

APPENDIX 5 – BIODIVERSITY

Biodiversity Reports



Wilpinjong Coal Mine

2016 Annual Biodiversity Monitoring Report

Prepared for
Wilpinjong Coal Pty Ltd

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Abbreviations

Abbreviation	Description
BOA	Biodiversity Offset Area
DNG	Derived native grassland
ECA	Enhancement and Conservation Area
EIS	Environmental Impact Statement
ELA	Eco Logical Australia
EPBC Act	<i>Environmental Protection and Biodiversity Conservation Act 1999</i>
FL	Fallen Logs
LFA	Landscape Function Analysis
LOI	Landscape Organisation Index
LGA	Local Government Area
ML	Mining Lease
MOP	Mine Operations Plan
MWRC	Mid-Western Regional Council
NGC	Native Ground Cover
NMC	Native Mid-storey Cover
NOS	Native Over-storey Cover
NP	National Park
NPWS	National Parks and Wildlife Service
NR	Nature Reserve
OR	Overstorey Regeneration
NSR	Native Species Richness
PA	Project Approval
SSA	Soil Surface Assessment
TSC Act	<i>Threatened Species Conservation Act 1995</i>
WCBMP	Wilpinjong Coal Biodiversity Management Plan
WCPL	Wilpinjong Coal Pty Ltd
WSGW	Western Slopes Grassy Woodland
WSDSF	Western Slopes Dry Sclerophyll Forest

1 Introduction

Wilpinjong Coal Pty Ltd (WCPL) a wholly owned subsidiary of Peabody Energy Australia Pty Ltd (Peabody), operates the Wilpinjong Coal Mine situated approximately 40 km north-east of Mudgee, within the Mid-Western Regional Council (MWRC) Local Government Area (LGA), in the Western Coalfields of NSW. Project Approval (PA) 05-0021 was granted by the Minister for Planning under Part 3A of the NSW *Environmental Planning and Assessment Act 1979* on 1 February 2006. Modifications have been made to the original PA, with the most recent being Modification 7 approved in October 2016.

The Wilpinjong Coal Biodiversity Management Plan (WCBMP) was prepared to fulfil the requirements of the PA and in accordance with the Environmental Impact Statement (EIS) and Statement of Commitments. The WCBMP details the management strategies, procedures, controls and monitoring programs required to manage the flora and fauna within the Management Domains, which include Enhancement and Conservation Areas (ECAs), Biodiversity Offset Areas (BOAs), and Regeneration and Rehabilitation Areas. The Management Domains are listed below in **Table 1-1-1** with locations shown in **Figure 1**.

Eco Logical Australia (ELA) was engaged by WCPL to undertake biodiversity monitoring of terrestrial flora, fauna and landscape stability in autumn, winter and spring 2016, consistent with the requirements and methods outlined in the WCBMP. This report summarises the results of the biodiversity monitoring undertaken during autumn 2016 (baseline autumn monitoring), winter 2016, and spring 2016 (year 1 spring monitoring), and provides an analysis against the Interim Performance Targets and Completion Criteria set out in the WCBMP. A comparative analysis against the baseline data is included where applicable to inform future monitoring and to promote progress towards achieving the Interim Performance Targets and Completion Criteria.

1.1 Objective

The objective of biodiversity monitoring at WCPL is to ensure that the Management Domains are progressing towards the relevant Completion Criteria. The biodiversity monitoring includes assessment of native vegetation and habitat complexity, landscape stability and fauna diversity (WCPL 2016). Monitoring undertaken during spring 2015 and autumn 2016 represents the baseline data for the Management Domain monitoring sites outlined in the WCBMP. The baseline data will be used to assist with the development of site specific Completion Criteria contained within the WCBMP and to inform ongoing management actions.

Table 1-1: WCPL Management Domains

Management Domain	Area (ha)	Location Description
BOA-D	50.36	Located approximately 12 km north-east of Mining Lease (ML) 1573
BOA-E	160.18	Located approximately 3 km east of ML 1573
ECA-A	180.52	Located approximately 3 km east of ML 1573
ECA-B	224.3	Located in the northern section of the Wilpinjong exploration area, between Wilpinjong
ECA-C	97.29	Located in the southern and eastern portion of the Wilpinjong mine exploration area
Regeneration Area 1	78.98	Located adjacent to the eastern boundary of the approved disturbance area
Regeneration Area 2	90.52	Located on the western side of ECA-A
Regeneration Areas 3, 7 and 8	49.26	Located adjacent to the south and south western boundary of the approved disturbance area
Regeneration Area 4	8.68	Located on the north side of the mine, between the approved disturbance boundary and ECA-B
Regeneration Area 5	29.86	Located towards the western end of ECA-B
Regeneration Area 6	38.54	Located in the western portion of the Wilpinjong exploration lease area
Regeneration Area 9	27.56	Located in the northern part of the Wilpinjong exploration lease
Rehabilitation Areas		Includes areas within the approved disturbance area for the mine, including active and future mining areas, infrastructure areas and rehabilitation of disturbed areas that is undertaken on a progressive basis in accordance with the approved WCPL Mine Operations Plan (MOP)

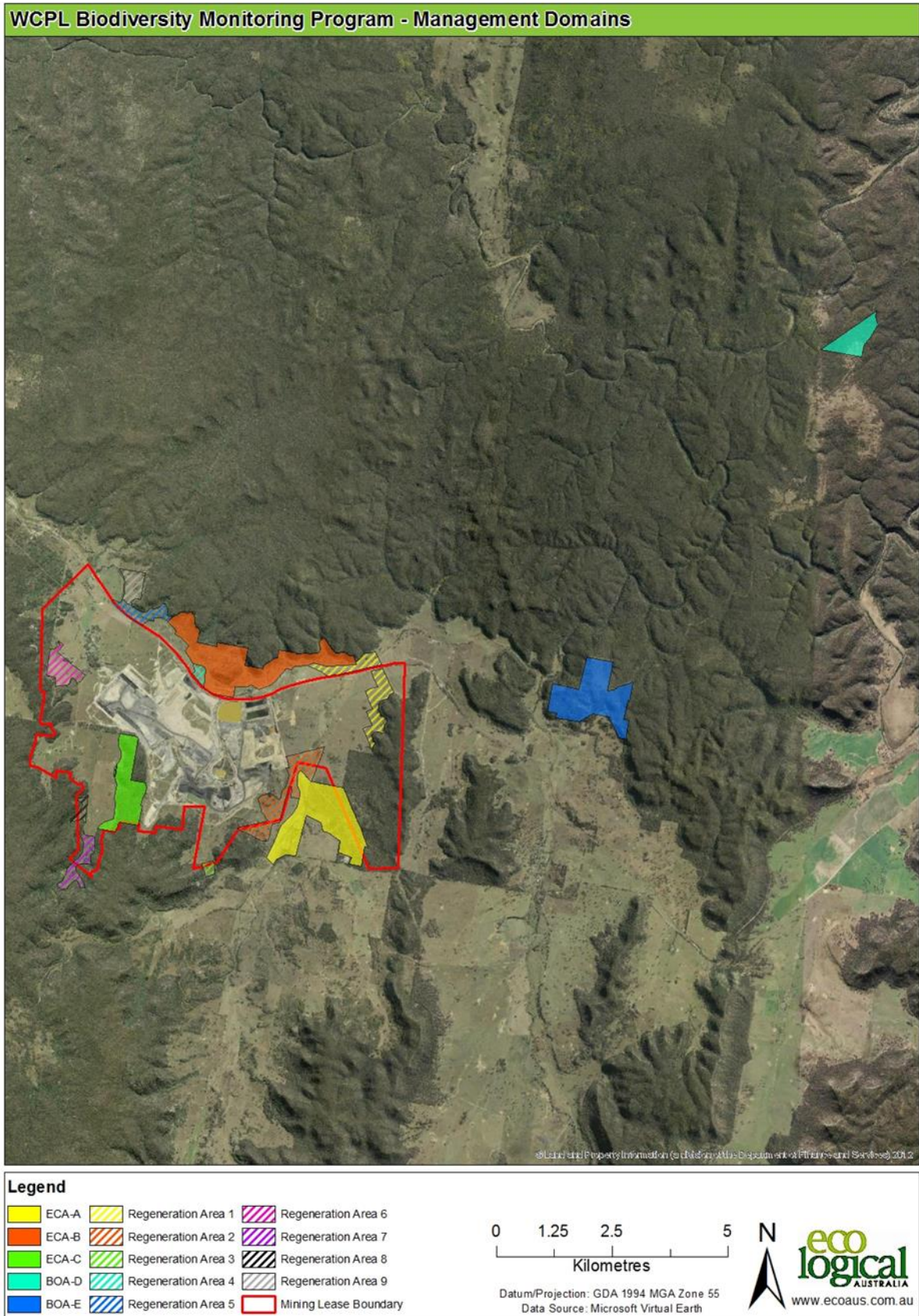


Figure 1: WCPL Management Domains

1.2 Previous monitoring

Biodiversity assessment and monitoring of the Management Domains was undertaken as part of the baseline studies and vegetation community mapping components of the EIS, as well as for the Rehabilitation Areas and ECAs under the rehabilitation monitoring requirements of the MOP. However, this data does not directly correlate with the performance criteria contained in the WCBMP, and therefore is unable to be used to measure the effectiveness of management practices to improve biodiversity values in the Management Domains,

The monitoring program outlined in the WCBMP commenced in spring 2015. Monitoring undertaken during 2016 was consistent with the methods and approach described in the 2015 spring monitoring report (ELA 2016) and the WCBMP.

1.3 Assessment against Interim Performance Targets

The WCBMP outlines Interim Performance Targets that will be used to determine progression towards the Completion Criteria and overall mine closure objectives. The Interim Performance Targets provide ongoing targets against which the progression of rehabilitation and regeneration activities can be assessed against over time. The Completion Criteria will be used to assess the success of establishment of rehabilitation and regeneration areas against the proposed final land use.

1.3.1 Vegetation

The WCBMP defines Interim Performance Targets and Benchmark values (Completion Criteria) for low, moderate to good and high condition vegetation within each of the Keith Vegetation Classes (Western Slopes Dry Sclerophyll Forest (WSDSF) and Western Slopes Grassy Woodland (WSGW)).

Within this monitoring report, Interim Performance Targets for year 0 (baseline, autumn) and years 1-5 (spring) have been used to assess the performance of individual floristic monitoring sites and to evaluate progress towards achieving benchmark condition. A colour coding system has been applied to all the Management Domain site attributes results, whereby:

- GREEN indicates site attributes that have met the relevant Interim Performance Target (no additional management intervention required);
- AMBER indicates site attributes that have not met the relevant Interim Performance Target, but are within 50 - <100% of the Interim Performance Target and do not show a substantial decrease compared to the previous year's monitoring results (monitor closely, management intervention may be required); and
- RED indicates site attributes that are <50% of the relevant Interim Performance Target or show a substantial decline compared to the previous year's monitoring results (management intervention required)

A "substantial decline" is defined as a relative decline of 50% or greater compared to the previous year's results (e.g. a decline from a value of 20 to a value of 10 or less).

This colour coding and scoring system is to be reviewed annually.

Reference sites were assessed against the relevant Benchmark values, utilising the same colour coding system described above (replacing reference to Interim Performance Targets with Benchmark values).

1.3.2 Landscape Function Analysis

The WCBMP defines Completion Criteria for a self-sustaining landform as achievement of a score of 50 or more for each Soil Surface Assessment (SSA) Index. A ranking system has been applied in this

report, with sites obtaining an SSA Index score of 50 or above (thereby meeting the Completion Criteria) colour coded green, and sites with a SSA score of less than 50 colour coded red. The WCBMP further states that incremental improvement (an increase of five or more index points annually) is anticipated, with achievement of Completion Criteria by Year 10. Where sites did not achieve the Completion Criteria score of 50 for a particular SSA index, the changes in this index from spring 2015 to spring 2016 have been assessed against the predicted annual increase. In these cases, sites that achieved the target increase of five points or more within an SSA index are colour coded green, and sites that did not achieve this annual increase are colour coded red.

2 Methodology

The autumn, winter and spring 2016 biodiversity monitoring program was undertaken in accordance with the methods and survey techniques prescribed in the WCBMP. As per the requirements of the WCBMP, the biodiversity monitoring program was comprised of the following components:

- Vegetation (floristic) monitoring
- Landscape stability monitoring using Landscape Function Analysis (LFA)
- Terrestrial fauna monitoring

Weather conditions during the autumn and spring 2016 monitoring are presented in **Appendix A**.

Additional information on all vegetation, LFA and fauna monitoring sites can be found in **Appendix B**.

2.1 Vegetation monitoring (BioMetric)

Autumn vegetation monitoring was undertaken from 11 to 21 April 2016 by ELA ecologists Sarah Dickson-Hoyle, Cassandra Holt and Mitchell Scott. Spring vegetation monitoring was undertaken between 31 August and 12 September 2016 by ELA ecologists David Allworth, Sarah Dickson-Hoyle, Cassandra Holt, Tomas Kelly and Jessica Southgate. The locations of vegetation monitoring sites are shown in **Figure 2**, **Figure 3** and **Figure 4**.

Monitoring in autumn 2016 involved the establishment and baseline monitoring of 30 vegetation monitoring sites. In addition, Rehabilitation sites R6 and R9, which had been monitored as part of previous monitoring programs, were also monitored. Monitoring in spring 2016 was the second round of monitoring conducted at the 36 sites previously established in spring 2015.

A total of 68 vegetation sites were monitored in 2016, including 25 reference sites.

Vegetation monitoring was undertaken utilising the method of plot assessment outlined in the Biobanking Assessment Methodology (OEH 2014) and prescribed in the WCBMP. Permanent BioMetric plots, comprising a 20 m x 20 m (0.04 ha) plot nested within a 20 m x 50 m plot, were established in spring 2015 and autumn 2016 and were monitored in accordance with the methods described in Section 9.1 of the WCBMP. Within each plot, the following data was collected:

- native species richness, cover and abundance within 20 m x 20 m plot;
- native and exotic tree cover and native mid-storey cover – at regular 5 m intervals along 50 m transect (10 points);
- native ground (grass, shrub, other) and exotic cover – at regular 1 m intervals along 50 m transect (50 points); and
- habitat features (number of trees with hollows, length of fallen logs) and proportion of over-storey species regeneration – within 20 m x 50 m plot.

Monitoring sites were permanently marked with star pickets at either end of the 50 m transect, and the start and end coordinates of the transect logged with a handheld GPS.

All vascular plants species were recorded and identified to the lowest taxonomic level possible, with samples of unknown species collected for further identification.

2.2 Landscape Function Analysis

LFA monitoring was undertaken from the 30 August to 12 September 2016 and 16 November 2016 by ELA ecologists David Allworth, Sarah Dickson-Hoyle, Cassandra Holt, Tomas Kelly, Lorraine Parish and Jessica Southgate. LFA monitoring was undertaken in accordance with the methods prescribed in Tongway and Hindley (2005) and the WCBMP.

LFA monitoring was undertaken at 22 previously established monitoring sites and one newly established monitoring site. The newly established site (Ref_13b) was established in spring 2016 to replace the formerly assessed Ref_13, which had been subject to a National Parks and Wildlife Service (NPWS) hazard reduction burn in autumn 2016 and was therefore no longer considered to be a suitable reference site.

In total, LFA assessments were undertaken at 23 monitoring sites: 13 within WCPL Management Domains and 10 reference sites within the NPWS estate (**Figure 2, Figure 3, Figure 4 and Figure 5**).

At each LFA site, a 50 m transect line was established downslope between transect start and end markers. The majority of LFA transects directly correspond to the 50 m BioMetric transect of the respective monitoring site. However, at a number of sites the LFA transect does not align with the BioMetric transect, predominantly due to the BioMetric transect being established across slope rather than downslope in these locations. Along each LFA transect, LFA attributes were assessed to monitor the Landscape Organisation Index (LOI) and Soil Surface Assessment (SSA).

2.2.1 Landscape organisation index

Landscape organisation characterises and maps the spatial patterns of resource loss or accumulation at a site. The data that was collected recorded the patch/inter-patch parameters along each transect.

