatic conditions and availability of suitable seed.

To achieve high to good quality perennial pasture the target pasture composition is as follows as well as suggest seed mix:

- Perennial grass composition > 50% (Wallaby grass (native) 40% and Phalaris 20%);
- Legumes 20 – 30% (Lucerne 20% and Sub-clover 10%)
- Annual grasses <20% (Snail medic 10%)

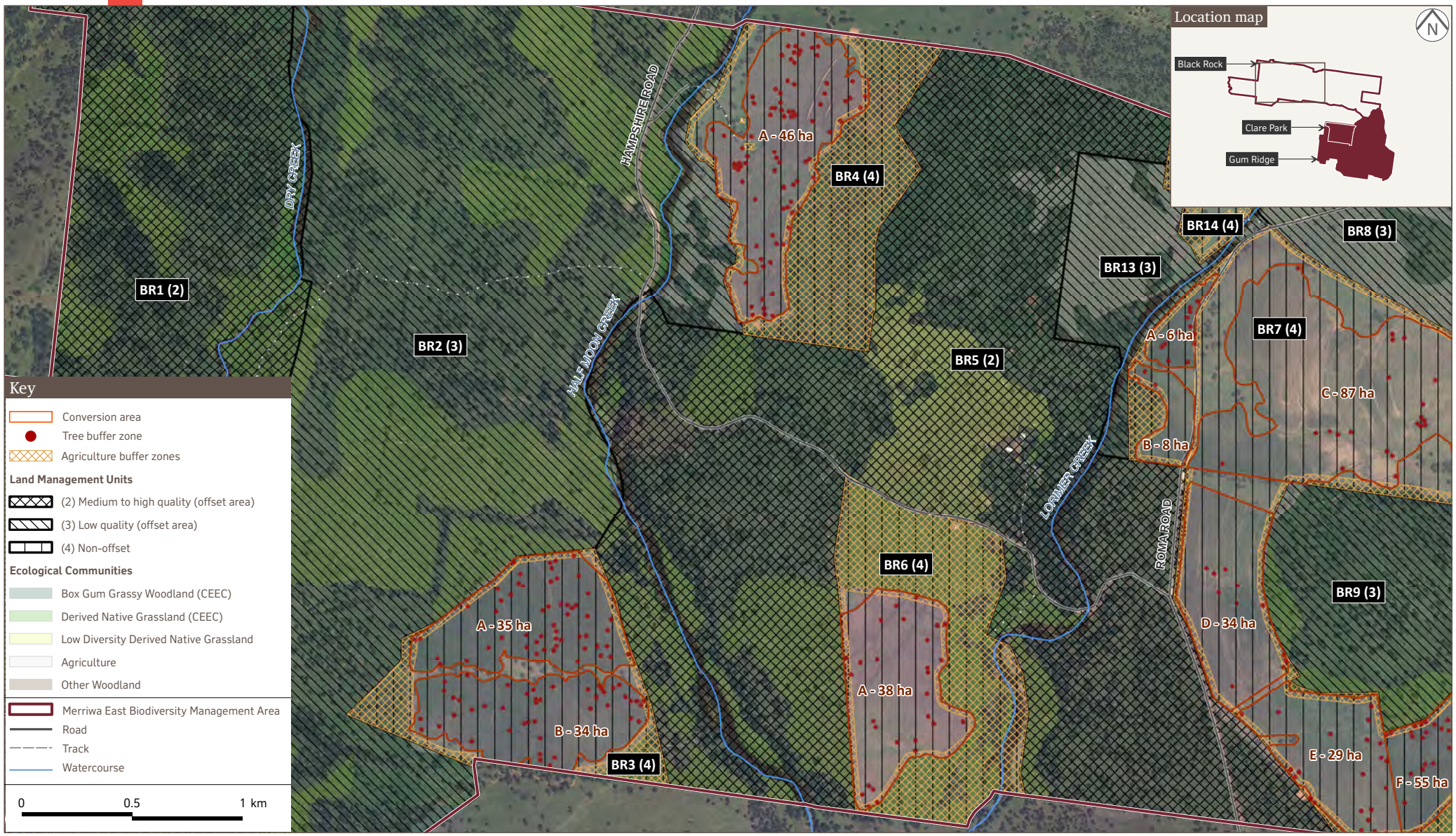
Table 16 Areas and timeframe for conversion to perennial pastures

BMA	Property	Compartment Id	Conversion Area (ha)	2015	2016	2017	2018
Merriwa East	Gumridge	GR2(4)	149	54	54	40	
	Black Rock	BR3(4)	69		69		
		BR4(4)	46		46		
		BR6(4)	38		38		
		BR7(4)	219			101	118
		BR15(4)	110			68	42
		BR16(4)	117	117			
Total			746	171	207	210	159

Black Rock (West) Areas for Conversion to Perennial Pasture and Tree Buffer Zones

Offset Management Plan

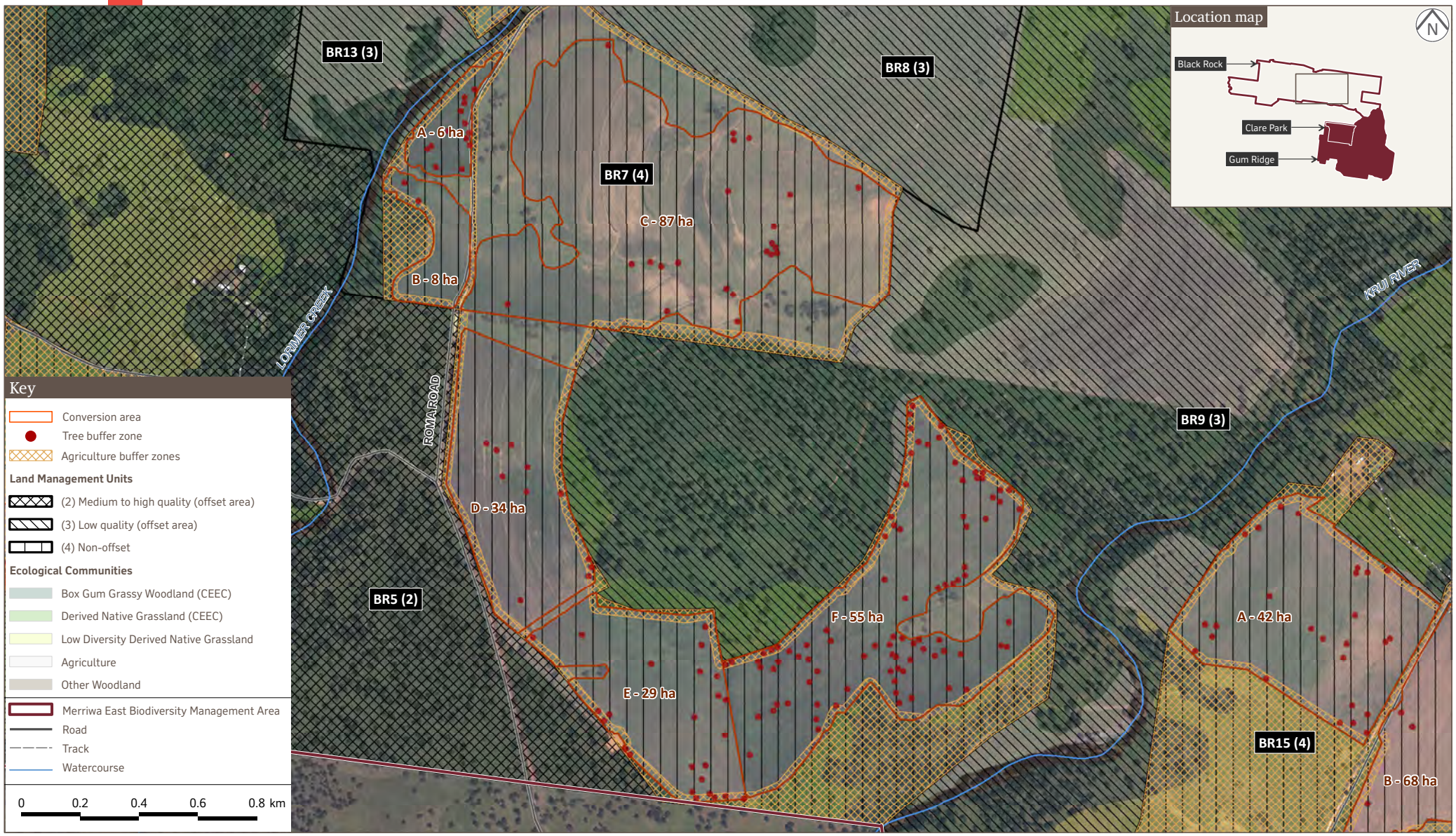
Figure 12a



Black Rock (Centre) Areas for Conversion to Perennial Pasture and Tree Buffer Zones

Offset Management Plan

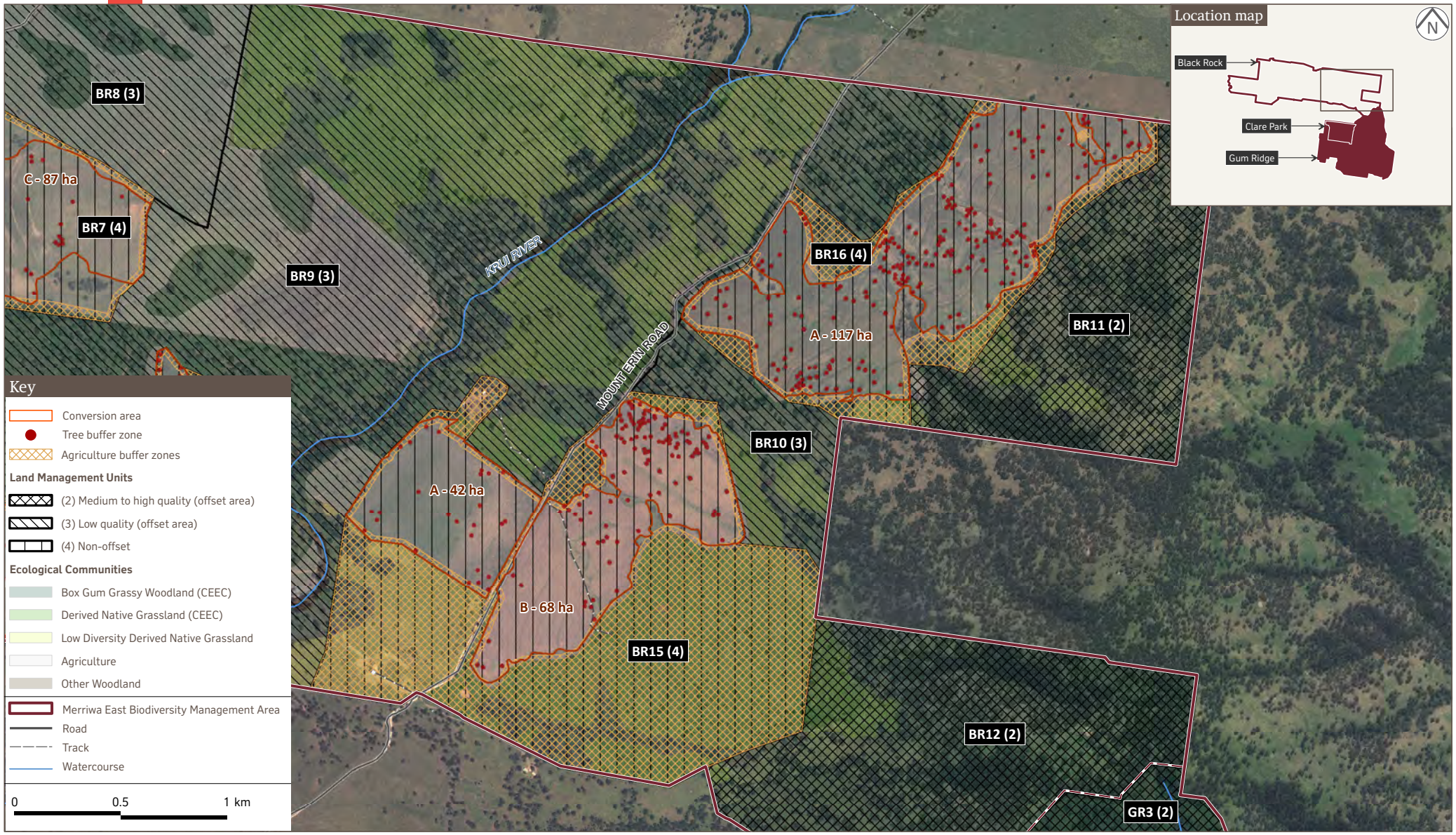
Figure 12b



Black Rock (East) Areas for Conversion to Perennial Pasture and Tree Buffer Zones

Offset Management Plan

Figure 12c

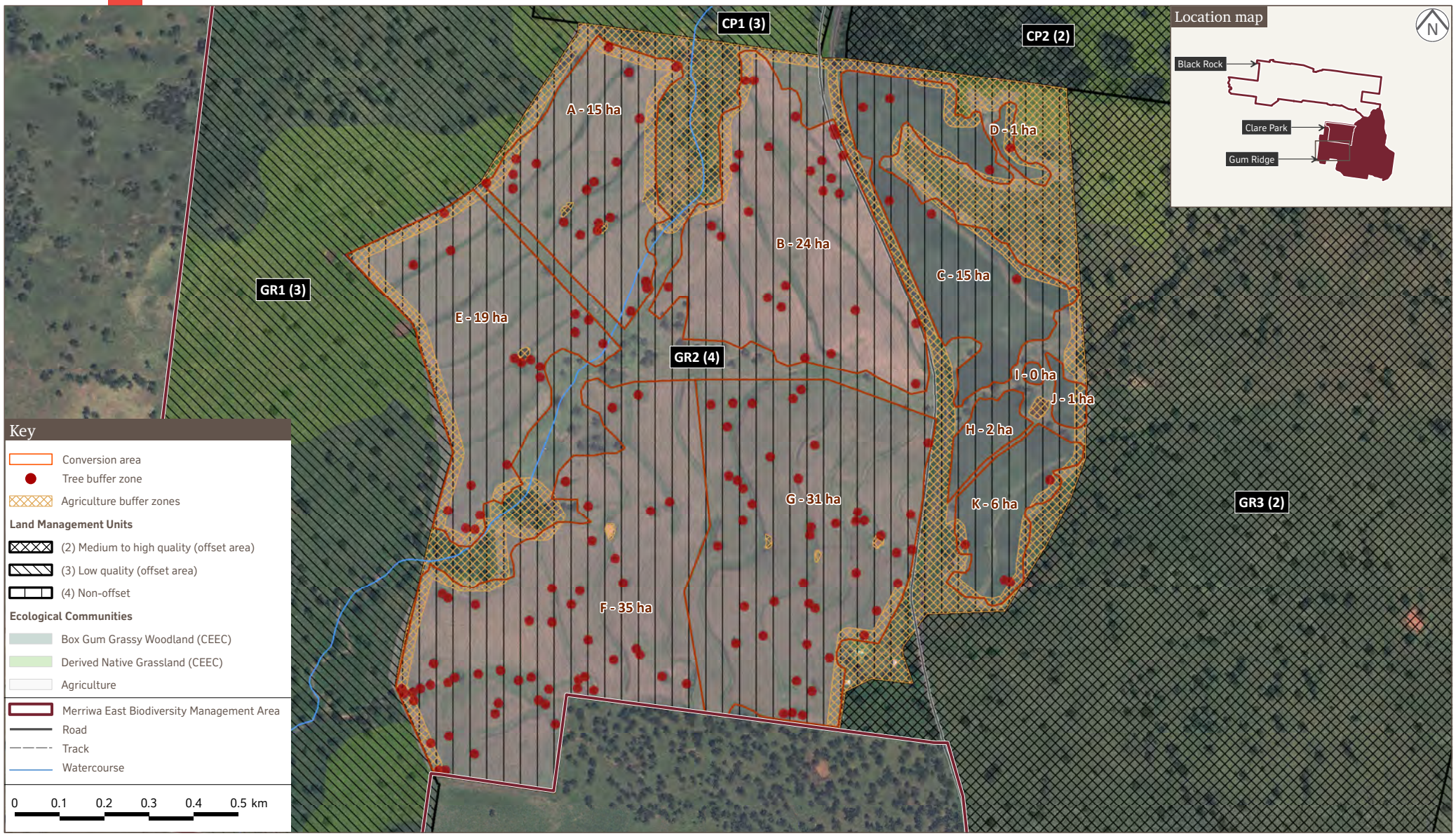


Mount Pleasant Project

Gum Ridge Areas for Conversion to Perennial Pasture and Tree Buffer Zones

Offset Management Plan

Figure 12d



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4.7.3 Implementation and Reporting

All cropping activities will be recorded to Coal & Allied via the quarterly audits undertaken by the Agriculture Auditor. All relevant information will be stored and accessed by the online Biodiversity Offsets Portal.