According to the LFA method, patches are long-lived/term features that obstruct or divert water flow and/or collect/filter out material from runoff and where there is evidence of resource accumulation. Inter-patches are zones where resources such as water, soil materials and litter may be mobilised and freely transported either down slope when water is the active agent or down-wind when Aeolian processes are active.

The following data was recorded for each patch/inter-patch along each transect:

- the distance (m) from the start of the transect;
- the patch width (cm); and
- the patch/inter-patch identification.

The following patch types were defined and monitored across all monitoring sites and monitoring periods (spring 2015 and spring 2016):

- Bare soil
- Litter (including annual plants)
- Rock (<5 cm diameter)
- Log (>10 cm diameter)
- Ground cover (perennial)
- Shrub/Tree
- Cryptogam
- Any combinations of the above (e.g. Ground Cover – Litter patch)

2.2.2 Soil surface assessment

Each patch/inter-patch type identified in the landscape organisation data log was subject to a SSA. A subset of up to five occurrences of each patch/inter-patch type were monitored, and the following SSA attributes measured:

- Rain splash protection
- Perennial vegetation cover
- Structural classification of vegetation, including the height of each canopy layer
- Litter
- Cryptogam cover
- Crust brokenness
- Soil erosion type and severity
- Deposited materials
- Soil surface roughness
- Surface nature (resistance to disturbance)
- Description of ephemeral drainage lines
- Slake test
- Soil texture

Each of these parameters was assigned a simple score in the field. Data were entered into the LFA calculation spreadsheets and used to calculate Stability, Infiltration and Nutrient Cycling Indices.

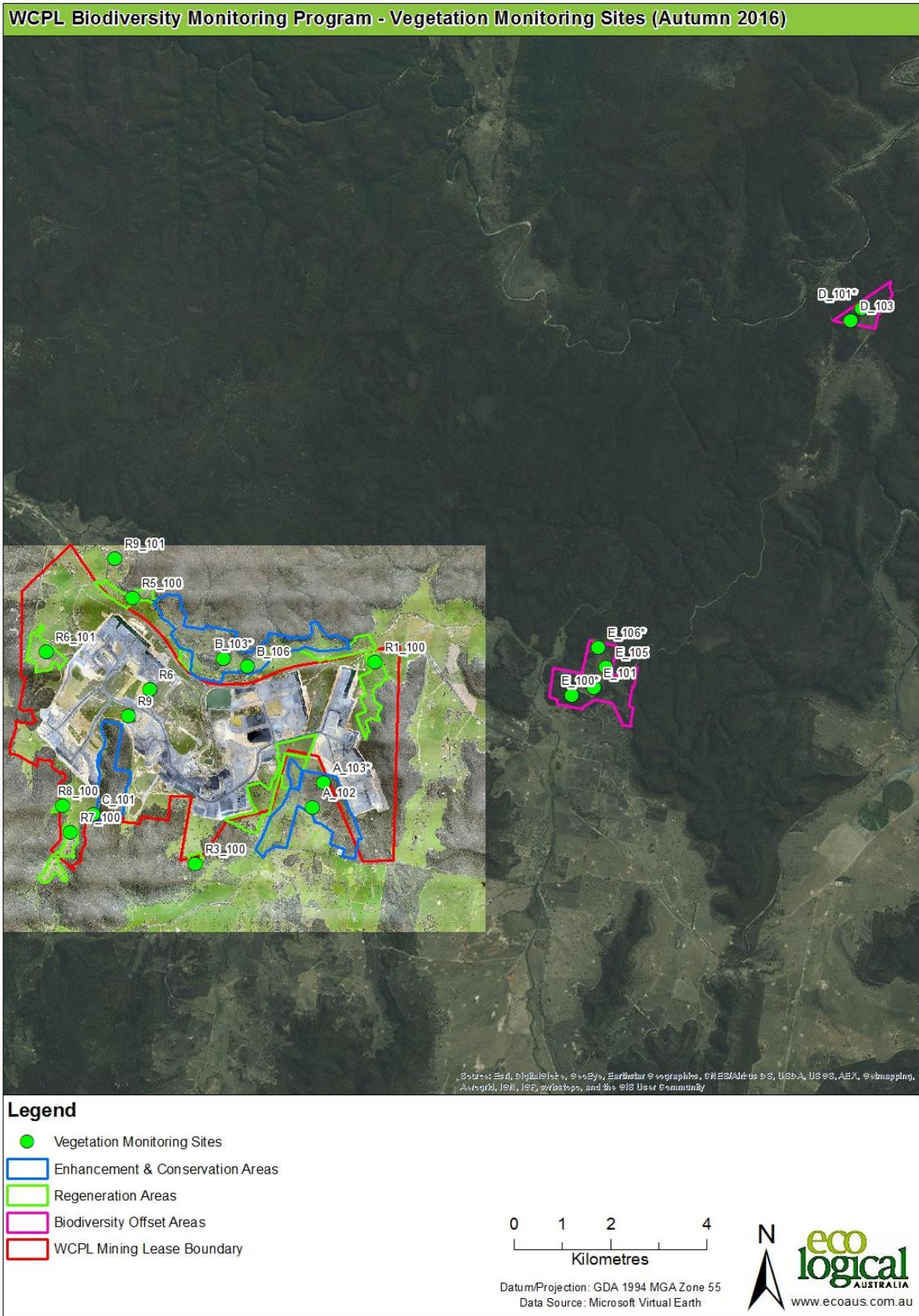


Figure 2: Autumn 2016 vegetation and LFA monitoring sites

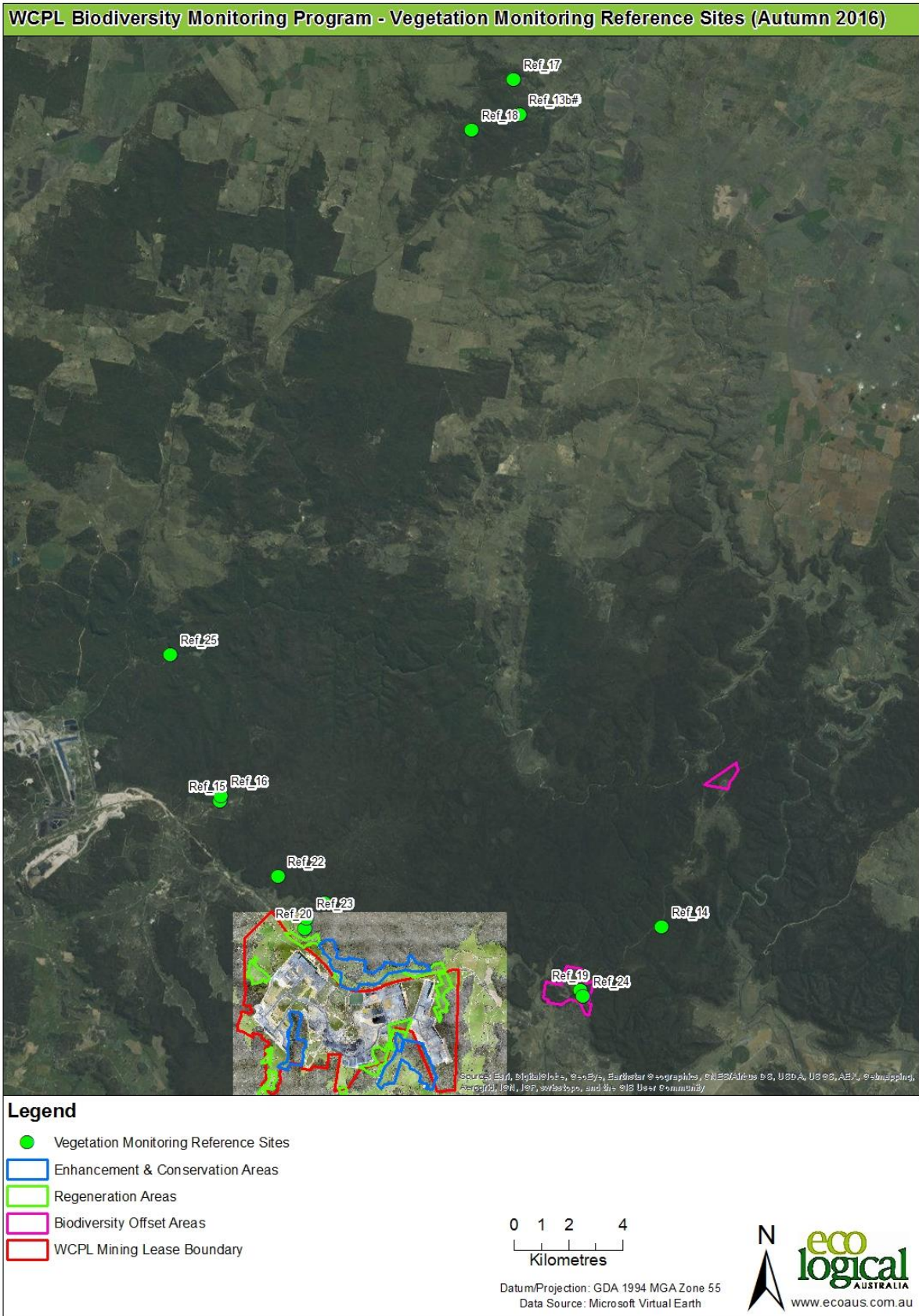


Figure 3: Autumn 2016 vegetation and LFA reference sites

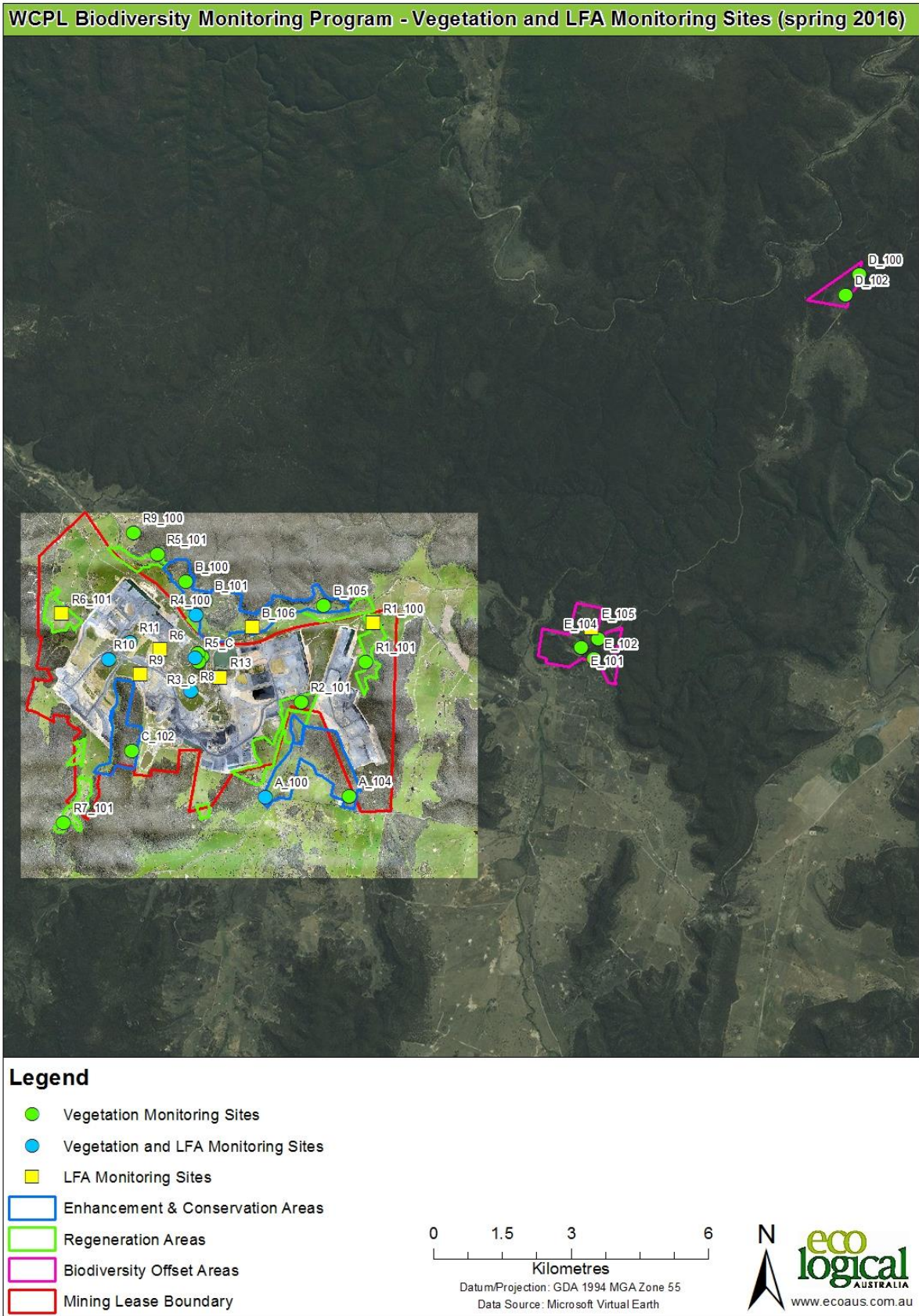


Figure 4: Spring 2016 vegetation and LFA monitoring sites

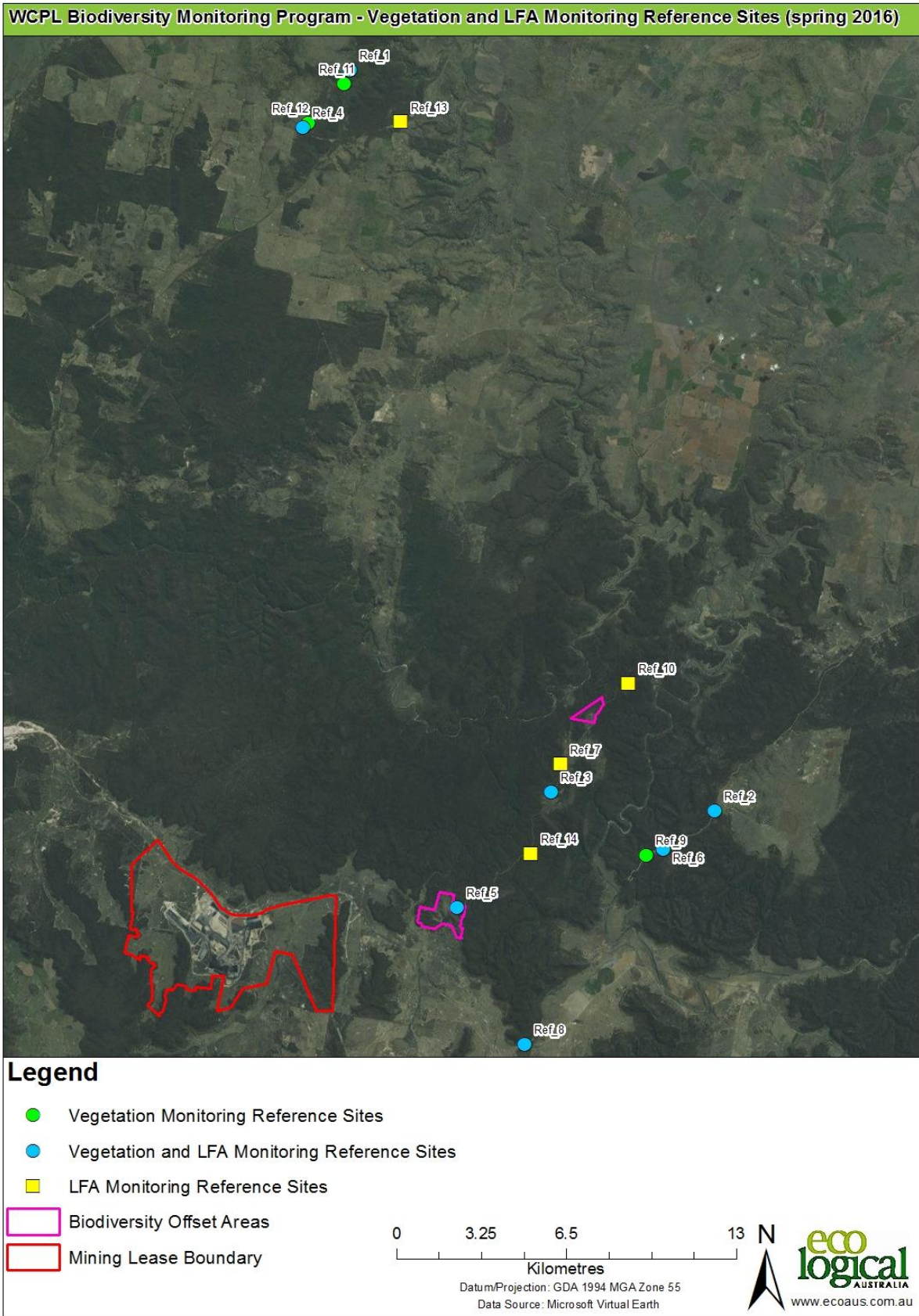


Figure 5: Spring 2016 vegetation and LFA reference sites

2.3 Fauna monitoring

2.3.1 Winter bird monitoring

Winter bird monitoring was conducted at 25 general fauna monitoring sites from 4 to 10 July 2016 by ELA ecologists Cassandra Holt and Daniel McKenzie. The objectives of the bird survey were to determine the presence of two species (*Anthochaera phrygia* (Regent Honeyeater) and *Lathamus discolor* (Swift Parrot)), both listed as either critically endangered or endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the NSW *Threatened Species Conservation Act 1995* (TSC Act). These species feed on the blossoms of winter-flowering eucalypts and lerps. Data for other bird species' distribution were also gathered during the winter bird survey.

Winter bird monitoring utilised the bird monitoring methods described in ELA (2016) for the spring 2015 monitoring.

2.3.2 Spring fauna monitoring

Spring fauna monitoring was undertaken from 29 August to 16 September 2016, with additional monitoring occurring from 24 to 28 November. The surveys were conducted by ELA ecologists Cassandra Holt, Daniel McKenzie and Tomas Kelly.

Table 2-1 below outlines the methodology and survey effort for each target species, and is based upon the methods prescribed within the WCBMP. The WCBMP requires that 26 general fauna monitoring sites should be established to target birds and ground fauna (amphibians, ground mammals and reptiles) within the WCPL Management Domains. However, operational restrictions and poor weather conditions prevented all 26 general fauna monitoring sites from being surveyed. The monitoring program was therefore reduced to 21 general fauna monitoring sites, four sites only targeting birds, and six reference sites targeting microbats. This is consistent with the methods for the 2015 spring monitoring. The locations of these 21 fauna monitoring sites are shown in **Figure 6** and **Figure 7**.

Microbat monitoring was undertaken at five general fauna monitoring sites during spring 2016, as required by the WCBMP (**Table 2-1**). In addition, baseline microbat monitoring was undertaken at six reference sites; spring 2016 represented the first season of microbat monitoring at these six sites. Anabat analysis was undertaken by ELA ecologist Rodney Armistead.

Opportunistic fauna sightings, including fauna evidence such as scats or tracks, were also recorded across all fauna monitoring sites.

Table 2-1: Fauna monitoring methods summary

Target species	Fauna site	Methodology	Total Survey Effort
Birds	General fauna	Bird census consisting of 10 minutes recording all birds seen/heard within 50 m radius of central plot point, and further 10 minutes recording all birds seen/heard within balance of a 2 ha plot.	80 minutes per site (20 minutes per survey, per person, per site), over one morning and one afternoon (25 sites)
Ground fauna (amphibians, mammals, reptiles)	General fauna	Pit fall/funnel trap line of 30 m drift fence and five 20 L buckets/10 funnel traps spaced 5 m apart covering both sides of the drift fence.	Twice daily inspections of traps (morning and afternoon) for five days/four nights (25 sites)
Bats	Bat	Automated ultrasonic acoustic recording	Recording for 2 Anabat nights

Target species	Fauna site	Methodology	Total Survey Effort
		(Anabat) to identify all bat species occurring.	(6pm – 6am) (11 sites)
All	Opportunistic	Any sightings of fauna recorded whilst moving throughout the Project Area and located using a GPS.	Opportunistic
Mammals	Opportunistic	Opportunistic collection of scats and observations of tree scratching's, animal tracks and paw prints.	Opportunistic

2.3.3 Indicator species analysis

Birds and microbats are common and diverse throughout Australia. Due to the ease of surveying birds and microbats, they are regularly a focus of monitoring surveys and are analysed as an indicator of biodiversity. For this reason, total bird and microbat assemblages, as well as indicator species, were surveyed and analysed during the 2016 spring monitoring.

A suite of indicator bird species were identified and used to assess the habitat quality at each site. Of the two bird indicator analyses carried out, the first analysis examines the richness of indicator species (both derived native grassland (DNG) and woodland/forest) in each DNG site. This was compared with the richness of DNG indicator species, and the richness of woodland/forest indicator species that occurred in each corresponding woodland/forest analogue site.

The second analysis utilised the same methodology and serves the same purpose as the first, but uses indicator species abundance data instead of indicator species richness data. Conducting the same analyses using two different units of measurement helps paint a more holistic picture of the environment we are monitoring. For this reason, both analyses should be interpreted together.

This process was repeated with microbats.

Bird indicator species identified as effective indicators of either woodland/forest or regeneration/revegetation DNG are listed in **Table 2-2**. Microbat indicator species identified as effective indicators of either woodland or DNG are listed in

Table 2-3.

Table 2-2: Key bird species

Scientific Name	Common Name	Strongest Habitat Association
<i>Cracticus nigrogularis</i>	Pied Butcherbird	DNG
<i>Anthus novaeseelandiae</i>	Australasian Pipit	DNG
<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill	DNG
<i>Platycercus eximius</i>	Eastern Rosella	DNG
<i>Manorina melanocephala</i>	Noisy Miner	DNG
<i>Cormobates leucophaea</i>	White-throated Treecreeper	Woodland/Forest
<i>Colluricincla harmonica</i>	Grey Shrike-thrush	Woodland/Forest
<i>Eopsaltria australis</i>	Eastern Yellow Robin	Woodland/Forest
<i>Acanthiza nana</i>	Yellow Thornbill	Woodland/Forest
<i>Acanthiza reguloides</i>	Buff-rumped Thornbill	Woodland/Forest

Table 2-3: Key microbat species identified as effective indicators of either woodland or DNG

Scientific Name	Common Name	Strongest Habitat Association
<i>Austronomus australis</i>	White-striped Free-tailed Bat	DNG
<i>Mormopterus planiceps</i>	South-eastern Free-tailed Bat	DNG
<i>Chalinolobus morio</i>	Chocolate Wattled Bat	Woodland/Forest
<i>Rhinolophus megaphyllus</i>	Eastern Horseshoe Bat	Woodland/Forest

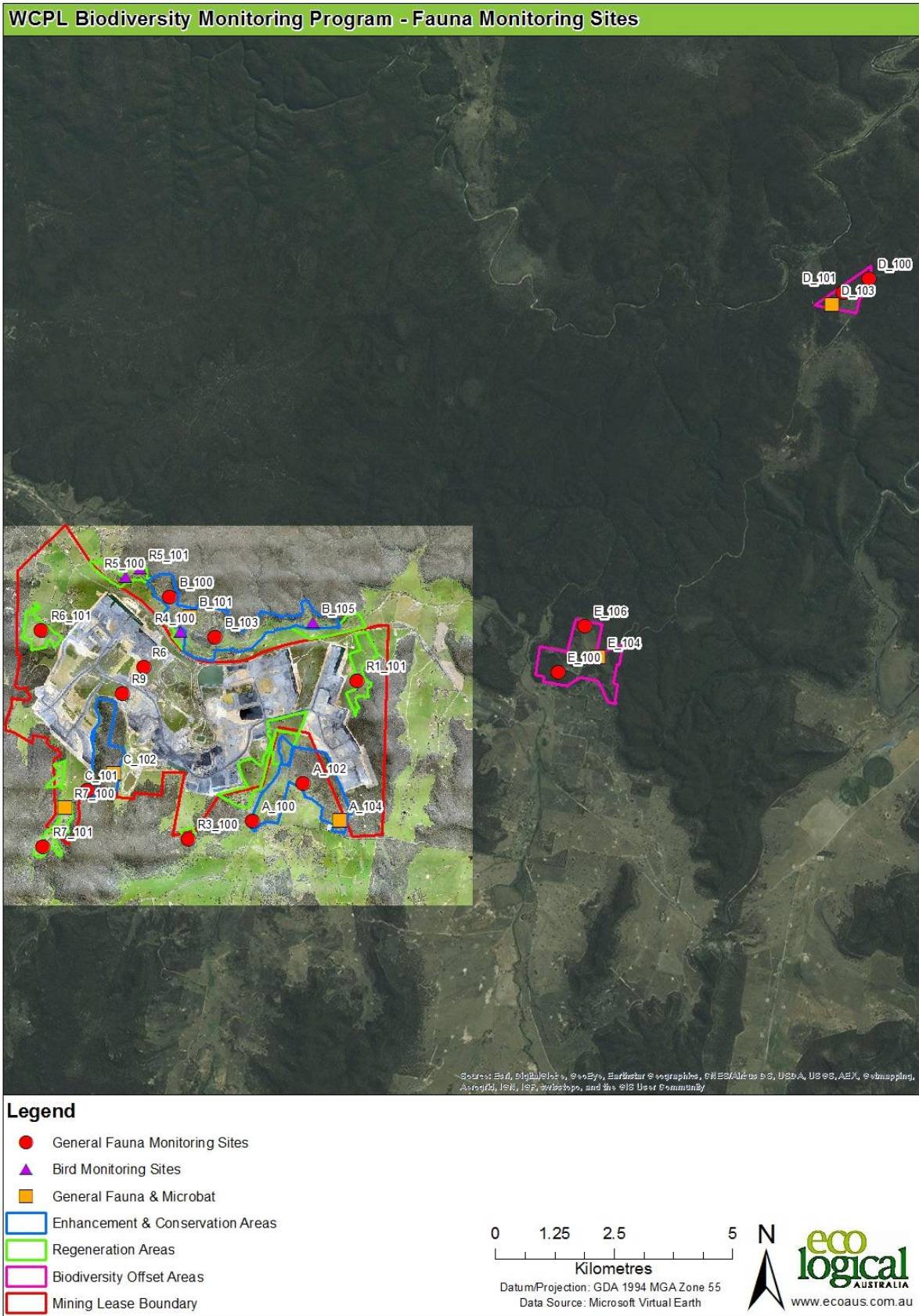


Figure 6: Spring 2016 fauna monitoring site locations

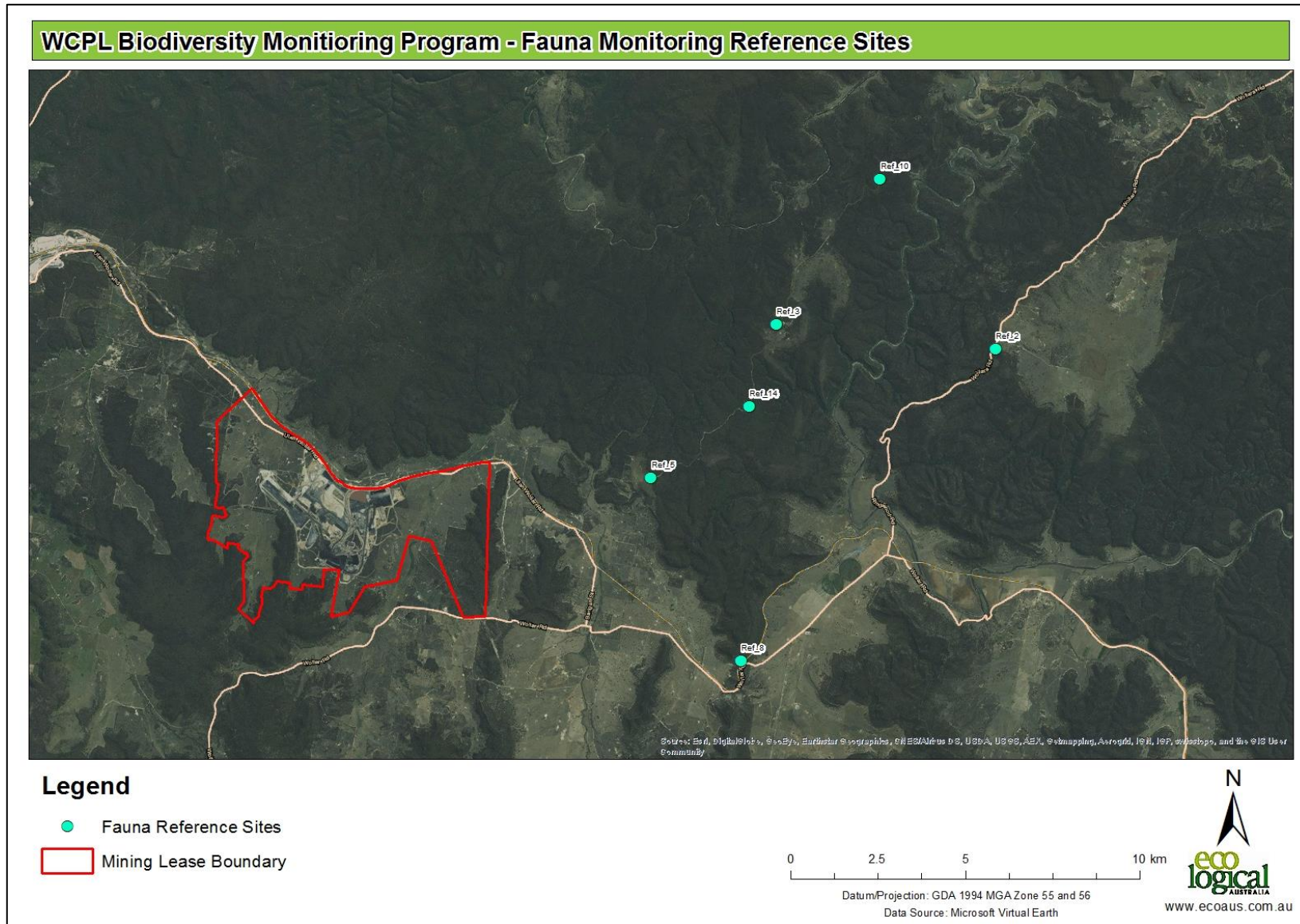


Figure 7: Spring 2016 fauna reference sites

3 Results and Discussion

This section presents the results from autumn 2016 vegetation monitoring, winter 2016 bird monitoring, and spring 2016 vegetation, LFA and fauna monitoring. Results are compared against the previous year's monitoring results (for spring results), and assessed against Interim Performance Targets or Benchmark Targets in order to evaluate trends and progress towards achieving Completion Criteria, as set out in the WCBMP.

Vegetation monitoring results are presented and discussed collectively for all Management Domains. LFA and fauna monitoring results are presented and discussed individually for each of the BOA, ECA, Regeneration and Rehabilitation Management Domains.

3.1 Vegetation monitoring

A total of 423 flora species were recorded across the WCPL Management Domains and Reference sites during autumn and spring 2016, consisting of 318 native species, 97 exotic species, and eight species unable to be identified as either native or exotic. A full list of all flora species recorded during autumn 2016 and spring 2016 surveys is included in **Appendix C**.

Native species richness ranged from four species (A_100) to 57 species (Ref_10), with Reference sites, on the whole, containing a higher native species richness compared to sites within Management Domains. However, a number of sites located within remnant native vegetation within the BOAs and ECAs also recorded a notably high native species richness. These included A_104 (39 species), B_100 (38 species), B_103 (38 species) and C_102 (51 species).

The native species richness recorded across the Management Domain sites reduced from spring 2015 to spring 2016, however a similar pattern was seen across the Reference sites over the same time period.

Exotic species richness was highest in Rehabilitation sites (14-19 exotic species within each site). The exotic species richness recorded across the Management Domains reduced from spring 2015 to spring 2016.

Three species declared as Noxious Weeds within the MWRC LGA were recorded across 20 sites within the Management Domains in 2016. These declared noxious weeds and their site locations are presented in **Table 3-1** (below).