4.8 Fire Management

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

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

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

An appropriate burning regime can be a useful to enhance the condition of Box Gum Grassy Woodlands.

4.8.1 Management Objective

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

4.8.2 Methods

Key control measures will focus on:

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

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

Current recommendations under the Code are:

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

Table 17 provides details of an appropriate burning regime as described in the Box Gum Grassy Woodland National Recovery Plan.

Table 17 Box Gum Grassy Woodlands National Recovery Plan (DECCW, 2011) Best Management Practices as shown in

Current Best Practice Site Management Practices for the Continued Existence of Box-Gum Grassy Woodland	
Implement appropriate burning regimes	The minimum fire interval suggested for Box-Gum Grassy Woodlands is five years, with a maximum interval of 40 years . Fire regimes implemented should have regard to the floristic composition and condition of the remnant. For example, remnants dominated by Snow Grass and Kangaroo Grass were found to regenerate well with autumn burning cycles approximately every 5-8 years, where this had historically occurred (Prober et al. 2008). Such high frequency burning cycles may negatively impact other native species, however, and further research is required before burning regimes can be explicitly determined. Any burning should be applied to remnants in mosaics (i.e. burning small areas at staggered intervals) to allow survival of soil and ground fauna (including invertebrates, amphibians and reptiles) and promote diversity in the states of the ecological community. Sites where burning is practiced should retain unburnt areas, to provide refuges for species of fauna and flora that may be intolerant of fire. Timing of burns must be considered in relation to the flowering and seeding of native and exotic species. Where possible burns should be carried out after natives have seeded but before weeds flower and seed. Be aware that some weed species (e.g. Coolatai Grass) increase with burning.

4.8.3 Implementation and Reporting

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

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

4.9 Cultural Heritage

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

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

4.10 Health, Safety and Environment Induction

Coal & Allied will undertake inductions for employees, Leaseholders, contractors, consultants and other visitors entering the BMAs and will cover:

- safety procedures;
- location of Offset Area;
- intent of the OMP;
- procedures to reduce the spreading of weed and pests;
- fire awareness and response procedures; and
- vehicle access management.

Where practical the Leaseholders will be encouraged to participate in the monitoring programmes to raise their awareness and knowledge of the biodiversity values.

5.0 Monitoring Programme

This chapter details programmes to measure short, medium and long term impacts of the OMP conservation management strategies. These assessments will provide quantitative data to guide adaptive management, monitor long term trends in biodiversity values and attainment of Key Performance Indicators.

This comprehensive monitoring programme has been designed to assess changes in the vegetation and habitats of the BMAs against the Key Performance Indicators outlined in Table 8, Table 9, and Table 10.

The monitoring programme comprises three components to capture environmental change at different scales and within different components of the landscape/ecosystems:

- Landscape monitoring: to assess vegetation changes and habitat connectivity at the landscape scale in the long term;
- Ecological monitoring: to provide a general indication of changes in biodiversity (indicators of ecosystem condition) and to monitor changes in Box Gum Grassy Woodland and threatened fauna listed under the EPBC Act (MNES) in the medium term; and
- Strategic Grazing monitoring: to inform management activities consistent with the adaptive management approach to strategic grazing in the short term.

The timing and frequency of monitoring activities will vary depending on the ecosystem/species being targeted. A summary of the monitoring schedule is provided in **Table 18**.

To enhance the understanding and knowledge of all key stakeholders in the management of the BMAs, the Leaseholders and Coal & Allied representatives, where feasible, will accompany the Agriculture and/or Biodiversity Auditors during the field based components of this monitoring programme.

5.1 Landscape Monitoring

Aerial photographic imagery analysis and rapid condition assessments will be used to monitor long-term changes in the distribution and condition of the ecological communities. These techniques will be used to evaluate the following predictions:

- under the proposed conservation management strategies, there will be an increase in the proportion of the BMAs mapped and categorised as LMU1 and LMU2, indicating an improvement in ecological condition; and
- under the proposed conservation management strategies, there will be an increase in the area of the BMAs mapped as Box Gum Grassy Woodlands, indicating a transition from Low Diversity Derived Native Grassland and Derived Native Grassland to Box Gum Grassy Woodlands.

These techniques will next be undertaken in 2020. The analysis of tree canopy cover and condition assessments will be used to map changes in the distribution and condition of Box Gum Grassy Woodlands and Other Woodland habitats and connectivity of vegetation remnants. **Appendix C** provides an overview of the rapid condition assessment technique. An increase in the area of tree cover at the expense of grassland, and an improvement in landscape connectivity for remnants of Box Gum Grassy Woodlands and Other Woodland habitats will also be indicative of successful management of the BMAs towards the Key Performance Indicators.

5.2 Ecological Monitoring

Ecological surveys will be conducted to assess changes in the general ecological condition of the BMAs and to monitor changes in Box Gum Grassy Woodlands, Derived Native Grasslands and threatened fauna listed under the EPBC Act and their habitats. The first round of ecological surveys were undertaken in October and November 2013

and will continue through to winter 2014. These surveys will document the baseline condition within LMUs 1-3, against which subsequent years of monitoring data can be compared.

High quality Box Gum Grassy Woodlands and Other Woodland (LMU2) on the BMAs will represent the target (reference) condition for vegetation and habitat restoration. These areas of high quality vegetation occur across all three BMAs and represent realistic targets for restoration for these properties, which will remain productive in the long-term.

Table 18 Monitoring Schedule

Landscape Monitoring	2012	2013	2014	2015	2016	2017	2018	2019	2020
Aerial photo analysis	Nov								Nov
Rapid Condition Assessment	Nov								Sept - Nov
Ecological Monitoring									
Indicators of Ecosystem Condition		Sept - Nov							Sept - Nov
MNES - Box Gum Grassy Woodlands		Sept - Nov		Sept - Nov		Sept - Nov		Sept - Nov	
MNES - Birds			July - Sept		July - Sept		July - Sept		July - Sept
MNES – Mammals			July - Sept		July - Sept		July - Sept		July - Sept
Strategic Grazing Monitoring									
Agricultural Audit		Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly
Paddock Assessments		Monthly	Monthly	Monthly	Monthly	Monthly	Monthly	Monthly	Monthly

The ecological surveys will test predictions about the expected change in vegetation/habitat condition resulting from implementation of the proposed conservation management strategies and investigate the presence and habitat usage of fauna MNES. These surveys have been designed to be repeatable and allow statistical analysis of the data according to testable predictions (hypotheses). Additional data will be collected to assist in interpreting ecological changes including incidental observations and photo reference points.

All plot and survey locations are to be geographically referenced using a GPS.

5.2.1 Indicators of Ecosystem Condition

Birds and reptiles are widespread and typically abundant taxa whose populations are easily surveyed. Although they are relatively mobile taxa, many species can show specialisation in their habitat requirements. Patterns in the distribution and abundance of bird and reptile assemblages can be indicative of biodiversity as a whole and of environmental change. Accordingly, bird and reptile assemblages will be monitored as indicators of general ecosystem condition. In addition, details of general fauna habitat features will also be recorded at each fauna monitoring site. Patterns in bird and reptile populations and habitat will be assessed to test the predication that:

- as grassland (LMU2 and LMU3) and low-quality woodland (LMU3) are restored, bird and reptile assemblages and their habitats will become more similar to assemblages/habitats in the medium-high quality woodland habitats (LMU2).

Thirty-two bird and reptile monitoring plots will be established across the BMAs. Their locations will be strategically and practically chosen to sample across accessible

grassland and woodland communities. The plots will take into account spatial variability across the BMAs and different LMU condition categories (LMUs 1-3).

Four monitoring sites will be located in the very-high quality vegetation (LMU1) in the Namoi BMA. The remaining 28 monitoring sites will be spread across all three BMAs to survey grassland (14 sites) and woodland habitats (14 sites) in LMUs 2 and 3.

Baseline surveys were conducted during late spring/early summer 2013 and subsequent surveys will be conducted again in 2020 (**Table 18**). **Table 19** outlines the survey methods for indicators of ecosystem condition.