Table 3-1: Declared noxious weeds recorded in 2016

Scientific name	Common name	Site	Management Domain
<i>Heliotropium amplexicaule</i>	Blue Heliotrope	E_104	BOA
<i>Rosa rubiginosa</i>	Sweet Briar	R1_C	Rehabilitation Area
<i>Hypericum perforatum</i>	St John's Wort	E_102, E_104, E_105, E_106	BOAs
		B_105, B_106	ECAs
		R1_100, R4_100, R5_100,	Regeneration Areas

Scientific name	Common name	Site	Management Domain
		R5_101, R7_100, R7_101, R8_100, R9_100, R9_101	
		R10, R11, R1_C, R2_C, R5_C	Rehabilitation Areas

3.1.1 Vegetation structure

Vegetation structure data recorded at the monitoring sites in autumn 2016 and spring 2016 (dominant species, height range and percentage foliage cover for all vegetation strata) are presented in **Appendix D**.

Floristic sites within both regenerating and intact native vegetation in the BOAs show a relatively high level of structural complexity, with native species present in multiple strata, and often a well developed upper canopy. However, close to half of the ECA monitoring sites (those identified as “regeneration” within the WCBMP) have no upper strata or mid-storey.

Only one Regeneration and two Rehabilitation Area sites contain an upper canopy of eucalypt species. These two Rehabilitation sites (R1_C and R2_C) are located within 2008 woodland rehabilitation, the oldest stage of rehabilitation within the WCPL Rehabilitation Domain. An additional two Rehabilitation sites (R6 and R9) contain *Eucalyptus* species in the mid-storey, along with various *Acacia* species.

All Rehabilitation sites have a ground cover dominated by exotic species, predominantly the perennial pasture species *Eragrostis curvula* (Consol Love Grass), *Phalaris aquatica* (Phalaris) and *Digitaria eriantha* (Premier Digit). While all Regeneration sites contained exotic species in the ground cover (often in moderately high to high covers of abundances) the majority of Regeneration sites had a predominantly native ground cover. Ground cover in these sites predominantly consisted of native perennial grass species that are indicative of a history of grazing and agricultural disturbance, such as *Aristida* species and *Bothriochloa macra* (Red Grass).

3.1.2 Assessment against Interim Performance Targets

Tables 3-2 to 3-5 (below) present the performance of the monitoring sites across each Management Domain (BOAs, ECAs, Regeneration and Rehabilitation Areas) and Reference sites, in relation to the Interim Performance Targets and Benchmark Targets (respectively) for each Keith Vegetation Class as per the BMP. Vegetation condition scores are based on the autumn 2016 and spring 2016 BioMetric site attribute results.

Table 3-2: Assessment against Interim Performance Targets - autumn 2016

Management Domain	Vegetation Community	Site	Site attributes (% cover)											
			Vegetation condition	SVS	NSR	NOC	NMS	NGCG	NGCS	NGCO	EC	NTH	OR	FL (M)
BOA	WSDSF	D_101	MOD-GOOD	46	28	13	1	28	6	32	0	1	1	30
	WSDSF	D_103	MOD-GOOD	39	23	5	28	14	78	0	0	0	1	0
	WSDSF	E_100	MOD-GOOD	53	31	21	0	4	24	8	0	0	1	82
	WSGW	E_105	LOW	21	14	0	0	88	0	4	0	0	0	0
	WSGW	E_106	MOD-GOOD	38	23	0	0	84	0	20	0	0	1	5
ECA	WSGW	A_102	MOD-GOOD	37	16	0	14	56	38	0	2	0	1	0
	WSGW	A_103	MOD-GOOD	48	31	14	0	38	26	6	0	0	0.66	21
	WSDSF	B_103	MOD-GOOD	44	38	24	0	12	8	6	0	0	0	21
	WSGW	B_106	LOW	20	14	0	0	32	0	32	20	0	0	0
	WSDSF	C_101	LOW	14	14	0	0	96	0	1	18	0	0.33	2
Regeneration Areas	WSGW	R1_100	LOW	15	8	0	0	10	0	0	64	0	1	0
	WSDSF	R3_100	LOW	15	15	0	0	50	0	0	32	0	1	0
	WSGW	R5_100	LOW	17	12	0	0	72	0	0	16	0	0	0
	WSGW	R6_101	LOW	8	8	0	0	54	0	0	38	0	0	0
	WSGW	R7_100	LOW	17	5	0	0	2	0	44	46	0	1	0
	WSDSF	R8_100	LOW	7	9	0	0	54	0	0	48	0	0	0
	WSGW	R9_101	LOW	27	29	0	0	62	0	10	28	0	0	0
Rehabilitation Areas	WSDSF	R6	LOW	26	28	0	10.1	42	0	4	20	0	0	0
	WSDSF	R9	LOW	8	12	0	0	2	2	18	74	0	0	0

SVS = Site Value Score, NSR = Native Plant Species Richness, NOC = Native Over-storey Cover, NMC = Native Mid-storey Cover, NGCG = Native Ground Stratum Cover (grasses), NGCS = Native Ground Stratum Cover (shrubs), NGCO = Native Ground Stratum Cover (other), EC = Exotic Plant Cover, NTH = Number of Trees with Hollows, OR = Over-storey Regeneration and FL = Total Length of Fallen Logs

Table 3-3: Assessment against Interim Performance Targets - spring 2016

Management Domain	Vegetation Community	Site	Site attributes (% cover)											
			Vegetation condition	SVS	NSR	NOC	NMS	NGCG	NGCS	NGCO	EC	NTH	OR	FL (M)
BOA	WSDSF	D100	MOD-GOOD	63	33	8.3	10.3	4	2	46	0	2	0	65
	WSGW	D102	LOW	33	36	1.7	0	30	2	58	16	0	0	18
	WSDSF	E101	MOD-GOOD	40	33	1.5	11.2	40	0	12	6	0	0.66	0
	WSGW	E102	LOW	7	7	0	0	24	0	0	76	0	0	0
	WSGW	E104	MOD-GOOD	44	17	11	0	40	0	10	10	0	1	36
ECA	WSGW	A100	LOW	10	4	0	0	82	0	0	18	0	0	0
	WSGW	A104	MOD-GOOD	59	39	2.2	14	38	0	6	8	0	1	95
	WSGW	B100	MOD-GOOD	38	38	19	2	8	4	4	22	0	0.33	0
	WSGW	B101	LOW	27	23	0	0	36	0	16	22	0	0	0
	WSDSF	B105	LOW	8	7	0	0	12	0	6	80	0	0	0
	WSGW	C102	MOD-GOOD	55	51	13.5	0.5	0	8	2	0	0	1	30
Regeneration Area	WSGW	R1_101	LOW	17	22	0	0	32	0	16	36	0	0	0
	WSGW	R2_101	LOW	15	15	0	0	32	0	0	60	0	0	0
	WSGW	R4_100	LOW	9	5	0	0	2	0	44	46	0	0	0
	WSDSF	R5_101	LOW	7	9	0	0	54	0	0	48	0	0	0
	WSDSF	R7_101	LOW	26	29	0	0	62	0	10	28	0	1	0
	WSDSF	R9_100	LOW	26	28	0	10.1	42	0	4	20	0	0	0
Rehabilitation Area	WSDSF	R1_C	LOW	16	16	1.1	5.2	0	0	2	86	0	0	0
	WSDSF	R5_C	LOW	8	12	0	0	2	2	18	74	0	0	0
	WSGW	R8	LOW	8	9	0	0	6	0	12	70	0	0	0
	WSGW	R10	LOW	16	16	0	0	4	4	1	54	0	0	23
	WSGW	R11	LOW	16	13	0	0	0	0	24	38	0	0	0
	WSDSF	R2_C	LOW	16	21	6.2	2.6	0	4	0	80	0	0	0
	WSDSF	R3_C	LOW	7	14	0	0	0	12	0	84	0	0	0

SVS = Site Value Score, NSR = Native Plant Species Richness, NOC = Native Over-storey Cover, NMC = Native Mid-storey Cover, NGCG = Native Ground Stratum Cover (grasses), NGCS = Native Ground Stratum Cover (shrubs), NGCO = Native Ground Stratum Cover (other), EC = Exotic Plant Cover, NTH = Number of Trees with Hollows, OR = Over-storey Regeneration and FL = Total Length of Fallen Logs

Table 3-4: Reference sites assessment against Benchmark Targets - autumn 2016

Management Domain	Vegetation Community	Site	Site attributes (% cover)											
			Vegetation condition	SVS	NSR	NOC	NMS	NGCG	NGCS	NGCO	EC	NTH	OR	FL (M)
Reference Sites	WSDSF	Ref_13b	MOD-GOOD	56	37	26	0	20	8	22	0	2	0.50	0
	WSDSF	Ref_14	MOD-GOOD	61	32	5	1	2	6	34	0	6	0.80	34
	WSGW	Ref_15	MOD-GOOD	57	21	17	0	34	0	4	0	5	0.00	54
	WSGW	Ref_16	HIGH	71	35	17	0	28	0	4	0	4	0.50	28
	WSGW	Ref_17	HIGH	71	28	14	0	42	0	40	1	7	0.25	68
	WSGW	Ref_18	HIGH	80	32	24	1	46	0	20	0	5	0.50	75
	WSGW	Ref_19	MOD-GOOD	68	20	13	0	46	0	4	1	2	1	28
	WSDSF	Ref_20	MOD-GOOD	57	24	27	1	2	4	2	0	4	0.33	48
	WSDSF	Ref_21	MOD-GOOD	67	20	23	0	30	0	12	0	5	0.50	90
	WSDSF	Ref_22	MOD-GOOD	61	22	34	1	36	0	6	0	2	0.50	175
	WSGW	Ref_23	NO DATA	ND	25	ND	ND	ND	ND	ND	ND	ND	ND	ND
	WSGW	Ref_24	HIGH	93	34	24	5	30	4	4	0	3	0.66	251
	WSGW	Ref_25	MOD-GOOD	68	29	32	1	60	0	48	0	1	0.50	40

SVS = Site Value Score, NSR = Native Plant Species Richness, NOC = Native Over-storey Cover, NMC = Native Mid-storey Cover, NGCG = Native Ground Stratum Cover (grasses), NGCS = Native Ground Stratum Cover (shrubs), NGCO = Native Ground Stratum Cover (other), EC = Exotic Plant Cover, NTH = Number of Trees with Hollows, OR = Over-storey Regeneration and FL = Total Length of Fallen Logs, ND = No Data

Table 3-5: Reference sites assessment against Benchmark Targets - spring 2016

Management Domain	Vegetation Community	Site	Site attributes (% cover)											
			Vegetation condition	SVS	NSR	NOC	NMS	NGCG	NGCS	NGCO	EC	NTH	OR	FL (M)
Reference Sites	WSGW	Ref_1	LOW	28	31	0	0	40	0	10	32	0	0.66	0
	WSDSF	Ref_2	MOD-GOOD	61	37	18.5	3	44	0	26	2	2	0.50	10
	WSDSF	Ref_3	MOD-GOOD	54	42	3.5	0.3	6	12	16	0	3	0	40
	WSGW	Ref_4	MOD-GOOD	61	49	12.5	0	44	0	4	12	5	0	60
	WSDSF	Ref_5	MOD-GOOD	64	53	3.9	17.2	14	4	34	0	1	1	25
	WSDSF	Ref_6	MOD-GOOD	57	36	16.1	19.6	24	10	2	0	0	0.80	33
	WSDSF	Ref_7	MOD-GOOD	67	46	12	13.4	20	20	28	0	6	0	42
	WSGW	Ref_8	HIGH	86	42	11.3	1.8	32	0	48	0	5	1	105
	WSDSF	Ref_9	HIGH	80	53	30.5	6.1	40	10	6	0	1	0.80	35
	WSDSF	Ref_10	MOD-GOOD	66	57	11.4	15.7	28	26	18	8	4	0	77
	WSGW	Ref_11	MOD-GOOD	51	22	14	0	58	2	16	16	2	0.33	20
	WSGW	Ref_12	MOD-GOOD	56	43	9.5	0	54	0	10	8	6	0	100

SVS = Site Value Score, NSR = Native Plant Species Richness, NOC = Native Over-storey Cover, NMC = Native Mid-storey Cover, NGCG = Native Ground Stratum Cover (grasses), NGCS = Native Ground Stratum Cover (shrubs), NGCO = Native Ground Stratum Cover (other), EC = Exotic Plant Cover, NTH = Number of Trees with Hollows, OR = Over-storey Regeneration and FL = Total Length of Fallen Logs

3.1.3 Discussion of vegetation monitoring results

Site value scores were calculated for all sites monitored in 2016 to determine the vegetation condition for each monitoring site. Each site was then assessed relative to the Interim Performance Targets (IPTs) (see **Appendix E**) for its respective vegetation condition, for Year 0 (Baseline) (autumn 2016 sites) and Year 1 (spring 2016 sites).

Management Domain sites monitored in autumn 2016 (**Table 3-2**) recorded a high level of achievement relative to their respective IPTs, with a total of 8 sites meeting the targets for all 10 site attribute scores. As is to be expected, BOA sites recorded the highest average site value scores, followed by ECA sites, and then Regeneration and Rehabilitation Area sites recording the lowest average scores. Native over-storey cover and number of hollow-bearing trees were the best performing site attributes, with all sites meeting the respective targets. Native mid-storey cover was the worst performing site attribute with 4 sites failing to meet the IPTs.

Management Domain sites monitored in spring 2016 (**Table 3-3**) demonstrate variable results relative to their IPTs. No site achieved the target for all 10 site attribute scores, with the majority of sites failing to meet targets for at least 3 attributes. Native over-storey cover and number of hollow-bearing trees were the best performing site attribute scores, with all sites meeting the respective targets. Native mid-storey and over-storey regeneration were the worst performing site attribute scores, with only 5 and 4 sites respectively, meeting the IPTs.

The low achievement of the targets for spring 2016 sites can be largely attributed to the significant increase in IPTs scores for several site attributes from Year 0 (Baseline) to Year 1. For example, the IPT for over-storey regeneration for low condition sites increases from 0% to 100% from Year 0 to Year 1. This increase is not reflective of the natural development of over-storey regeneration however, and as such, it is expected to be several years until over-storey regeneration reaches its respective target. BOA sites monitored in spring 2016 also recorded the highest average site value scores, followed by ECA sites, which is reflective of the largely remnant condition of these areas.

Reference Sites monitored in 2016 are compared to Benchmark Targets for their respective vegetation community (**Tables 3-4** and **Table 3-5**). Overall, sites monitored in autumn 2016 demonstrate a higher achievement of the benchmark targets compared to sites monitored in spring, with autumn sites recording an average site value score of 68 compared to 61 for spring sites. The performance of all sites relative to site attributes was largely consistent however, with native species richness and native ground cover grass scoring highly for all sites. Similarly, native mid-storey, native ground cover shrubs and over-storey regeneration were the worst performing attributes amongst all sites. Low scores for over-storey regeneration are likely attributable to the high level of natural ground layer competition found in grassy woodland communities which can limit the ability for over-storey regeneration to develop.

3.2 Landscape Function Analysis

The LOI and SSA scores calculated from spring 2016 LFA monitoring results are presented in **Tables 3-6** to **3-10** below.

The LOI provides a proportion of the transect occupied by patches - patches being landscape elements that are relatively permanent and provide stable, resource accumulating structures, such as grassy tussocks, ground cover and logs. A higher LOI implies a more stable transect that is less prone to erosion, with a LOI of 1.00 indicating that an entire transect is occupied by patches. The SSA is more in-depth, providing an index (0-100) of Stability, Soil Infiltration and Nutrient Cycling for the whole of

landscape (transect). Table 19 in the WCBMP summarises the SSA attributes that contribute to each of these indices.

A self-sustaining landform is deemed to have been achieved when LFS scores of 50 or more are recorded (the LFA Completion Criteria, expected to be achieved by Year 10 of the management cycle). Incremental improvement toward that target is expected with each year of monitoring. Failure to achieve an increase of 5 in the annual LFA scores represents a trigger for further investigation. Comparative annual results have been colour-coded to provide a visual indicator, with green reaching or exceeding the incremental increase of 5 or more, and red showing an increase of less than 5 (or in some cases, a reduction from the previous year). Red coded cells indicate a requirement for further investigation. Results maintained at or above the Completion Criteria (50) have been coded green regardless of comparative incremental increase or decrease from 2015.

It should be noted that there are a number of contributing factors in the data collection and calculation of scores which may result in minor inconsistencies from year to year.

LFA results are presented in the below sections with a discussion of the results provided at **Section 3.2.6**.

3.2.1 Biodiversity Offset Areas (BOAs)

Site E_105 is the only LFA monitoring site within the BOA Management Domains. The LOI and SSA results for this site are presented in **Table 3-6**, with the spring 2015 results included to provide an assessment of tracking toward the Completion Criteria.

The LOI of 1.00 achieved at this site indicates that the entire transect continues to be occupied by patches, with a dense cover of native perennial ground cover and leaf litter. This is consistent between the 2015 and 2016 monitoring results. Stability continues to exceed the Completion Criteria (>50), with Soil Infiltration and Soil Nutrients both below the Completion Criteria, also representing a reduction from the spring 2015 results.

Table 3-6: LOI and SSA results for BOA transects

Site	Monitoring Season	Landscape Organisation Index	Soil Surface Assessment		
			Stability	Infiltration	Nutrient cycling
E_105	Spring 2016	1.00	62.6	41.4	34.0
E_105	Spring 2015	1.00	57.9	45.0	54.8
Annual incremental increase			4.7	-3.6	-20.8

3.2.2 Enhancement and Conservation Areas (ECAs)

Two LFA monitoring sites are located within the ECA Management Domains: site A_100 within ECA-A and site B_106 within ECA-B. Both of these sites are located in regenerating vegetation.

The LOI and SSA results for these sites are presented in **Table 3-7**. In spring 2016, site A_100 recorded a LOI of 1.00, being entirely covered by perennial ground cover. Site B_106 recorded a LOI of 0.97, with extensive perennial ground cover and litter patches, and three small, discrete patches of bare soil.

In spring 2016, the Stability Completion Criteria was exceeded at both ECAs. At Site A_100, the Soil Infiltration and Nutrient Cycling scores recorded in spring 2016 were below the Completion Criteria

target of 50. At site B_106 the Soil Infiltration Completion Criteria has been achieved, and Nutrient Cycling is close (within four points, expected to be achieved within one year) of the Completion Criteria.

Table 3-7: LOI and SSA results for ECA transects

Site	Monitoring Season	Landscape Organisation Index	Soil Surface Assessment		
			Stability	Infiltration	Nutrient Cycling
A_100	Spring 2016	1.00	56.7	42.1	31.8
	Spring 2015	1.00	58.5	54.8	57.8
	Annual incremental increase			-1.8	12.7
B_106	Spring 2016	0.97	79.8	57.3	46.2
	Spring 2015	1.00	55.5	43.0	41.3
	Annual incremental increase			24.3	14.3

3.2.3 Regeneration Areas

Three LFA monitoring sites are located within the Regeneration Area Management Domains: site R1_100 within Regeneration Area 1; site R4_100 within Regeneration Area 4 and site R6_101 within Regeneration Area 6 (see **Appendix A**). The LOI and SSA results for these sites are presented in **Table 3-8**.

In spring 2016, the transects within Regeneration Area 4 at site R4_100, and within Regeneration Area 6 at site R6_101, were close to being entirely occupied with patches. At site R_100 within Regeneration Area 1, the proportion of the transect occupied by patches was lower and had reduced from spring 2015 to spring 2016. The Soil Stability score exceeded the Completion Criteria at all three Rehabilitation Areas, however the incremental increase was not observed at R_100. The Soil Infiltration and Nutrients scores were below the annual incremental increase target.

Table 3-8: LOI and SSA results for Regeneration Area transects

Site	Monitoring Season	Landscape Organisation Index	Soil Surface Assessment		
			Stability	Infiltration	Nutrient Cycling
R1_100	Spring 2016	0.88	70.4	39.3	24.1
	Spring 2015	0.99	57.1	44.9	33.2
	Annual incremental increase			13.3	-5.6
R_100	Spring 2016	0.95	52.2	40.6	34.0
	Spring 2015	0.98	55.6	43.5	47.0
	Annual incremental increase			-3.4	-2.9
R6_101	Spring 2016	0.99	58.3	39.4	33.0
	Spring 2015	56.7	43.2	50.1	56.7
	Annual incremental increase			15.1	-10.7

3.2.4 Rehabilitation Areas

Seven LFA monitoring sites are located within the Rehabilitation Areas; these are R5; R6; R8; R9; R10; R11 and R13. The LOI and SSA results for the sites are presented in **Table 3-9**.

Spring 2016 monitoring results indicate that one of the Rehabilitation Area transects was entirely occupied with patches and four additional Rehabilitation Area transects had high LOI scores. The LOI scores recorded at R6 and R10 were lower (less than 0.8), and both showed a decrease compared to spring 2015 results. The Soil Stability scores recorded at all the Rehabilitation Area transects exceeded the Completion Criteria, however four of the seven sites did not achieve the annual incremental increase of five or more. The Soil Infiltration and Nutrients scores for all the Rehabilitation Area transects were below the Completion Criteria, with most not achieving the incremental increase target. With the exception of R10, all sites experienced a reduction from the 2015 monitoring results for at least one of the SSA indices.

Table 3-9: LOI and SSA results for Rehabilitation Area transects

Site	Monitoring Season	Landscape Organisation Index	Soil Surface Assessment		
			Stability	Infiltration	Nutrient cycling
R5_C	Spring 2016	0.96	58.2	33.5	28.3
	Spring 2015	0.85	57.6	30.6	28.4
	Annual incremental increase		0.6	2.9	-0.1
R6	Spring 2016	0.78	62.5	35.6	28.0
	Spring 2015	0.93	54.1	32.1	32.3
	Annual incremental increase		8.4	3.5	-4.3
R8	Spring 2016	0.96	58.8	41.5	33.3
	Spring 2015	0.88	52.2	46.4	43.8
	Annual incremental increase		6.6	-4.9	-10.5
R9	Spring 2016	1.00	57.4	41.0	34.7
	Spring 2015	0.99	60.6	44.7	51.7
	Annual incremental increase		-3.2	-3.7	-17
R10	Spring 2016	0.63	59.2	30.0	21.7
	Spring 2015	0.98	56.4	32.5	37.7
	Annual incremental increase		2.8	-2.5	-16
R11	Spring 2016	0.98	65.2	40.8	34.3
	Spring 2015	0.07	50.1	13.0	9.6
	Annual incremental increase		15.1	27.8	24.7
R13	Spring 2016	0.87	56.3	36.6	29.3
	Spring 2015	0.67	54.9	24.6	34.9
	Annual incremental increase		1.4	12	-5.6

3.2.5 Reference sites

In spring 2016, ten LFA transects were undertaken at Reference sites to provide comparative data to assist in guiding management of WCPLs Management Domains (see **Appendix A**). The LOI and SSA scores for the Reference Site transects are presented in **Table 3-10**.

In spring 2016, high LOI scores were recorded at all the Reference sites, indicating that all the sites were close to being entirely occupied with patches and have a stable landform. The Soil Surface Stability scores recorded at all Reference sites were above the Completion Criteria. However, the Soil Infiltration for all except two (Ref_5 and Ref_14) of the Reference sites, and Nutrient Cycling for all Reference sites, were below the Completion Criteria and did not achieve the incremental increase target, which is consistent with the results obtained from LFA monitoring within the Management Domains.

Table 3-10: Spring 2016 LOI and SSA results - Reference Sites

SITE	Monitoring Season	Landscape Organisation Index	Soil Surface Assessment		
			Stability	Infiltration	Nutrient cycling
Ref_1	Spring 2016	0.95	59.3	41.9	32.2
	Spring 2015	0.95	53.8	64.9	62.2
	Annual incremental increase		5.5	-23	-30
Ref_2	Spring 2016	0.98	55.3	45.8	35.6
	Spring 2015	0.98	57.6	63.7	60.7
	Annual incremental increase		-2.3	-17.9	-25.1
Ref_3	Spring 2016	0.96	54.1	45.2	34.8
	Spring 2015	0.96	52.4	83.2	63.3
	Annual incremental increase		1.7	-38	-28.5
Ref_4	Spring 2016	1.00	61.2	43.4	35.3
	Spring 2015	1.00	56.6	63.9	58.4
	Annual incremental increase		4.6	-20.5	-23.1
Ref_5	Spring 2016	0.98	56.6	55.3	38.0
	Spring 2015	0.98	64.0	81.1	52.8
	Annual incremental increase		-7.4	-25.8	-14.8
Ref_6	Spring 2016	0.99	53.2	48.8	35.8
	Spring 2015	0.99	52.6	70.2	54.4
	Annual incremental increase		0.6	-21.4	-18.6
Ref_7	Spring 2016	0.98	55.7	44.9	37.5
	Spring 2015	0.98	55.5	66.3	62.9
	Annual incremental increase		0.2	-21.4	-25.4
Ref_8	Spring 2016	0.89	55.7	48.9	33.1
	Spring 2015	0.89	52.5	64.2	61.1
	Annual incremental increase		3.2	-15.3	-28

Ref_13b*	Spring 2016	1.00	57.9	38.2	31.7
	Spring 2015	-	-	-	-
	Annual incremental increase		n/a	n/a	n/a
Ref_14	Spring 2016	0.88	55.3	54.1	39.7
	Spring 2015	0.88	51.2	80.8	58.7
	Annual incremental increase		4.1	-26.7	-19

Note: Ref_13b was established in spring 2016. The original Ref_13 site was impacted by fire from a NPWS controlled burn.

3.2.6 Discussion of LFA monitoring results

All the sites recorded relatively high LOI scores, indicating stable, functioning landform covered by patches. However, LOI should be considered as an indicator only and correlation of these scores against vegetation and non-vascular ground cover data (for example, fallen logs) is important to gain a more detailed understanding of the overall functioning of the sites.

Within the Management Domains, the dominant patch types were ground cover and litter (with litter consisting of exotic annual species and/or leaf litter). The dense perennial ground cover at many sites is reflective of their vegetation type and condition, including regenerating DNG of grassy woodland communities.

All sites met the Completion Criteria target for Stability, despite some experiencing a decrease from the 2015 monitoring results. The Stability scores across the Management Domains monitoring sites were comparable to the Reference site scores. The decrease in Stability scores may be attributed to a range of factors, including field personnel changes resulting in subjective interpretation of field conditions, or increased soil moisture levels affecting individual indicators, for example, surface roughness and slake tests.

While Infiltration and Nutrient Cycling indices were lower and did not meet the annual incremental increase targets for the majority of sites, this pattern was similarly recorded in Reference sites. Nutrient Cycling may be affected by perennial vegetation cover, litter cover and extent of decomposition, cryptogam cover and soil surface roughness. While many LFA sites have moderate to dense cover of perennial vegetation (grasses) and/or high litter cover, there was limited litter decomposition observed, no cryptogam presence, and largely flat soil micro topography. Low Soil Infiltration and Nutrient Cycling scores may be due to historical clearing and livestock usage across the BOA, ECA and Regeneration Sites. Low scores recorded within the Rehabilitation Sites may be due to the compacted artificial soils on which the Rehabilitation areas are located.

Longer term data would be required to assess whether the reduction in the SSA scores at the Management Domains and Reference Sites (from spring 2015 to spring 2016) represent a short-term change (for example due to seasonal variance, data collection and calculation or field personnel changes) or an ongoing trend indicating a requirement for management action.

3.3 Fauna monitoring

Fauna monitoring undertaken during spring 2016 recorded 133 fauna species, comprising six amphibian, 21 mammal (including 14 microchiropteran bat (microbat) species), seven reptile and 99 bird species. Four introduced species were recorded. 12 species listed as vulnerable under TSC Act and/or the EPBC Act were recorded and are listed below in **Table 3-11**.

The most commonly occurring bird species were *Lichenostomus chrysops* (Yellow-faced Honeyeater) and *Philemon corniculatus* (Noisy Friarbird), both being recorded at 20 of the 25 bird monitoring sites. *Chalinolobus morio* (Chocolate Wattled Bat) was the most commonly occurring microbat species, recorded at 10 of the 11 bat monitoring sites.

A full list of all fauna species recorded during the winter and spring 2016 monitoring program is included in **Appendix E**.

Table 3-11: Threatened fauna recorded

Assemblage	Scientific Name	Common Name	Site Recorded	TSC Act Listing	EPBC Act Listing
Microbats	<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	B_101, C_102, E_104, R7_100, Ref_14	V	V
	<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing Bat	A_104, B_101, E_104, R7_100, Ref_3, Ref_10	V	-
	<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail Bat	Ref_14	V	-
	<i>Myotis macropus*</i>	Large-footed Myotis	E_104	V	-
Birds	<i>Climacteris picumnus victoriae</i>	Brown Treecreeper	D_101	V	-
	<i>Artamus cyanopterus</i>	Dusky Woodswallow	A_102, A_104, B_100, E_104, E_106, R7_101	V	-
	<i>Calyptorhynchus lathamii</i>	Glossy Black-cockatoo	D_103	V	-
	<i>Stagonopleura guttata</i>	Diamond Firetail	BOA-B	V	-
	<i>Melanodryas cucullata</i>	Hooded Robin	A_102	V	-
	<i>Glossopsitta pusilla</i>	Little Lorikeet	D_101, D_103, R7_101	V	-
	<i>Pyrrholaemus sagittatus</i>	Speckled Warbler	A_102, E_104, E_106, R3_100, R7_101	V	-
<i>Daphoenositta chrysoptera</i>	Varied Sittella	E_106	V	-	

*Possible identification only. V = Vulnerable

3.3.1 Biodiversity Offset Areas

The results of microbat monitoring undertaken across BOA-D and BOA-E during spring 2016 is presented below in **Table 3-12**.

Table 3-12: Results of the Anabat analysis for BOA-D and BOA-E, spring 2016

Species Name	Common Name	D_103		E_104	
		19 – 30 August		29 – 30 August	
		Positively identified	Possibly present	Positively identified	Possibly present
<i>Austronomus australis</i>	White-striped Freetail Bat				
<i>Chalinolobus dwyeri</i> *	Large-eared Pied Bat			X	
<i>Chalinolobus gouldii</i>	Gould's Wattled Bat	X		X	
<i>Chalinolobus morio</i>	Chocolate Wattled Bat	X		X	
<i>Miniopterus orianae oceanensis</i> *	Eastern Bentwing Bat	X		X	
<i>Mormopterus (Ozimops) planiceps</i>	South-eastern Freetail Bat	X			
<i>Myotis macropus</i> *	Large-footed Myotis				X
<i>Nyctophilus</i> spp.	Long-eared Bats			X	
<i>Rhinolophus megaphyllus</i>	Eastern Horseshoe Bat	X		X	
<i>Saccolaimus flaviventris</i> *	Yellow-bellied Sheath-tail Bat				X
<i>Scotorepens balstoni</i>	Inland Broad-nosed Bat				
<i>Vespadelus darlingtoni</i>	Large Forest Bat		X		X
<i>Vespadelus pumilus</i>	Eastern Forest Bat		X		
<i>Vespadelus regulus</i>	Southern Forest Bat		X		X
<i>Vespadelus vulturnus</i>	Little Forest Bat		X		X
Species Diversity (Positive identification)		5		6	
Species Diversity (Possible identification)		4		5	
Total (at least) number of species		9		11	

*Listed as threatened under the TSC Act and/or EPBC Act

Biodiversity Offset Area D (BOA-D)

All sites occur in remnant eucalypt and *Callitris* dominated dry sclerophyll forest that contains a range of habitat features suitable for supporting various fauna assemblages (**Table 3-13**). Overall species richness recorded in BOA-D during spring 2016 was greater than that recorded in spring 2015, however microbat species richness was lower.

A total of 57 fauna species were recorded within BOA-D during spring 2016, comprising 46 bird species, five mammal species (including four microbat species), four reptile species and two amphibian species.