Table 19 Survey methods for indicators of ecosystem condition

Survey Method	Details
Birds	
Habitat area searches	Habitat area searches will be conducted in accordance with Birds Australia Atlas search methodology (Birds Australia 2013) and EPBC Act bird survey guidelines (DEWHA 2010). This method involves searching a set area and recording data only from within the pre-defined search zone. A two Ha area will be surveyed for 20 minutes at each of the designated monitoring sites by two observers.
Incidental and opportunistic records	Incidental and opportunistic surveys will include visual observations and calls, and suitable habitat areas will also be recorded when travelling to and between monitoring sites. All opportunistic sightings and their locations will be recorded. General notes and important habitat resources such as tree hollows, flowering trees and nests will be recorded incidentally and photographed, as will any notable bird activities such as specific forage behaviour or signs of breeding activity.
Reptiles	
Active searches	Reptiles will be surveyed at the monitoring sites by undertaking diurnal and nocturnal active searches in suitable habitat (SEWPaC 2011). Diurnal active searches will involve disturbing shrubs and tussock grasses, lifting bark, fallen logs, bush rock and scraping top soil and nocturnal searches will involve spotlighting for reptiles.
Funnel traps	Four funnel traps will be set at each monitoring location in grassland areas to capture medium to large-sized reptiles. All traps will be checked at least twice a day as they will not be shaded.
Habitat	
50x20m plot	Within a 50x20m plot, the number and species of canopy trees will be recorded. The proportion of trees with hollows (minimum entrance width of 5cm), mistletoe or flowers/fruit as well as any dead trees and the total length of fallen logs (minimum diameter 10cm and minimum length 0.5m) within the plot will also be recorded. Permanent photo reference points are to be established.
20x20m quadrat	Within a 20x20m quadrat, the % cover of litter, rock and bare ground will be estimated.

Photo Reference Points

A photo reference point will be established and permanently marked within each habitat monitoring plot. Photo reference points will be established at the top of the middle 50m transect at each monitoring site. During each monitoring event, a series of photos will be taken from this point to provide a visual record of any changes in vegetation and habitat condition. Depending of the location of the monitoring site, 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 will be taken, in the following directions:
- downslope;
- upslope;
- across the slope - left;
- across the slope - right; and
- directly down (when facing downslope).

Photo records will be stored on the Mount Pleasant Project – Biodiversity Management Areas Portal and will be displayed so that monitoring photos can be viewed against the baseline (2013) photo. This will provide an ongoing and gradual visual record of changes in vegetation and habitat as the management strategies are implemented as well as changes in existing threats and early warning of emerging threats at monitoring sites.

5.2.2 Matters of National Environmental Significance

Baseline and subsequent monitoring surveys for Box Gum Grassy Woodlands and fauna species that are MNES will be undertaken. These surveys will also help to assess the progress of management and enhancement activities of Box Gum Grassy Woodlands and habitat for MNES within the BMAs.

The relevant MNES are the CEEC and threatened and migratory fauna species listed under the EPBC Act:

- Box-Gum Grassy Woodlands
- Regent Honeyeater (*Anthochaera phrygia*);
- Swift Parrot (*Lathamus discolor*);
- Spotted-tailed Quoll (*Dasyurus maculatus maculatus*); and
- Greater (South-eastern) Long-eared Bat (*Nyctophilus corbeni*).

Box Gum Grassy Woodlands

The monitoring programme for the Box Gum Grassy Woodlands aims to assess the success of the proposed conservation management strategies in maintaining or improving the condition of the Box Gum Grassy Woodland within the BMAs. Accordingly, the monitoring programme has been designed to test the predictions that:

- as the low-quality Box Gum Grassy Woodlands (LMU3), low quality Derived Native Grassland(LMU3) and medium-high quality Derived Native Grassland (LMU2) are restored, this vegetation will become more similar to the medium-high quality Box Gum Grassy Woodlands (LMU2).

To assess this prediction, data will be collected on community composition, vegetation structure, canopy regeneration/health and habitat features.

a. Monitoring sites

The design of the Box Gum Grassy Woodlands monitoring programme is similar to that for indicators of ecological condition except that sites will be focused in Box Gum Grassy Woodlands vegetation at the exclusion of Other Woodland habitats. Accordingly, thirty two permanent monitoring sites will be established across the following vegetation/LMU categories:

- Very high quality Box-Gum Grassy Woodlands within LMU1 (4 sites);
- Medium - high quality Box-Gum Grassy Woodlands within LMU2 (7 sites);
- Medium - high quality Derived Native Grassland within LMU2 (7 sites);
- Low quality Box-Gum Grassy Woodlands within LMU3 (7 sites); and

- Low quality Derived Native Grassland within LMU3 (7 sites).

The location of the monitoring sites will be determined according to the following criteria:

- Property – where possible, one or more monitoring sites of each condition class will be selected from each of the six properties to capture the range of vegetation types across the BMAs and to capture possible variation among properties due to prior management regimes;
- Field assessment – since each LMU has been categorised according to the average vegetation condition and consequently there is some variation in the actual condition across the LMU, field assessment will be used to ensure the sites are established within vegetation that is consistent with the designated average condition of the LMU (i.e. a site within LMU3 will be established in low-quality vegetation). This will ensure that the link between changes in vegetation condition and management activities can be established.

b. Field methods

Monitoring commenced in 2013 to establish baseline data and subsequent monitoring will occur in 2015, 2017 and 2019 (**Table 18**). Monitoring measurements will be undertaken between September and November, in line with the requirements of the Approval Conditions.

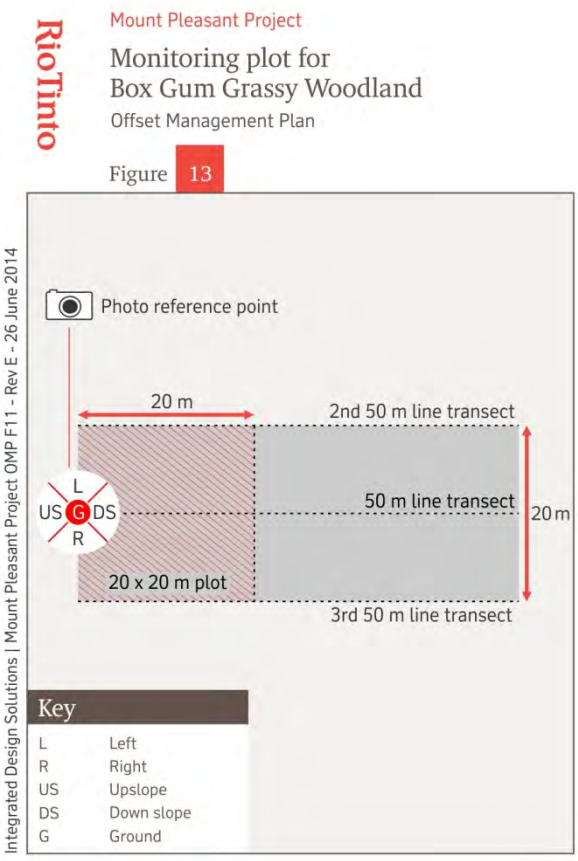
The field methods for data collection have been adapted from the *BioMetric 3.1 methods for assessing Site Value* (Department for Environment and Climate Change, NSW, 2011). Additional measurements have been added these methods to capture details relating to:

- species composition - to enable comparisons with the published species list for Box Gum Grassy Woodlands (DEH 2006);
- vegetation restoration - to assess community transition relative to the State and Transition Model;
- soil analysis; and
- other requirements in accordance with the Mount Pleasant Project Approval Conditions.

Quadrat and transect surveys will be conducted to collect information on changes in vegetation community composition, structure, canopy regeneration/health and additional habitat features. A 50m x 20m plot will be established at each monitoring site such that the plot runs downslope. A 20m x 20m quadrat will be positioned within this larger plot and three 50m transects will run its length (**Figure 13**). Where possible, four marker pegs will be used to establish a permanent plot position. GPS coordinates are taken to ensure monitoring plots can be relocated over time.

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

The 20m x 20m quadrat will be used to record details of the mid-storey and ground stratum species diversity and abundance. This will include details of the composition and % cover of native/exotic species, various plant groups (e.g. grasses, shrubs, other herbaceous plants) and the presence/absence of ‘important’ species listed for the Box Gum Grassy Woodlands (DEH 2006a). Additional habitat features such as rocks, litter and bare ground will also be recorded at this scale.