At all three BOA-D monitoring sites, the proportion of woodland/forest indicator bird species was greater than that of DNG indicator species, especially in the case of D_103 and D_100, at which no DNG indicator species were recorded. Site D_103 similarly had a high richness and abundance of woodland/forest indicator microbats. This is consistent with the high floristic and forage resource diversity at the sites (**Table 3-13**). *Parasuta dwyeri* (Dwyer's Snake) was trapped at D_101, the only live capture for the BOA.

Table 3-13: Habitat features at BOA-D fauna monitoring sites

Site Number	Habitat Features
D_100	<p>High floristic and forage resource diversity. Abundant canopy and shrub layer foliage with minimal ground vegetation coverage. The presence of litter and fallen logs provides good habitat features for ground fauna. No surface water present.</p> <p>The site is adjacent to Goulburn River National Park (NP) and surrounded by significant tracts of remnant woodland.</p>
D_101	<p>High floristic and forage resource diversity present with abundant canopy and shrub layer foliage. Abundant litter along with the presence of fallen logs provides good habitat features for ground fauna. Minimal rock coverage and no surface water available.</p> <p>The site is adjacent to Goulburn River NP and surrounded by significant tracts of remnant woodland.</p>
D_103	<p>High floristic and forage resource diversity. Dominant shrub layer vegetation with good canopy coverage (30%). Abundant litter and fallen logs provides good habitat features for ground fauna. No surface water present.</p> <p>The site is adjacent to Goulburn River NP and surrounded by significant tracts of remnant woodland.</p>

Biodiversity Offset Area E (BOA-E)

Site E_100 is located within remnant dry sclerophyll forest with sites E_104 and E_106 located in remnant grassy woodland communities. All three fauna monitoring sites contain substantial habitat features for a variety of fauna assemblages (**Table 3-14**).

A total of 63 fauna species were recorded within BOA-E during spring 2016, comprising 49 bird species, ten mammal species (including nine microbat species), two reptile species and one amphibian species.

Overall species richness recorded in BOA-E during spring 2016 was greater than that recorded in spring 2015. All three sites are in a woodland/forest community type and have a high proportion of woodland/forest indicator bird and microbat species. E_106 had the highest success rate for trapping of all the BOAs and ECAs, with one *Uperoleia laevigata* (Smooth Toadlet) and one *Lygisaurus foliorum* (Tree-based Litter-skink) being trapped. Three threatened microbat species were recorded at E_104: *Miniopterus orianae oceanensis* (Eastern Bentwing Bat), *Chalinolobus dwyeri* (Large-eared Pied Bat) and *Myotis macropus* (Large-footed Myotis). These species are predominantly cave-roosting. As E_104 does not contain and is not located near to suitable cave roosting habitat, it is likely that these species are utilising this site as foraging habitat.

Table 3-14: Habitat features at BOA-E fauna monitoring sites

Site Number	Habitat Features
E_100	<p>High floristic and forage resource diversity present with abundant canopy and shrub layer foliage. Litter, fallen logs and abundant rock coverage (70%) provides good habitat features for ground fauna. No surface water present.</p> <p>The site is located immediately south of Goulburn River NP and is surrounded by significant patches of remnant native vegetation.</p>
E_104	<p>Moderate floristic and forage resource diversity dominated by ground cover vegetation (99%). Limited litter, rock and fallen log coverage on ground. No surface water present.</p> <p>The site is located immediately south of Goulburn River NP and is surrounded by significant patches of remnant native vegetation.</p>
E_106	<p>Moderate floristic and forage resource diversity with dominant ground vegetation layer. Limited presence of litter, fallen logs and rocks. No surface water present. Abundant rock cover with only limited presence of litter and fallen logs. Large dam located on periphery of site.</p> <p>The site is located immediately south of Goulburn River NP and is surrounded by significant patches of remnant native vegetation.</p>

3.3.2 Enhancement and Conservation Areas

The results of microbat monitoring undertaken across ECA-A, ECA-B and ECA-C during spring 2016 is presented in **Table 3-15**. More detailed results from fauna monitoring are discussed per ECA below.

Table 3-15: Results of the Anabat analysis for A_104, B_101 and C_102

Species Name	Common Name	A_104		B_101		C_102	
		29 and 30 August		12 and 13 September		5 and 6 September	
		Positively identified	Possibly present	Positively identified	Possibly present	Positively identified	Possibly present
<i>Austronomus australis</i>	White-striped Freetail Bat	X		X			
<i>Chalinolobus dwyeri</i> *	Large-eared Pied Bat			X		X	
<i>Chalinolobus gouldii</i>	Gould's Wattled Bat	X		X		X	
<i>Chalinolobus morio</i>	Chocolate Wattled Bat	X		X		X	
<i>Miniopterus orianae oceanensis</i> *	Eastern Bentwing Bat	X		X		X	
<i>Mormopterus (Ozimops) planiceps</i>	South-eastern Freetail Bat	X		X		X	
<i>Myotis macropus</i> *	Large-footed Myotis		X		X		X

Species Name	Common Name	A_104		B_101		C_102	
		29 and 30 August		12 and 13 September		5 and 6 September	
		Positively identified	Possibly present	Positively identified	Possibly present	Positively identified	Possibly present
<i>Nyctophilus</i> spp.	Long-eared Bats				X		X
<i>Rhinolophus megaphyllus</i>	Eastern Horseshoe Bat						
<i>Saccolaimus flaviventris</i> *	Yellow-bellied Sheathtail Bat	X					
<i>Scotorepens balstoni</i>	Inland Broad-nosed Bat	X		X			
<i>Vespadelus darlingtoni</i>	Large Forest Bat		X		X		X
<i>Vespadelus pumilus</i>	Eastern Forest Bat			X			
<i>Vespadelus regulus</i>	Southern Forest Bat		X		X		X
<i>Vespadelus vulturnus</i>	Little Forest Bat		X		X		X
Species Diversity (Positive identification)		7		8		5	
Species Diversity (Possible identification)		4		5		5	
Total (at least) number of species		11		13		10	

*Listed as threatened under the TSC Act and/or EPBC Act

Enhancement and Conservation Area A (ECA-A)

Sites A_100 and A_102 are located within DNG areas, whilst A_104 is located in remnant *Callitris* forest with abundant lichen coverage in the ground layer. Landscape features within ECA-A provide habitat for a range of fauna assemblages (**Table 3-16**).

A total of 56 species were recorded within ECA-A during spring 2016, comprising 45 bird species, ten mammal species (including seven microbat species) and one amphibian species.

Results for the site A_104 were consistent with it being in remnant habitat. This site contained the highest species richness of the three ECA-A sites, and all five woodland/forest indicator bird species were recorded at this location. However, richness and abundance of DNG microbats was higher than woodland/forest microbats at this site. The threatened Eastern Bentwing Bat was also recorded at site A_104.

The other two sites contained a higher proportion of DNG indicator bird species. A_100 had the lowest species richness of the ECA-A sites and no woodland/forest indicator species. However, the only amphibian species recorded within ECA-A, *Limnodynastes tasmaniensis* (Spotted Marsh Frog), was trapped at this site.

Table 3-16: Habitat features at ECA-A fauna monitoring sites

Site Number	Habitat Features
A_100	Low floristic and forage resource diversity as site is situated in a cleared paddock with no canopy or shrub layer foliage. Some surface water present in drainage line.
A_102	Low floristic and forage resource diversity as site is situated in a cleared paddock with no canopy or minimal shrub layer foliage. Rocks and fallen logs absent. No surface water present.
A_104	High floristic and forage resource diversity dominated by abundant canopy coverage (70%). Shrub layer present with abundant litter coverage over ground. The presence of fallen logs and abundant lichen coverage adds further habitat value to the site.

Enhancement and Conservation Area B (ECA-B)

Landscape features present within ECA-B provide habitat for a range of fauna assemblages (**Table 3-17**). ECA-B is located immediately south of Goulburn River National Park, providing enhanced habitat values for the area through landscape connectivity. Sites B_101 and B_105 are located within DNG, whilst B_100 and B_103 are located in remnant eucalypt/*Callitris* forest. B_105 is in close proximity to remnant Yellow Box Woodland, while also being bordered by two creeks. These landscape features likely influence which species utilise and are recorded at this site.

A total of 60 species were recorded in ECA-B during spring 2016, comprising 45 bird species, 12 mammal species (including eight microbat species), one reptile species and two amphibian species.

Results of the indicator species analysis of microbats were consistent with B_101 being a DNG site. Richness and abundance of DNG indicator microbat species were higher than that of woodland/forest indicator species, however the site also contains two threatened species, suggesting that the habitat can support a variety of species. This may be due to the presence of water at the site. Pig tracks were observed at B_101, and rabbits were observed at B_105.

Table 3-17: Habitat features at ECA-B fauna monitoring sites

Site Number	Habitat Features
B_100	High floristic and forage resource diversity with abundant canopy, shrub and ground layer cover. Litter cover and the presence of fallen logs provides further habitat values for ground fauna. No surface water present.
B_101	Moderate floristic and forage resource diversity with only limited canopy coverage but abundant shrub and ground layer coverage. Dam located on southern border of the site.
B_103	High floristic and forage resource diversity with dominant canopy coverage (80%). The site is located on a rocky ridge which combined with the presence of fallen logs and litter coverage, provides good habitat features for ground fauna. No surface water present.
B_105	Low floristic and forage resource diversity as site has been extensively cleared. A creek line borders the southern and western edges of the site which contain bulrushes and some canopy coverage.

Enhancement and Conservation Area C (ECA-C)

Across the monitoring sites within this domain, landscape features provide habitat for a range of fauna assemblages (**Table 3-18**). ECA-C is located adjacent to Munghorn Gap Nature Reserve (NR), which

provides enhanced habitat values for the area through landscape connectivity. Site C_101 is located within DNG whilst site C_102 is located in remnant eucalypt/*Callitris* forest.

A total of 37 species were recorded in ECA-C during spring 2016, comprising 30 bird species, seven mammal species (including four microbat species).

The threatened Large-eared Pied Bat was recorded at C_102. This was the only threatened fauna species recorded within ECA-C during the monitoring period. C_100 contained no indicator bird species, the only woodland/forest community site lacking such data, and C_102 contained no woodland/forest indicator microbat species, despite it being in a woodland/forest community with high forage resource diversity.

Table 3-18: Habitat features at ECA-C fauna monitoring sites

Site Number	Habitat Features
C_101	Low floristic and forage resource diversity as site has been cleared. Limited litter, fallen log and rock cover. No surface water present.
C_102	High floristic and forage resource diversity with abundant canopy, shrub and ground layer coverage. The site is located on a rocky ridge which combined with the presence of fallen logs and litter coverage, provides good habitat features for ground fauna. No surface water present.

3.3.3 Regeneration Areas

The results of microbat monitoring undertaken within Regeneration Areas (one site, R7) during spring 2016 is presented in **Table 3-19**. More detailed results from fauna monitoring are discussed per Regeneration Area below.

Table 3-19: Results of the Anabat analysis for R7_100

Species Name	Common Name	R7_100	
		5 and 8 September	
		Positively identified	Possibly present
<i>Chalinolobus dwyeri</i> *	Large-eared Pied Bat	X	
<i>Chalinolobus gouldii</i>	Gould's Wattled Bat	X	
<i>Chalinolobus morio</i>	Chocolate Wattled Bat	X	
<i>Miniopterus orianae oceanensis</i> *	Eastern Bentwing Bat	X	
<i>Myotis macropus</i> *	Large-footed Myotis		X
<i>Nyctophilus</i> spp.	Long-eared Bats		X
<i>Rhinolophus megaphyllus</i>	Eastern Horseshoe Bat	X	
Species Diversity (Positive identification)		5	
Species Diversity (Possible identification)		2	
Total (at least) number of species		7	

*Listed as threatened under the TSC Act and/or EPBC Act

Regeneration Area 1

Landscape features at site R1_101 provide habitat for a range of fauna assemblages (**Table 3-20**). The site is located within a regenerating paddock with a ground cover dominated by exotic forb species. The site is in close proximity to a densely vegetated hillside with extensive rocky outcropping. The proximity to this higher quality habitat likely affected the fauna observed/heard during monitoring of this site. For example, *Vombatus ursinus* (Common Wombat) would likely utilise the forested area for cover and the regenerating paddock for grazing, and birds such as Pardalotes and Yellow-faced Honeyeater would likely utilise the edge of the forested area for foraging.

A total of 24 species were recorded, comprising 20 birds and four mammals. No threatened fauna species were recorded within Regeneration Area 1. Rabbits were observed at the site. The presence of four DNG indicator bird species is consistent with the vegetation type at R1_101.

Table 3-20: Habitat features at Regeneration Area 1 fauna monitoring site

Site Number	Habitat Features
R1_101	Low floristic and forage resource diversity as the site has been extensively cleared (no canopy or shrub layer present). Scattered rock cover provides habitat value across the site with small pools of water present in several rock cavities.

Regeneration Area 3

Site R3_100 is located within a regenerating paddock dominated by exotic perennial pasture species, with limited habitat features (**Table 3-21**). The site is in close proximity to an area of White Box Shrubby Woodland, with a creek approximately 50 m away that was running at the time of survey. These landscape features would be affecting which species were observed/heard at the site. For example, *Cacomantis flabelliformis* (Fan-tailed Cuckoo), *Chalcites basalis* (Horsefield's Bronze Cuckoo) and *Oriolus sagittatus* (Olive-backed Oriole) are medium woodland birds that were recorded utilising the edge of the remnant vegetation close to site R3_100.

A total of 33 species were recorded at R3_100 during spring 2016, comprising 32 birds and one mammal species. R3_100 had a higher proportion of woodland/forest indicator bird species than DNG species.

Table 3-21: Habitat features at Regeneration Area 3 fauna monitoring site

Site Number	Habitat Features
R3_100	Low floristic and forage resource diversity due to minimal canopy (2%) and shrub (5%) coverage. Limited presence of litter and rock cover. No surface water present on site.

Regeneration Area 4

Site R4_100 is located within a regenerating paddock, with cover dominated by the native forbs *Crassula sieberiana* and *Cotula australis*, and a high abundance of exotic grasses and forbs (**Table 3-22**).

A total of 22 species were recorded, comprising 20 birds and two amphibian species (**Appendix F**). Regeneration Area 4 is located south of Goulburn River NP.

No threatened fauna species were recorded within Regeneration Area 4 during the monitoring period. No woodland/forest indicator bird species were recorded at the site.

Table 3-22: Habitat features at Regeneration Area 4 fauna monitoring site

Site Number	Habitat Features
R4_100	Low floristic and forage resource diversity as the site has been extensively cleared. Creek lines border the site to the north and east.

Regeneration Area 5

Regeneration Area 5 is located immediately south of Goulburn River NP, which provides enhanced habitat values for the area through landscape connectivity. Both sites in this Management Domain are located within DNG (**Table 3-23**). R5_101 is in close proximity to an area of Rough-barked Apple Woodland and Yellow Box Woodland, while R5_100 is bordered by a running creek and riparian vegetation. These landscape features would likely be affecting what species were observed/heard at the sites. This would likely explain the relatively even spread of both DNG indicator birds and woodland/forest indicator birds at the two sites.

A total of 36 species were recorded, comprising 32 birds, three reptile and one mammal species. *Stagonopleura guttata* (Diamond Firetail), listed as vulnerable under the TSC Act, were recorded opportunistically in Regeneration Area 5 near the disused farmhouse. Rabbits were observed at R5_101.

Table 3-23: Habitat features at Regeneration Area 5 fauna monitoring sites

Site Number	Habitat Features
R5_100	Moderate floristic and forage resource diversity. Scattered canopy coverage, mostly on border of site. Creek along the southern and eastern edge of site with a large dam at the north of the site. Minimal litter and rock cover.
R5_101	Moderate floristic and forage resource diversity. Good canopy coverage, mostly on borders of site. Creek along the southern edge of site with a dam in the centre. Presence of litter, rocks and fallen logs provide good habitat features for ground fauna.

Regeneration Area 6

Site R6_101 is located within heavily degraded DNG, with a moderately high cover of exotic pasture species and limited habitat features (**Table 3-24**).

A total of 19 species were recorded, comprising 16 birds and three amphibian species. Only DNG indicator birds were recorded at R6_101.

Table 3-24: Habitat features at Regeneration Area 6 fauna monitoring site

Site Number	Habitat Features
R6_101	Low floristic and forage resource diversity due to absence of canopy and shrub cover. Minimal litter and rock cover present. Small dam situated in the eastern section of the site.

Regeneration Area 7

Landscape features within this Management Domain provide habitat for a range of fauna assemblages (**Table 32-5**). Regeneration Area 7 is located directly adjacent to the Munghorn Gap NR, which provides enhanced habitat values for the area through landscape connectivity. Both sites are located within DNG, however the proximity of both sites to remnant vegetation would be effecting what species were observed/heard at the site.

A total of 51 species were recorded, comprising 43 bird, nine mammal species (including five microbat species). Both sites had very similar species richness and a relatively even spread of woodland/forest indicator birds and DNG indicator birds. R7_100 contained both of the defined woodland/forest indicator microbat species at low numbers, but none of the DNG species. Two threatened microbat species were also recorded at R7_100. In the context of the surrounding landscape (i.e. proximity to Munghorn Gap NR), this assemblage of species is perhaps not surprising as the site may be in a flyway.

Dama dama (Fallow Deer) and rabbits were observed at R7_100.

Table 3-25: Habitat features at Regeneration Area 7 fauna monitoring sites

Site Number	Habitat Features
R7_100	Moderate floristic and forage resource diversity. Scattered canopy and shrub coverage across site. Litter, rock and fallen logs present within site. No surface water present.
R7_101	Moderate floristic and forage resource diversity. Scattered canopy and shrub coverage across site. Litter cover and fallen logs present within site. No surface water present.

3.3.12 Rehabilitation Areas

Sites R6 and R9 are surrounded by active mine operations which presents limitations to landscape connectivity and fauna dispersal (**Table 3-26**). Both of these sites have a dense ground cover dominated by exotic pasture species. These sites are to be rehabilitated to a woodland community; scattered eucalypt seedlings and saplings are present.

A total of 15 species were recorded within this Management Domain, comprising 10 bird, two reptile and three amphibian species. This is the lowest species richness of all the monitoring areas. However, some success with funnel traps on the two sites yielded a total of two Spotted Marsh Frog and five *Carlia tetradactyla* (Southern Rainbow Skink).

Table 3-26: Habitat features at Rehabilitation Area fauna monitoring sites

Site Number	Habitat Features
R6	Moderate floristic and forage resource diversity due to abundant shrub and ground vegetation cover and presence of litter and rock coverage. No surface water present.
R9	Moderate floristic and forage resource diversity due to abundant shrub and ground vegetation cover and presence of litter, rock and fallen log coverage. No surface water present.

3.3.4 Reference sites

Results for the Anabat analysis at five of the six reference sites is shown in **Table 3-27**. An Anabat was deployed at Ref_5 however no useable data were recorded on it so it is not included in these results. Ref_2 had a microbat species richness of three, with no threatened species but both woodland/forest indicator species in low abundances. Ref_8 and Ref_10 had similar results, with neither containing any DNG species and Ref_10 recording a single call of the vulnerable Eastern Bentwing Bat. Ref_3 and Ref_14 had much better results in terms of being closer to what would be expected in intact remnant forest/woodland, with species richness of five and nine, respectively.

2016 represented the first year of monitoring at the reference sites and as such there is limited capacity to discuss the results at each site and variation between sites. Future monitoring seasons will be

necessary to see whether there are any relationships between microbats and habitat within this group of sites, and between the reference sites and others in the WCPL lease.

Table 3-27: Results of the Anabat analysis for the WCPL Reference Sites

Species Name	Common Name	Ref_2		Ref_3		Ref_8		Ref_10		Ref_14	
		16 and 23 Nov		16 and 17 Sept		12 and 15 Sept		12 and 15 Sept		16 – 17 Nov	
		Positively identified	Possibly present	Positively identified	Possibly present	Positively identified	Possibly present	Positively identified	Possibly present	Positively identified	Possibly present
<i>Austronomus australis</i>	White-striped Freetail Bat									X	
<i>Chalinolobus dwyeri</i> *	Large-eared Pied Bat									X	
<i>Chalinolobus gouldii</i>	Gould's Wattled Bat	X		X		X				X	
<i>Chalinolobus morio</i>	Chocolate Wattled Bat	X		X		X		X		X	
<i>Miniopterus orianae oceanensis</i> *	Eastern Bentwing Bat		X	X		X		X			X
<i>Mormopterus (Ozimops) planiceps</i>	South-eastern Freetail Bat			X						X	
<i>Myotis macropus</i> *	Large-footed Myotis		X		X						
<i>Nyctophilus spp.</i>	Long-eared Bats		X		X						
<i>Rhinolophus megaphyllus</i>	Eastern Horseshoe Bat	X						X		X	
<i>Saccolaimus flaviventris</i> *	Yellow-bellied Sheathtail Bat									X	
<i>Scotorepens balstoni</i>	Inland Broad-nosed Bat			X							
<i>Vespadelus darlingtoni</i>	Large Forest Bat		X		X		X		X		X
<i>Vespadelus pumilus</i>	Eastern Forest Bat										
<i>Vespadelus regulus</i>	Southern Forest Bat		X		X		X		X		X
<i>Vespadelus vulturnus</i>	Little Forest Bat		X		X		X		X		X
Species Diversity (Positive identification)		3		5		3		3		7	
Species Diversity (Possible identification)		6		5		3		3		4	
Total (at least) number of species		9		10		6		6		11	

*Listed as threatened under the TSC Act and/or EPBC Act

3.3.5 Fauna discussion

Whilst survey effort varied across Management Domains, both fauna species diversity and abundance correlated positively with habitat condition and complexity (vegetation structural diversity, presence of hollows, and presence of fallen logs). This was demonstrated through the high species counts and diversity recorded within BOA, ECA and Reference monitoring sites. Regeneration and Rehabilitation areas did not have such complexity and were often isolated from larger tracts of native vegetation.

Proximity to relatively intact remnants and patch size is likely to have influenced monitoring results, although this was not specifically measured. Several survey sites within ECA and Regeneration areas that contained relatively low habitat features, but were close to Munghorn Gap NR or Goulburn River NP, recorded high bird and microbat richness and/or abundance. In contrast, isolated monitoring sites within Rehabilitation Areas (R6 and R9) that are surrounded by active mine operations had low bird observations, presumably due to lower habitat values in these areas and disturbance caused by mining operations.

Limitations

In contrast to the 2015 monitoring period, which was extremely hot, the 2016 monitoring program took place early in spring during an unseasonably wet period for the region, and with much lower temperatures. This could have impacted the fauna surveys in the following ways.

In the case of birds, a wet season would likely have increased foraging resource availability, and therefore abundances would potentially be higher, with a possible influx of species from the wider area. However, the time of year would also have meant migratory species such as *Merops ornatus* (Rainbow Bee-eater) and *Scythrops novaehollandiae* (Channel-billed Cuckoo) were not yet present in the region.

For the funnel trap/pitfall trap surveys, the cold weather and frequent heavy rainfall decreased success rates due to inactivity of reptiles. In addition to this, funnel traps had to be closed on two occasions for animal welfare reasons, reducing the potential number of total trap nights (survey effort) from 753 to 690.

3.3.6 Winter bird monitoring

A summary of results obtained during winter bird monitoring is presented below. More detailed results and discussion can be found in ELA (2016b).

Bird species richness at the 25 sites surveyed ranged from one (R6) to 23 (R7_101). A total of 70 species were identified during the surveys. The most abundant species was *Eolophus roseicapillus* (Galah), with 196 individuals recorded across all sites. The most commonly occurring species were the *Malurus cyaneus* (Superb Fairy-wren), *Manorina melanocephala* (Noisy Miner) and *Cracticus tibicen* (Australian Magpie), which were all recorded at 60% of sites. One introduced species was recorded; *Sturnus vulgaris* (Common Starling).

The two target species (Swift Parrot and Regent Honeyeater) were not observed at any site.

Four species listed as vulnerable under the TSC Act were identified; these were *Climacteris picumnus* subsp. *Victoriae* (Brown Treecreeper), *Daphoenositta chrysoptera* (Varied Sittella), *Calyptorhynchus lathami* (Glossy Black-cockatoo) and *Pyrrholaemus sagittatus* (Speckled Warbler) (**Table 3-28**).

Table 3-28: Threatened species recorded during the bird survey

Species	Site	Management Zone	Vegetation Class
Brown Treecreeper	R5_100	Regeneration (moderate resilience)	Western Slopes Grassy Woodland
Varied Sittella	D_103	Regeneration (moderate resilience)	Western Slopes Dry Sclerophyll Forest
Speckled Warbler	R3_100 R7_101	Regeneration (moderate resilience)	Western Slopes Dry Sclerophyll Forest
Glossy Black-cockatoo	D_100	Native vegetation (good resilience)	Western Slopes Dry Sclerophyll Forest

4 Recommendations and Conclusion

Biodiversity monitoring undertaken at the Wilpinjong Coal Mine during 2016 represented the first year of monitoring or Year 0, for autumn, and the second year of monitoring, or Year 1, for spring. Seasonal variation and timing cannot be discounted as impacting the results and therefore drawing any conclusions at this early stage is difficult.

4.1.1 Vegetation

Surveys conducted in autumn 2016 completed the baseline vegetation monitoring for the WCPL monitoring program, whilst surveys conducted in spring 2016 added to the baseline data collected during spring 2015. A total of 68 sites were surveyed during 2016 across all Management Domains and inclusive of Reference Sites. Management Domain sites surveyed during autumn 2016 demonstrated a high level of achievement for their respective IPTs, with eight sites achieving targets for all 10 site attribute scores. Sites surveyed in spring 2016 demonstrated more variable results against their relevant IPTs, which is reflective of the increases in IPTs between Year 0 (Baseline) and Year 1.

The results collected at Reference Sites during both autumn and spring 2016, continue to add to the dataset to be used for comparison with vegetation sites within the various Management Domains. The WCBMP suggests that baseline data collected from Year 0 monitoring at the Reference Sites will be used to develop more relevant, locally based benchmark values against which future monitoring data would be analysed.

ELA recommends that this should occur following a number of years of successive monitoring to account for seasonal variability and assessment of the performance of the reference sites as adequate for this purpose. Whilst this is not in complete compliance with the WCBMP, ELA recommends this approach to ensure that locally based benchmark values are realistic, comparable and attainable. A comparison of all reference site data is to be included in future monitoring reports, with assessment against the WCBMP benchmark values which were developed based on theoretical site attribute scores for the specified vegetation types.

4.1.2 Landscape stability

Due to the current monitoring program being established in spring 2015, there is no capacity to compare the results in 2015 and 2016 with previous monitoring results. However, data captured during the previous monitoring season relating to ground cover and erosion can be used as broad references for tracking progression of regeneration and rehabilitation across the Management Domains.

Ground cover in the form of living flora species, litter and rock material has been monitored within ECAs since 2007, Rehabilitation Areas since 2009 and Regeneration Areas (formerly Regrowth Areas) since 2011. This data can be correlated with the LOI data captured in spring 2015 and spring 2016, and both data sets demonstrate consistently high scores since monitoring commenced. Similarly, low levels of erosion observed throughout previous monitoring seasons (2007-2013) can be correlated with the high SSA Stability scores and the lack of any substantial erosion (as recorded in the erosion SSA assessment) recorded in spring 2015 and spring 2016. Overall these combined data sets demonstrate that consistently stable landforms occur across the WCPL Management Domains.

4.1.3 Fauna

As these are baseline data, the conclusions that can be drawn are limited and therefore it is recommended that fauna monitoring continue. However, the varying weather conditions of the last two years monitoring highlights limitations of the program, some of which can be addressed. It is clear that

timing of both the bird and trapping surveys is a determinant of success. Though this can be difficult to control, an additional method of herpetological survey may assist in increasing trap success during colder months; that is, placing sheets of metal on the ground at monitoring sites several months before spring, which may provide shelter for reptiles and amphibians so that during spring there is a greater chance of them being present.

4.2 General recommendations

To inform the recommendations for the Management Domains, **Table 4-1** provides a review of the monitoring results and Interim Performance Targets, and provides recommendations to inform future monitoring and to meet the Interim Performance Targets and progress towards the Completion Criteria.

An Annual Works Program (ELA 2017) has been developed separate to this Annual Monitoring Report to provide specific management actions to be considered in response to this findings of this report.

Table 4-1: Review of monitoring results and recommendations

Interim Performance Target	Comment from results	Recommendations
Vegetation		
<p>Interim Performance Targets (IPTs) are listed in the WCBMP for Western Slopes Dry Sclerophyll Forest and Western Slopes Grassy Woodlands based on vegetation condition. BioMetric site attribute scores for the Management Domain monitoring sites (ECAs, BOAs, Regeneration and Rehabilitation Areas) were compared to the Interim Performance Targets whilst Reference Sites were compared to Benchmark Targets.</p>	<p>Management Domain sites surveyed during autumn 2016 demonstrated a high level of achievement for their respective IPTs whilst, spring 2016 recorded more variable results reflective of increased IPTs for Year 1 comparison.</p> <p>Inability of Reference Sites to meet benchmark targets (e.g. over-storey regeneration) likely due to naturally occurring factors.</p>	<p>Ongoing weed management is recommended across all Management Domains with a particular focus on the occurrences of Noxious Weeds.</p> <p>Targeted planting of native over-storey and mid-storey species is recommended to accelerate the establishment of the mid and upper strata. These recommendations are in line with short term biodiversity management strategies outlined in the WCBMP.</p> <p>Ongoing monitoring of the Reference Sites to inform the development of more relevant benchmarks.</p>
<p>The management of noxious weeds is listed as a priority in the WCBMP in accordance with the legal responsibility of WCPL under the <i>Noxious Weeds Act 1993</i>.</p>	<p>Noxious weed species were recorded in all Management Domains.</p>	<p>Targeted weed management is recommended. Noxious weed locations have been noted and their presence should be reviewed during future monitoring periods. It is noted that noxious weeds have been recorded within the cattle monitoring sites, and cattle can provide a means of exotic species spread.</p>
LFA		
<p>Completion criteria for SSA indices (Slope Stability, Soil Infiltration and Nutrient Cycling) are listed in the WCBMP as a minimum score of 50. The WCBMP also anticipates a minimal annual increase by 5 for these scores.</p>	<p>High LOI indicating stable, functioning landforms, was recorded at all the sites, with the exception of two Rehabilitation Areas monitoring sites. Slope Stability was above completion criteria for all sites. Soil Infiltration and Nutrient Cycling scores were more variable and below completion criteria for the majority of sites. Soil Infiltration and Nutrient Cycling scores reduced instead of recording the anticipated annual improvement of 5. However, this was reduction was also recorded at the reference sites.</p>	<p>Management measures to be implemented as recommended in the WCBMP would be expected to improve LFA monitoring results over time. Annual improvement of less than 5 for any of the SSA indices triggers the need for further investigation. WCPL should review past management measures in these areas and consult the WCBMP recommended management actions going forward.</p> <p>Continued monitoring of sites to provide longer term data</p>

Interim Performance Target	Comment from results	Recommendations
		and determine the effectiveness of management actions.
Fauna		
Landforms and vegetation structure within WCPL Management Domains are inhabited or frequented by local fauna.	A broad variety of species were recorded in monitoring sites across the various Management Domains. These results demonstrated that the condition of landforms, vegetation structure and other habitat features at the monitoring sites, including the surrounding environment, was a key factor in determining species numbers and diversity.	Continue monitoring fauna sites, targeting fauna groups such as birds and microbats. Birds and microbats are common and diverse throughout Australia. Due to the ease of surveying birds and microbats, they are regularly a focus of monitoring surveys and are analysed as an indicator of biodiversity. Comparison of bird and microbat assemblages can be undertaken and tracking of trends over time can indicate sites moving from.
Introduced feral and pest species control is essential to environmental management works with targeted programs implemented.	Introduced predators and herbivores were observed throughout all Management Domains. Targeted monitoring of these species would be necessary to determine abundance and activity levels.	Ongoing management of introduced species is recommended. Management methods are to be implemented as per the WCBMP (including poison baiting of predators and ripping rabbit warrens) and recommendations from this report. Control of herbivore populations should be prioritised within regeneration and rehabilitation areas to increase resilience. Ongoing control of introduced predators will reduce pressure on native species.