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

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

c. Photo Reference Points

Photo reference points will be established as described previously in **Section 5.2.1**. The photo records will be stored on the Mount Pleasant Project – Biodiversity Management Areas Portal and will be displayed so that monitoring photos can be viewed against the baseline (2013) photo. This will provide an ongoing and gradual visual record of changes in vegetation as the management strategies are implemented as well as changes in existing threats and early warning of emerging threats at monitoring sites.

d. Soil analysis

Soil samples will be undertaken using standard soil sampling techniques with a core sampler within the monitoring quadrat. At least 12 cores will be taken at each site and bulked together. Soil analysis will consist of assessing the parameters, pH, EC, Available Ca, Mg, K, ammonia, sulphur, organic matter, exchangeable Na, Ca, Mg, K, H, Al, cation exchange capacity, available and extractable phosphorus, micronutrients (Zn, Mn, Fe, Cu, B), total carbon and nitrogen. Exchangeable Sodium Percentages are to be calculated as a measure of sodicity or dispersion.

Results of key parameters such as pH, electrical conductivity, organic matter, phosphorous, nitrate, Cation Exchange Capacity and Exchangeable Sodium Percentages are used as primary indicators of the suitability of the soil for native vegetation within the monitoring site.

Birds (Regent Honeyeater and Swift Parrot)

Monitoring for the Regent Honeyeater and Swift Parrot aims to determine the presence of these species within the BMAs and collect information regarding their movements and habitat usage. In recognition of the difficulty in monitoring migratory bird species, Leaseholders will be given training to enhance their identification skills and increase their awareness of migratory movements and foraging preferences for these bird species.

Targeted bird searches will be conducted in accordance with EPBC Act bird survey guidelines (DEWHA 2010). This method involves searches of woodland patches with heavily flowering trees or mistletoes, particularly around water points such as dams and creek lines and especially where flocks of other blossom nomads such as lorikeets and honeyeaters have been detected. In addition to the targeted searches, call playback will be used to elicit a response from various species and GPS readings will be taken when threatened species are observed or heard calling. Where possible, photographs will be taken of threatened bird species.

A desktop study has been undertaken to more accurately predict the timing and distribution of both species in the Merriwa region and to inform monitoring surveys, ensuring surveys are targeted based on known habitat requirements and migratory movements for these species. Swift Parrots are likely to occur in the BMA region occasionally and in very low numbers between July and October to feed on winter-flowering eucalypts (Swift Parrot Recovery Team 2000; Saunders and Heinsohn 2008; Saunders and Tzaros 2011; OEH 2012). The Regent Honeyeater is known to breed around the Upper Hunter Valley and Mudgee regions. The species has regular movements with seasonal patterns of abundance and breeding related to regional patterns in flowering of key forage species (Franklin, Menkhorst et al. 1989; Menkhorst, Schedvin et al. 1999; OEH 2012; SEWPaC 2012).

Monitoring surveys for the Regent Honeyeater and Swift Parrot will start in winter/spring 2014 to collect baseline data and subsequent monitoring will occur in 2016, 2018 and 2020 (**Table 16**). Birds Australia will be consulted prior to the commencement of these surveys to coordinate survey effort and increase the likelihood of observations, therefore the timing of survey maybe adjusted. These surveys are in addition to the general bird surveys discussed in **Section 5.2.1**.

Mammals (Spotted-tailed Quoll and Greater Long-eared Bat)

As for the birds, monitoring for the Spotted-tailed Quoll and Greater Long-eared Bat aims to determine the presence of these species within the BMAs and collect information regarding their movements and habitat usage.

Baseline surveys for these mammals will start in winter/spring 2014 and subsequent monitoring will occur in 2016, 2018 and 2020 (**Table 18**). Mammal monitoring sites will be located close to the bird and reptile monitoring plots and exact locations will be chosen based on the presence of suitable habitat and connectivity. Mammal surveys will use a combination of:

- Hair tubes;
- Infra-red (IR) cameras;
- Visual observation; and
- Ultrasonic call recording devices.

Infra-red cameras are a long-term passive detection technique that will maximise the likelihood of detecting the Spotted-tailed Quoll. These cameras will be strategically placed along riparian zones (typical movement corridors for the Spotted-tailed Quoll) across the Merriwa plateau BMAs. It is estimated that the batteries will need to be replaced every 5 months and data uploaded for identification and analysis. The cameras can then be re-deployed in new locations for the next round of passive surveying.

Monitoring for the Greater Long-eared Bat will be undertaken using ultrasonic call recording devices set up along suitable flyways.

5.2.3 Data Analysis and Interpretation

To assess the success of the management activities in meeting the Key Performance Indicators, data on bird and reptile assemblages, fauna habitats and Box Gum Grassy Woodlands will be 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 may include:

- 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 (Anderson, 2001; 2004) 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.

Analysis of the baseline data will assess difference in fauna assemblages, habitats and vegetation condition between grasslands and woodlands across the LMU condition categories. It is expected that in subsequent years, with the progressive improvement in vegetation condition of LMUs, the ecological data analysis will eventually show a convergence of ecological variables to that of the medium-high quality woodland. This is expected to be a medium to long-term upward trend that will reflect the regeneration of grassland areas to 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 strategies have been successful in restoring the lower quality vegetation and fauna habitats towards the reference condition.

Any records of fauna MNES on the BMAs will be reported along with any information obtained regarding their habitat usage and movements.

Monitoring data and summary reports of monitoring outcomes will be stored on the Biodiversity Offsets Portal. Authorised users will have access to these data and reports ensuring transparency and enabling independent verification of reported monitoring outcomes.

5.3 Strategic Grazing Monitoring

To ensure that the strategic grazing regimes do not harm biodiversity values but achieve the desired management outcomes, a monitoring programme that includes monthly reporting by Leaseholders and quarterly audits is to be implemented.

This facilitates regular on-ground monitoring of grassland condition, with a feedback to ensure grazing regimes are targeted to outcomes and responsive to changes in climatic conditions.

To use the LMU Decision Tree (**Figure 9**) an assessment of the paddocks ground cover and grassland condition is required to allocate the appropriate grazing regime. This assessment will be undertaken in consultation with the Agriculture Auditor and the Leaseholder. Typically this will occur during a quarterly audit. To ensure paddocks are not over grazed, paddock assessments will be undertaken by the Leaseholder and reported to Coal & Allied and the Agriculture Auditor monthly.

5.3.1 Paddock Assessments

Paddock assessments will be undertaken by the Leaseholder, to monitor basic elements of the critical trigger points and to ensure that livestock are moved out of a paddock before the threshold trigger point is reached.

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

For each assessment, record the: date, name of paddock, area and LMU compartment identifier. Using a wooden or metal square (quadrat) of at least 0.5m x 0.5m internal dimensions, undertake the following steps:

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

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

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

   B = the percentage cover of live native plants;

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

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

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

d. Calculate the percentage of the assessment area covered by vegetation (living or dead): Sum of A / Number of samples.

e. Calculate the percentage of the living vegetation that is live native groundcover by: (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 in monthly reports along with the following information:

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

Monthly reports will be stored on the Mount Pleasant Project - Biodiversity Management Areas Portal and will be accessible by key stakeholders.

5.3.2 Agricultural Audit

The Agriculture Auditor will prepare a quarterly audit that includes a summary of the monthly paddock assessments and, where necessary, the Agriculture Auditor will perform additional monitoring.

The Agriculture Auditor will review and report on achievement of the management objectives:

- Weed control - new or significant changes to noxious weed infestations and control activities;
- Pest animal control - damage or presence of feral pest animal and control activities;
- Strategic Grazing - effects of grazing, changes in seasonal growing conditions and grassland growth;
- Revegetation – update on planned activities;
- Infrastructure improvements – requirements for new infrastructure as well as maintenance or repair of existing infrastructure (roads/fences);
- Buffer zones- management operations (spraying/cropping);
- Fire management - fire fuel hazard assessments and control activities; and
- Tree flowering events.

Soil and water analysis will be conducted where circumstances require investigation.

6.0 Conclusion

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

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

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

Table 20 identifies the key risks to the OMP, proposed contingency measures and the relevant section in the OMP that addresses this risk. The table identifies the key responsible person and the components of the monitoring programme aimed to observe the presence or impacts of the risk. This adaptive management approach to risk and contingency management is made effective by the monitoring programmes, communication of information via the online to relevant stakeholders and implementation of conservation management strategies.

Photo: Box Gum Grassy Woodlands, Wahrane, Merriwa West BMA (Cumberland Ecology 2013)

Table 20 Risk and Contingency Assessment Matrix

Risk	Description of risk	Contingency Measure	Reference in OMP	Key responsible person	Monitoring Programme
Weed Incursion	Introduction of new weeds through stock movements.	Weed hygiene.	Table 10 Weed Control Methods	Leaseholder.	Ecological monitoring – MNES –Box Gum Grassy Woodlands (section 5.2.2) Strategic Grazing Monitoring – Agricultural audit (section 5.3.2)
	Vehicles spreading weeds	Establishment of containment zones. Weed hygiene.	Weed Control Method, at section 4.4.2. Table 10 Weed Control Methods	Leaseholder All visitors to the BMAs	Strategic Grazing Monitoring – Agricultural audit (section 5.3.2)
	Absence of groundcover and poor pasture condition.	Maintenance of ground cover and pasture condition by following trigger points to commence and cease grazing.	Strategic Grazing (section 4.4)	Leaseholder Agriculture Auditor	Strategic Grazing Monitoring – Agricultural audit (section 5.3.2)
Over Grazing	Stock grazing preventing natural regeneration or over grazing.	Select and apply the correct targeted strategic grazing regime, review monitoring data.	Target strategic grazing regimes (section 4.4.3)	Leaseholder Agriculture Auditor Biodiversity Auditor	Ecological monitoring – MNES –Box Gum Grassy Woodlands (section 5.2.2) Strategic Grazing Monitoring – Agricultural audit (section 5.3.2)
	Stock grazing causing stream bank degradation.	Implementation of Habitat Protection Zones	Land Management Units (section 2.4)	Leaseholder Agriculture Auditor Biodiversity Auditor	Ecological monitoring (section 5.2) Strategic Grazing Monitoring – Agricultural audit (section 5.3.2)
Pest Animals	High populations of pest animals restricting native plant regeneration or growth.	Annual control of pest animals and monitoring impacts.	Pest animal control (section 4.3)	Leaseholder Agriculture Auditor Biodiversity Auditor	Ecological monitoring (section 5.2) Strategic Grazing Monitoring – Agricultural audit (section 5.3.2)
	Negative outcomes for control programmes – ie baiting	Prohibit the use of baiting and adhere to method in OMP.	Controlled activities (section 4.1) and Pest animal control (section 4.3.2)	Leaseholder Agriculture Auditor	
Fire	Wildfire entering the BMA.	Implementation of annual Bushfire Management Plan	Fire management (section 4.8)	Manager - Offsets Rio Tinto	

Risk	Description of risk	Contingency Measure	Reference in OMP	Key responsible person	Monitoring Programme
	Increases fire intensity due to higher fuel loads	Strategic grazing to control hazardous fuel loads.	Strategic Grazing (section 4.4) Fire management (section 4.8)	Leaseholder Agriculture Auditor	Ecological monitoring (section 5.2) Strategic Grazing Monitoring – Agricultural audit (section 5.3.2)
	Fire ignition on BMA	Implementation of annual Bushfire Management Plan	Fire management (section 4.8)	Manager - Offsets Rio Tinto	
Drought	Reduction of ground cover damage to native flora.	Destock	Strategic Grazing (section 4.4)	Leaseholder Agriculture Auditor	Strategic Grazing Monitoring – Agricultural audit (section 5.3.2)
Herbicide Drift	Chemical spray drift.	Establish buffer zones, follow government regulations and only spray in variable weather conditions. Use alternative weed control measures where practical (e.g. Biological control)	Buffer zones (section 4.7) Weed Control (section 4.2) Controlled activities (section 4.1)	Leaseholder Agriculture Auditor	Ecological monitoring (section 5.2) Strategic Grazing Monitoring – Agricultural audit (section 5.3.2)
Vegetation Management	Removal or clearing of native vegetation, including dead timber and live plants.	Property security, where possible leaseholder will live on the properties. Clearing of vegetation for essential farm infrastructure will adhere to relevant legislation.	Controlled activities (section 4.1) Infrastructure improvement (section 4.6)	Leaseholder Agriculture Auditor Biodiversity Auditor	Ecological monitoring (section 5.2) Strategic Grazing Monitoring – Agricultural audit (section 5.3.2)
	High density regrowth restricting native species diversity	Review monitoring data.	Revegetation (section 4.5)	Biodiversity Auditor	Ecological monitoring (section 5.2)
Erosion	Loss of native vegetation cover	Strategic grazing or destock	Strategic Grazing (section 4.4)	Leaseholder Agriculture Auditor Biodiversity Auditor	Ecological monitoring (section 5.2) Strategic Grazing Monitoring – Agricultural audit (section 5.3.2)
	Stream bank erosion	Limit livestock access to creeks. Provide off stream stock water.	Figures 7 a) to d) indentify the revegetation areas targeting stream bank stabilisation.	Leaseholder Agriculture Auditor Biodiversity Auditor	Ecological monitoring (section 5.2) Strategic Grazing Monitoring – Agricultural audit (section 5.3.2)

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Appendix A – Approval Conditions Relating to Offsets

Table 1 Mount Pleasant Project Approval Conditions relevant to this Offset Management Plan

Approval Condition	Reference
2. The person taking the action must register a legally binding conservation covenant over the Biodiversity Management Areas in the map at Appendix B no later than 6 months prior to commencement of construction. The mechanism must provide enduring protection of no less than: a) 12,875 Ha of White Box – Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland Ecological Community b) 8,475 Ha of suitable habitat for Anthochaera phrygia (regent honeyeater) and Lathamus discolour (swift parrot) c) 8,475Ha of suitable habitat for Dasyurus maculatus maculatus (spotted quoll) d) 8,475 Ha of suitable habitat for Nyctophilus corbeni (greater long-eared bat) (formerly Nyctophilus timoriensis). Note: Offsetting requirements for some species' habitat may be accommodated within the White Box – Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland Ecological Community components it this habitat is verified as present and included specific habitat requirements for each relevant species.	Offset Security (Section 1.1.2)
3. The person taking the action must submit to the Minister for approval an Offset Management Plan for the Biodiversity Management Areas by no later than 31 May 2013, or as otherwise agreed to in writing by the Minister. The Offset Management Plan must contain details of measures to offset the impacts to the White Box—Yellow Box—Blakely's Red Gum Grassy Woodland and Derived Native Grassland Ecological Community, and fauna species identified in condition 2. The approved Offset Management Plan must be implemented.	This Offset Management Plan.
4. The Offset Management Plan must include, but not be limited to, the following information:	
a) a text description and map to clearly define the location and boundaries of the Biodiversity Management Areas. This must be accompanied with the offset attributes and shapefile.	a) Biodiversity Management Areas (Section 2).
b) a detailed survey and description (prior to any management activities, hence a baseline) of the current condition of the extant vegetation of each Biodiversity Management Area. This must be consistent with the State and Transition Model and include, but not be limited to: i) location of survey points (gps reference) ii) vegetation condition mapping iii) photo reference points iv) tree age class representation v) percentage tree canopy cover vi) number of native plant species in ground layer vii) percentage of nativeness of total plant groundcover (herbaceous plants and small shrubs, 1m tall), measured using basal area viii) description of fauna habitat including condition, type and connectivity ix) bird and reptile surveys The detailed description will provide the baseline condition for the purpose of monitoring;	b) Biodiversity Management Areas (Section 2)

Approval Condition	Reference
c) details of the management actions that will improve the baseline condition (referred to in condition 2 (b)), of a minimum of 12,875 Ha within the Biodiversity Management Areas consistent with the State and Transition Model, listing advice and recovery plan for the White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland Ecological Community	c) Conservation Management Strategies (Section 4).
d) management implementation schedules for all Biodiversity Management Areas identifying targeted activities for specific areas to protect and enhance the extent and condition of habitat values of the Biodiversity Management Areas, including but not limited to: i) a map showing areas to be managed ii) type of actions for each areas and details of the methods to be used iii) timing of management activity for each area iv) performance criteria for each area v) a monitoring plan to assess the success of the management activities measured against the baseline condition. The monitoring must be statistically robust and able to quantify change in the condition of White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland Ecological Community. This should include, but not be limited to, control sites, periodic ecological surveys to be undertaken by a qualified ecologist as agreed to in writing by the Minister vi) contingency measures to be implemented if performance criteria are not met vii) a process to report, to the department, the progress of management activities undertaken in the Biodiversity Management Areas and the outcome of those activities, including identifying any need for improved management and activities to undertake such improvement viii) details of the various parties responsible for management, monitoring and implementing the management activities, including their position or status as a separate contractor ix) details of the independent committee review of the Offset Management Plan as set out in the condition 24 Note: Unless otherwise agreed to in writing by the department the baseline surveys must be undertaken between September and November, and monitoring must include September and November	d) Land Management Units (Section 2.4), Conservation Management Strategies (Section 4), and Monitoring Programme (Section 5)
5. Where the person undertaking the action has proposed cropping activities on non-offset areas within the offset properties, a minimum 150m buffer zone surrounding the cropping area must be established in order to protect the proposed offset areas	Sustainable Agriculture (Section 4.7)
6. No cropping activities are to be undertaken within 10m of a tree	Sustainable Agriculture (Section 4.7)
7. The person undertaking the action must submit to the department, as part of the Offset Management Plan identified in condition 3, a map identifying cropping areas and buffer zones	Sustainable Agriculture (Section 4.7) Figure 12
8. Where strategic grazing has been proposed as a management activity, the person undertaking the action must provide, as part of the Offset Management Plan identified in condition 3, details of the proposed grazing activities for each Biodiversity Management Area. This must include: a) objectives b) a map showing areas to be grazed c) details of the grazing methods to be used d) timing including seasons in which grazing will occur, period of grazing and rest period e) proposed stocking rate per season f) monitoring of impacts of grazing including any changes in the condition of vegetation, habitat and weed density.	Strategic Grazing (Section 4.4)
9. Grazing activities must be undertaken in accordance with the guidelines for Strategic Grazing (Rawlings et al., 2010). A minimum sward height of 10cm and 70% groundcover must be maintained at all times on at least 50% of the area to be grazed, as identified in condition 8(b).	Strategic Grazing (Section 4.4).
Note: Condition 5, 6, 7, 8 and 9 must be implemented unless otherwise agreed to in writing by the department	

Appendix B – BMA Biophysical Description

1. Merriwa East and West BMAs

1.1 Climate

The region's climate is greatly affected by topography, elevation and aspect. While the climate is temperate, the proximity of the Liverpool Range to the north causes considerable variation in rainfall, particularly due to summer thunderstorms. Temperatures are highest in December and January, with a 30°C mean monthly maximum and 14°C mean monthly minimum at Cassilis.

A mean annual rainfall up to 660mm is recorded for the Merriwa area, with considerable variation occurring from the lower elevations, which have lower, less reliable rainfall, and the more elevated sites, which receive as much as 850mm annually. To the western boundary, Cassilis has an annual rainfall of 624mm.

The distribution of rainfall is strongly influenced by elevation and proximity to the Liverpool Ranges to the north. Summer thunderstorms have an important bearing on rainfall intensity, with the higher elevations having a higher frequency of intense rainfalls than the lower areas of the Merrriwa plateau. Typically monthly rainfall shows summer dominance, with monthly rainfall in the range of 50-60mm in summer and 30-40mm in winter. The late summer-autumn rainfall is the most variable due to reliance on thunderstorms, and consequently, the risk of erosion and minor flooding is heightened because of the high intensity events.

1.2 Topography/Landform

These BMAs are located on the Merriwa plateau and lie parallel to the Liverpool Range. The landform consists mostly of rolling hills, with scattered basaltic knolls and hillocks rising to moderately steep hills. Slopes range from gently to moderately inclined (5-10%), with slopes from 500-1,500m long. Drainage lines are mostly between 500m -1000m apart and dissect the landscape with southward flowing streams. Alluvial flats and terraces occur on larger streams.

Elevation ranges from 450 to 620 m above sea level.

The long slopes give the area a potentially high erosion hazard, with some severe gully erosion occurring in drainage lines, especially in association with Black earth (basaltic) soils.

The sharp dissected streams, often with rocky outcrops, make access difficult, particularly in the steeper slopes. Access is also often impeded by the high soil clay content, which can be impassable when wet.

1.3 Soils

The Black Earths soils across the Merriwa BMAs are predominantly formed from basalt parent material. The soils have high natural fertility levels, moderate to high water holding capacity and are well drained.

Topsoil's are seasonally cracking or friable, with some surface layers self–mulching and loose. They have silty clay to light medium clay textures that have a hard consistency when dry but are very sticky when wet.

Other characteristics of these soils include: neutral to alkaline pH of the topsoil's, which are often relatively deep (25cm), and the black medium- heavy clay alkaline subsoil's.

Other common soil types include Red Clays (usually on the upper slopes and steep mid-slopes) and Euchrozems (shallow sandy clay loam topsoils overlaying clay loams of moderate fertility) which occur mostly on crests and upper slopes.

Alluvial soils occur along drainage lines which have formed from the accumulation of sediment and tend to be a high flood risk areas.

1.4 Land Use

The Merriwa plateau was dominated by woodlands, which have largely been cleared for agricultural production. The area supports a range of agricultural enterprises. Grazing enterprises are significant, particularly on the land that has limitations for cropping (e.g. slope, stoniness and extent). Beef production (both breeding and fattening) has slowly replaced sheep production as the dominant livestock enterprise.

Cropping of winter cereal crops, canola and some summer crops is limited to the floor of valleys and the Merriwa plateau where the flatter land is more suitable for cultivation. Areas used for cropping are decreasing, with the smaller areas (such as minor alluvial valleys) being used for the growth of forage crops or improved pastures for livestock enterprises.

Across the BMAs, recent land use has been mostly beef cattle grazing, with some sheep and a relatively small amount of cropping with forage crops for livestock fattening. Improved pastures such as Lucerne usually form a rotation on the cropping land, which is mostly on alluvial land or along drainage lines.

Merriwa is a main service town with rail transport facilities. Cassilis (43km to the west) is a small village situated on the Munmurra River.

Coolah Tops National Park is situated to the north/west of Cassilis and the BMAs.

1.5 Vegetation

McRae and Cooper (1985) have mapped four vegetation communities within the Merriwa plateau and all have been characterised by widely spaced trees 8 -15m high, very little to no shrub cover and a ground cover consisting mainly of perennial grass species. The main tree, White Box (*Eucalyptus albens*) / Coastal Grey Box (*E. moluccana*) is an intergrade between two related box species with White Box being found more commonly in the west and Coastal Grey Box to the east in the Hunter Valley (McRae and Cooper 1985). On the Merriwa plains, open woodland of White Box – Yellow Box (*E. melliodora*) and Kurrajong (*Brachychiton populneus)* usually dominated the broad valleys and rounded hills with an altitudinal range from 400–500 ASL and slopes less than 15 degrees.

Native grasses occur over most of the region, becoming the dominant community where clearing has occurred. Plains grass (*Austrostipa aristiglumis*) is common on the areas of Black Earth soils, *Poa sp*. on lighter soils, in protected aspects and along drainage lines in the higher altitudes. Red grass (*Bothriochloa macra*) and blue grass (*Dicanthium sericium*) are also common with kangaroo grass (*Themeda australis)* being limited to areas less intensively grazed.

2. Namoi BMA

2.1 Climate

The region has a dry sub-humid climate. This is a function of its latitudinal location and is influenced by substantial mountain ranges to the east and south. Temperatures are warm to hot in summer, mild in autumn and spring and cold in winter. The average monthly maximum temperatures are highest in January with 31.6°C and lowest in July with 15.7°C.

Frosts may occur between April and September but peak in July.

Rainfall is fairly equally distributed across the year, with slight summer dominance. Summer rain is dominated by storms. Average annual rainfall is 642mm (at Gunnedah Research Centre) with an average of 75 rain days per year.

Soil moisture storage is greatest during the winter and spring periods and least during summer and autumn.

2.2 Topography/Landform

The terrain consists of broad undulating to rolling hills of sandstones and conglomerates. Slopes range from 3-10% but average around 5-6%. Rock outcrops are relatively common.

Crests are broad with moderately long mid-slopes with well incised drainage lines.

Some saline outbreaks occur in deep gully beds and along lower foot-slopes, especially where sub-surface drainage is impeded.

Much of the land has water erosion hazards, with evidence of sheet and gully erosion, particularly in previously cropped areas.

2.3 Soils

The soils vary considerably due to major differences in parent material. The dominant soils are shallow, Red-brown Earths on crests and sideslopes, with moderately deep Red-brown Earths, Yellow Pozolic and Yellow Solodic soils on the lower side-slopes and along drainage lines. Some Black Earths occur on benches and fans along lower side-slopes. Localised areas of rock outcrop and stony soils occur sporadically across the landscape.

Soil limitations include high water erosion hazards and high structural decline hazards, which include hard setting surfaces. Dryland salinity potential is developing on the lower foot-slopes. Soils have localised high erodibilty and stoniness.

The soils are generally of low natural fertility.

2.4 Land Use

The area was inhabited originally by a number of different tribal groups of the Kamilaroi language group. European settlement began in the 1830's and the land was predominantly used for sheep and cattle grazing. In the 1880's cropping became an important land use on the red soils of the area on the foot-slopes and low sandstone hills. As technology became available to cultivate the heavy clays of the basalt slopes and plains in the Gunnedah region, cropping of the more marginal lighter soils on the slopes declined.

Original land clearing and cultivation of slopes have resulted in several soil and landscape related problems including soil erosion, structural decline and dryland salinity in some areas.

The Warrawoona property has been used for grazing and cropping in the past. Recently crops have been restricted to forage crops for livestock and improved pastures.

2.5 Vegetation

Much of the landscape has been largely cleared with the exception of the steep ridges, which retain native woodland.

Common native grass species include Wiregrasses (*Aristida spp*), Spear grasses (*Austrostipa spp.),* red grass (*Bothriocloa decipiens*), love grasses (*Eragrostis spp.*) and others.

Agricultural weeds and introduced pasture plants are also common.

Appendix C – Rapid Condition Assessment

The 'Save the Bush Toolkit' provides a rapid assessment technique which identifies the presence or absence of key habitat components and threatening processes. It is not applicable to all types of native vegetation (eg. native grasslands, wetlands or pastures) but is a quick and reliable way to determine the condition of bushland and woodland communities.

It requires answering true or false to a series of questions and a tally of the "True" scores will tell you how healthy it is. 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 needs 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.

Table 1 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
Total No. True answers (x/20)	18/20

Appendix D – Area of each Ecological Community within LMU Compartments

Table 1 Merriwa East: Area of each Ecological Community and Agriculture within LMU Compartments

LMU Type	Compartment ID	Box Gum Grassy Woodland	Derived Native Grassland	Low Diversity Derived Native Grassland	Other Woodland	Agriculture	Total
2	BR1 (2)	485	331		15	4	834
2	BR11 (2)	114	10			1	125
2	BR12 (2)	194	15				208
2	BR5 (2)	374	85	48	20	8	535
Sub total LMU2		*1,166*	*440*	*48*	*35*	*13*	*1,702*
3	BR10 (3)	34	12			1	47
3	BR13 (3)	12			5	32	49
3	BR2 (3)	330	191		11	14	545
3	BR8 (3)	22			1	85	109
3	BR9 (3)	338	222	8	18	100	685
Sub total LMU3		*735*	*425*	*8*	*35*	*232*	*1,435*
4	BR14 (4)	1			0	12	13
4	BR15 (4)	28	114	37		122	301
4	BR16 (4)	19	6			136	161
4	BR3 (4)	6	4			83	94
4	BR4 (4)	49	0	0	0	62	111
4	BR6 (4)	9	48		4	42	104
4	BR7 (4)	23	8		0	275	307
Sub total LMU4		*134*	*181*	*37*	*5*	*733*	*1,090*
Black Rock Total		*2,035*	*1,047*	*93*	*74*	*978*	*4,228*
2	CP2 (2)	301	67				368
3	CP1 (3)	21	27			0	48
Clare Park Total		*322*	*94*	*0*	*0*	*0*	*416*
2	GR3 (2)	1,332	356	5		3	1,695
3	GR1 (3)	126	71			2	198
3	GR5 (3)	10				8	18
3	GR6 (3)	28	7	0		2	37
3	GR7 (3)	89	115	0		97	302
Sub total LMU3		*253*	*193*	*0*	*0*	*109*	*555*
4	GR2 (4)	17	2			179	199
4	GR4 (4)		0			41	41
4	GR8 (4)	3	1	39		0	43
4	GR9 (4)	36	8	17		46	107
Sub Total LMU4		*56*	*11*	*56*	*0*	*266*	*389*
Gum Ridge Total		*1,641*	*560*	*61*	*0*	*378*	*2,639*
Merriwa East BMA		3,998	1,701	154	74	1,356	7,284

Table 2 Merriwa West: Area of each Ecological Community and Agriculture within LMU Compartments

LMU Type	Compartment ID	Box Gum Grassy Woodland	Derived Native Grassland	Low Diversity Derived Native Grassland	Other Woodland	Agriculture	Total
2	SA11 (2)	326	158	54	15		553
Sub total LMU2		*326*	*158*	*54*	*15*		*553*
3	SA10 (3)	719	357	13	2	3	1,094
3	SA12 (3)	313	277		21		611
3	SA13 (3)	1		2		8	11
3	SA2 (3)					12	12
3	SA3 (3)	0			1	33	34
3	SA4 (3)	517	547	68	0	158	1,291
3	SA5 (3)	358	80	126	3	412	978
3	SA6 (3)	53	50	20	40	176	339
3	SA8 (3)	31	14		3	47	96
3	SA9 (3)	186	59	14			259
Sub total LMU3		*2,179*	*1,384*	*243*	*71*	*848*	*4,725*
4	SA1 (4)	9		45	2	183	239
4	SA7 (4)	12		17		29	58
Sub total LMU4		*21*	*0*	*62*	*2*	*212*	*297*
St Antoine Total		*2,526*	*1,541*	*359*	*88*	*1,060*	*5,575*
2	WA7 (2)	829	152			0	981
Sub total LMU2		*829*	*152*	*0*	*0*	*0*	*981*
3	WA3 (3)	124	177		26	55	383
3	WA4 (3)		1		2	0	4
3	WA5 (3)	1	16		6	31	53
3	WA8 (3)	7	4				11
Sub total LMU3		*131*	*198*	*0*	*35*	*87*	*451*
4	WA1 (4)	7	2		0	65	74
4	WA2 (4)	2	0			56	58
4	WA6 (4)	16	2			18	36
Sub total LMU4		*26*	*3*	*0*	*0*	*139*	*169*
Wahrane Total		*987*	*353*	*0*	*35*	*226*	*1,601*
Merriwa West BMA		3,512	1,894	359	123	1,286	7,176

Table 3 Namoi BMA: Area of each Ecological Community and Agriculture within LMU Compartments

LMU Type	Compartment ID	Box Gum Grassy Woodland	Derived Native Grassland	Low Diversity Derived Native Grassland	Other Woodland	Agriculture	Total
(1)	W4 (1)	113	48		0	3	164
(1)	W6 (1)	149	1		45	1	195
Sub total LMU1		*261*	*49*	*0*	*45*	*4*	*359*
(2)	W1 (2)	44	78			3	125
(2)	W5 (2)	174	46			0	221
Sub total LMU2		*219*	*124*	*0*	*0*	*3*	*345*
(3)	W2 (3)	5	12			65	82
(3)	W3 (3)	33	5		0	156	193
(3)	W9 (3)	2	4			21	27
Sub total LMU3		*39*	*22*	*0*	*0*	*241*	*303*
(4)	W7 (4)	2	14			35	52
(4)	W10 (4)	0	1			23	24
(4)	W8 (4)	2	2			62	66
Sub total LMU4		*5*	*17*	*0*	*0*	*120*	*142*
Warrawoona Total		*524*	*211*	*0*	*45*	*369*	*1,149*
NAMOI BMA		524	211	0	45	369	1,149

Appendix E –Baseline Ecological Monitoring Box Gum Grassy Woodlands Data

Table 1 Comparison of the Baseline Ecological Monitoring Data against the Biometric Vegetation Condition Benchmarks

	LMU	Native plant species richness	Native over-storey cover	Native mid-storey cover	Native ground cover (grasses)	Native ground cover (shrubs)	Native ground cover (other)	No. trees with hollows	Total length fallen logs
Biometric Benchmark		23	10-45	5-60	5-45	2-10	5-35	2	50
Box Gum Grassy Woodlands	1	23	25	6	41	24	6	6	45
	2	22	18	3	55	4	7	2	47
	3	24	12	1	50	3	8	1	10
Derived Native Grassland	2	20	0	3	58	4	7	0	0
	3	15	0	0	51	0	5	0	0

Appendix F – Weed Control Classes

Table 1 Weed Control Classes

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 potentially serious threat to primary production or the environment of a region 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 potentially serious 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 of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its reproduction*
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 exists.

Appendix G – Field Methods for Monitoring Box Gum Grassy Woodlands

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

- **50x20m plot**

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

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

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

- **20x20m quadrat**

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

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

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

- **50m transect**

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

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

Attributes	Measurement units	Sampling units
SPECIES RICHNESS		
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
COMMUNITY STRUCTURE		
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
OVERSTOREY REGENERATION & HEALTH		
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
ADDITIONAL HABITAT FEATURES		
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