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Appendix A – Weather conditions

Table A-1: 2016 Monthly mean and historical average weather conditions

Month	2016			Historical Averages		
	Min Temp (°C)	Max Temp (°C)	Total Rainfall (mm)	Min Temp (°C)	Max Temp (°C)	Rainfall Mean (mm)
April	11.7	26.5	14.8	9.8	23.5	41.2
May	7.7	19.6	71.8	6.3	19.1	45.2
June	5.6	14.3	116.6	3.7	15.4	46.3
July	4.8	15.4	84.8	2.7	14.7	47.5
August	4.1	16.1	40.9	3.4	16.5	47.1
September	7.4	17.6	198.7	6.1	19.8	42.5
October	7.8	21.6	86.6	9.2	23.6	55.2
November	11.4	27.4	51.9	12.3	26.8	57.5
December	16.4	32.2	90.6	14.9	29.7	65.8

Source: WCPL (2016 data); Bureau of Meteorology, 2017 (Historical averages)

Table A-2: Weather conditions during 2016 Biodiversity Monitoring Program

Date	Min Temp (°C)	Max Temp (°C)	Rainfall (mm)	Average Wind Speed (km/hr)
Autumn monitoring				
11-Apr-16	10.3	25.5	0.0	1.6
12-Apr-16	10.4	24.6	0.0	2.3
13-Apr-16	12.1	24.2	0.0	2.7
16-Apr-16	9.8	28.2	0.0	0.6
17-Apr-16	12.1	23.8	0.0	2.1
18-Apr-16	13.4	21.9	0.4	1.3
19-Apr-16	11.7	25.7	0.0	0.9
20-Apr-16	10.0	26.8	0.0	0.9
21-Apr-16	11.7	27.3	0.0	0.8
Winter bird monitoring				
04-Jul-16	-0.7	15.8	0.8	0.4
05-Jul-16	6.1	12.6	25.2	2.7

Date	Min Temp (°C)	Max Temp (°C)	Rainfall (mm)	Average Wind Speed (km/hr)
06-Jul-16	6.2	10.8	3.4	6.5
07-Jul-16	8.4	16.9	2.0	4.2
08-Jul-16	5.7	14.7	11.0	0.2
10-Jul-16	2.7	16.7	0.2	0.6
Spring monitoring				
29-Aug-16	0.3	17.7	0.0	0.8
30-Aug-16	3.2	22.1	0.0	0.4
31-Aug-2016	9.4	17.3	11.6	1.8
1-Sep-16	9.2	19.6	11	0.8
2-Sep-16	12.5	15.6	42.4	1.2
5-Sep-16	1.8	20.5	0	0.2
6-Sep-16	2.8	20.7	0	0.8
7-Sep-16	4.4	21.1	0	0.8
8-Sep-16	7.6	21.7	0	0.7
9-Sep-16	7.8	20.5	4.6	0.7
12-Sep-16	4.2	21.4	0	0.1
16-Nov-16	8.4	27.7	0	1.1
24-Nov-16	10.2	24.3	0	2.6
25-Nov-16	8.1	25.5	0	1.8
26-Nov-16	8.3	28.3	0	0.6
27-Nov-16	9.2	29.8	0	1.5
28-Nov-16	16.5	31	0	0.4

Source: WCPL

Table E3: Monthly Rainfall from 2013 - 2016 (mm)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Total
2013	73.6	54.2	61.4	12.2	17.4	77.9	20.8	6.6	33.0	8.8	78.6	27.6	472.1
2014	15.6	60.0	112.6	62.8	13.8	29.8	28.6	28.8	14.6	15.4	24.4	126.7	533.1
2015	127.6	11.6	9.4	108.4	42.8	42.8	38.0	53.8	7.8	61.0	59.0	118.4	680.6
2016	152.1	7.2	23.5	14.8	66.8	104.2	101.1	40.9	198.7	86.6	51.9	90.6	938.4
Historical Mean	70.8	61.9	54.8	44.3	45.1	50.8	49.1	46.0	46.3	55.3	59.7	67.7	651.3

Source: Bureau of Meteorology, 2017.

Appendix B – 2016 biodiversity monitoring sites

Table B-1: Autumn 2016 Vegetation Monitoring Sites

Domain	Site	Management Domain	Condition	Keith Vegetation Class	Vegetation Community	Easting	Northing
BOA	D_101	BOA-D	Native vegetation	WSDSF	Narrow-leaved Ironbark Woodland	784318	6427419
	D_103	BOA-D	Native vegetation	WSDSF	Mugga Ironbark Woodland	784084	6427171
	E_100	BOA-E	Native vegetation	WSDSF	Narrow-leaved Ironbark - Brown Bloodwood - Dwyer's Red Gum Woodland	778311	6419426
	E_105	BOA-E	Regeneration	WSGW	White Box Grassy Woodland (regenerating)	779016	6419982
	E_106	BOA-E	Native vegetation	WSGW	White Box Grassy Woodland (DNG)	778855	6420402
ECA	A_102	ECA-A	Regeneration	WSGW	Box-Gum Grassy Woodland on Valley Floors (DNG)	772917	6417079
	A_103	ECA-A	Native vegetation	WSGW	Blakely's Red Gum Woodland	773142	6417621
	B_103	ECA-B	Native vegetation	WSDSF	Grey Gum - Narrow-leaved Stringybark Forest	771079	6420160
	B_106	ECA-B	Regeneration	WSGW	Yellow Box Woodland (DNG)	771570	6420003
	C_101	ECA-C	Regeneration	WSDSF	White Box Shrubby Woodland (DNG)	768365	6416938
Regeneration	R1_100	Regeneration Area 1	Regeneration	WSGW	Blakely's Red Gum Woodland (DNG)	774228	6420096
	R3_100	Regeneration Area 3	Regeneration	WSDSF	White Box Shrubby Woodland (DNG)	770462	6415880
	R5_100	Regeneration Area 5	Regeneration	WSGW	Rough-barked Apple Woodland (DNG)	769194	6421424
	R6_101	Regeneration Area 6	Regeneration	WSGW	Rough-barked Apple Woodland (DNG)	767412	6420304
	R7_100	Regeneration Area 7	Regeneration	WSGW	Yellow Box Woodland (DNG)	767957	6416541

	R8_100	Regeneration Area 8	Regeneration	WSDSF	Rough-barked Apple Woodland (DNG)	767740	6417104
	R9_101	Regeneration Area 9	Regeneration	WSGW	Rough-barked Apple Woodland (DNG)	768829	6422231
Rehabilitation	R6	Rehabilitation	Rehabilitation	WSDSF	NA	769566	6419516
	R9	Rehabilitation	Rehabilitation	WSDSF	NA	769120	6418969
Reference	Ref_13b [#]	Turrill SCA	Native vegetation	WSDSF	N/A	776970	6451670
	Ref_14	Goulburn River NP	Native vegetation	WSDSF	N/A	782174	6421967
	Ref_15	Goulburn River NP	Native vegetation	WSGW	N/A	766024	6426575
	Ref_16	Goulburn River NP	Native vegetation	WSGW	N/A	766047	6426748
	Ref_17	Turrill SCA	Native vegetation	WSGW	N/A	776767	6452950
	Ref_18	Goulburn River NP	Native vegetation	WSGW	N/A	775232	6451125
	Ref_19	BOA-E	Native vegetation	WSGW	N/A	779189	6419668
	Ref_20	Goulburn River NP	Native vegetation	WSDSF	N/A	769129	6421893
	Ref_21	Goulburn River NP	Native vegetation	WSDSF	N/A	769832	6422848
	Ref_22	Goulburn River NP	Native vegetation	WSDSF	N/A	768130	6423829
	Ref_23	Goulburn River NP	Native vegetation	WSGW	N/A	769183	6422270
	Ref_24	BOA-E	Native vegetation	WSGW	N/A	779295	6419440
	Ref_25	Goulburn River NP	Native vegetation	WSGW	N/A	764212	6431932

Table B-2: Spring 2016 vegetation monitoring sites

Domain	Site	Management Domain/Location	Condition	Keith Vegetation Class	Vegetation Community	Easting	Northing
BOA	D_100	BOA-D	Native Vegetation	WSDSF	Narrow-leaved Ironbark - Box Woodland	784857	6427722
	D_102	BOA-D	Regeneration	WSGW	Grassy White Box Woodland	784563	6427262
	E_101	BOA-E	Regeneration	WSDSF	Shrubby regeneration	778761	6419564
	E_102	BOA-E	Regeneration	WSGW	Yellow Box Woodland	779053	6419319
	E_104	BOA-E	Native Vegetation	WSGW	Grassy White Box Woodland	779148	6419734
ECA	A_100	ECA-A	Regeneration	WSGW	DNG - other native (non EEC)	771861	6416276
	A_104	ECA-A	Native Vegetation	WSGW	Narrow-leaved Ironbark Forest	773695	6416293
	B_100	ECA-B	Native Vegetation	WSGW	Sandstone Ranges Shrubby Woodland	770111	6420997
	B_101	ECA-B	Regeneration	WSGW	DNG - other native (non EEC)	770542	6420592
	B_105	ECA-B	Regeneration	WSDSF	DNG - other native (non EEC)	773141	6420468
	C_102	ECA-C	Native Vegetation	WSGW	Shrubby White Box Woodland	768940	6417281
Regeneration Area	R1_101	Regeneration Area 1	Regeneration	WSGW	DNG - other native (non EEC)	774053	6419239
	R2_101	Regeneration Area 2	Regeneration	WSGW	DNG - other native (non EEC)	772639	6418355
	R4_100	Regeneration Area 4	Regeneration	WSGW	DNG - other native (non EEC)	770347	6420268
	R5_101	Regeneration Area 5	Regeneration	WSDSF	DNG - other native (non EEC)	769500	6421595

Domain	Site	Management Domain/Location	Condition	Keith Vegetation Class	Vegetation Community	Easting	Northing
	R7_101	Regeneration Area 7	Regeneration	WSDSF	DNG - other native (non EEC)	767446	6415726
	R9_100	Regeneration Area 9	Regeneration	WSDSF	DNG - other native (non EEC)	768975	6422067
Rehabilitation Area	R8	Rehabilitation Area	Rehabilitation – Grassland	WSGW	N/A	770231	6418596
	R10	Rehabilitation Area	Rehabilitation – Grassland	WSGW	N/A	768433	6419301
	R11	Rehabilitation Area	Rehabilitation – Grassland	WSGW	N/A	768896	6419664
	R1_C	Rehabilitation Area	Rehabilitation – Cattle excluded	WSDSF	N/A	770478	6419353
	R2_C	Rehabilitation Area	Rehabilitation – Cattle	WSDSF	N/A	770373	6419418
	R3_C	Rehabilitation Area	Rehabilitation – Cattle excluded	WSDSF	N/A	770396	6419246
	R5_C	Rehabilitation Area	Rehabilitation – Cattle	WSDSF	N/A	770315	6419331
Reference	Ref_1	Turill SCA	Native vegetation	WSGW	Blakely's Red Gum Grassy Woodland	775261	6451958
	Ref_2	Goulburn River NP	Native vegetation	WSDSF	Narrow-leaved Ironbark - Box Woodland	224152	6424015
	Ref_3	Goulburn River NP	Native vegetation	WSDSF	Grey Gum – Narrow-leaved Stringybark Forest	217853	6424354
	Ref_4	Turill SCA	Native vegetation	WSGW	Grassy White Box Woodland	773477	6449770

Domain	Site	Management Domain/Location	Condition	Keith Vegetation Class	Vegetation Community	Easting	Northing
	Ref_5	WCPL Offset Area	Native vegetation	WSDSF	Ironbark Bloodwood Red Gum Woodland	779353	6419938
	Ref_6	Goulburn River NP	Native vegetation	WSDSF	Ironbark Bloodwood Red Gum Woodland	222265	6422430
	Ref_7	Goulburn River NP	Native vegetation	WSDSF	Narrow-leaved Ironbark - Box Woodland	218145	6425455
	Ref_8	Goulburn River NP	Native vegetation	WSGW	White Box Shrubby Woodland	781932	6414688
	Ref_9	Goulburn River NP	Native vegetation	WSDSF	Grey Gum – Narrow-leaved Stringybark Forest	221614	6422152
	Ref_10	Goulburn River NP	Native vegetation	WSDSF	Narrow-leaved Ironbark - Box Woodland	220576	6428690
	Ref_11	Turill SCA	Native vegetation	WSGW	Blakely's Red Gum – White Box DNG	775036	6451459
	Ref_12	Turill SCA	Native vegetation	WSGW	Rough-barked Apple DNG	773663	6449945

Table B-3: LFA monitoring sites

Site	Management Domain	Easting	Northing	Zone	Type
A_100	ECA-A	771861	6416276	55H	BM LFA
B_106	ECA-B	771571	6420001	55H	LFA
E_105	BOA-E	779002	6419978	55H	LFA
R1_100	Regeneration Area 1	774228	6420095	55H	LFA
R10	Rehabilitation Area	768433	6419301	55H	BM LFA
R11	Rehabilitation Area	768896	6419664	55H	BM LFA
R13	Rehabilitation Area	770872	6418901	55H	LFA
R4_100	Regeneration Area 4	770347	6420268	55H	BM LFA
R5_C	Rehabilitation Area	770315	6419331	55H	BM LFA
R6	Rehabilitation Area	769562	6419517	55H	LFA
R6_101	Regeneration Area 6	767406	6420303	55H	LFA
R8	Rehabilitation Area	770231	6418596	55H	BM LFA
R9	Rehabilitation Area	769118	6418973	55H	LFA
Ref_1	Turill SCA	775261	6451958	55H	BM LFA
Ref_10	Goulburn River NP	220576	6428690	56H	LFA
Ref_13	Turill SCA	777202	6449998	55H	LFA
Ref_14	Goulburn River NP	782171	6421993	55H	LFA
Ref_2	Goulburn River NP	224152	6424015	56H	BM LFA
Ref_3	Goulburn River NP	217853	6424354	56H	BM LFA

Site	Management Domain	Easting	Northing	Zone	Type
Ref_4	Turill SCA	773477	6449770	55H	BM LFA
Ref_5	WCPL Offset Area	779353	6419938	55H	BM LFA
Ref_6	Goulburn River NP	222265	6422430	56H	BM LFA
Ref_7	Goulburn River NP	218145	6425455	56H	LFA
Ref_8	Goulburn River NP	781932	6414688	55H	BM LFA

Table B-4: Fauna monitoring sites

Area	Site ID	Coordinates		Management Zone	Vegetation Class	Survey		
		Easting	Northing			Fauna	Bats	Birds only
ECA-A	A_100	771861	6416276	Regeneration (poor resilience)	Western Slopes Grassy Woodland	Y		
	A_102	772926	6417078	Regeneration (moderate resilience)	Western Slopes Grassy Woodland	Y*		
	A_104	773695	6416293	Native vegetation (good resilience)	Western Slopes Grassy Woodland	Y	Y	
BOA-D	D_100	784857	6427722	Native vegetation (good resilience)	Western Slopes Dry Sclerophyll Forest	Y		
	D_101	784306	6427422	Native vegetation (good resilience)	Western Slopes Dry Sclerophyll Forest	Y		
	D_103	784083	6427173	Regeneration (moderate resilience)	Western Slopes Dry Sclerophyll Forest	Y	Y	
BOA-E	E_100	778299	6419408	Native vegetation (good resilience)	Western Slopes Dry Sclerophyll Forest	Y		
	E_104	779148	6419734	Native vegetation (good resilience)	Western Slopes Grassy Woodland	Y	Y	
	E_106	778854	6420399	Native vegetation (good resilience)	Western Slopes Grassy Woodland	Y		
ECA-B	B_100	770111	6420997	Native vegetation (good resilience)	Western Slopes Grassy Woodland	Y		
	B_101	770542	6420592	Regeneration (moderate resilience)	Western Slopes Grassy Woodland	Y	Y	
	B_103	771072	6420157	Native vegetation (good resilience)	Western Slopes Dry Sclerophyll Forest	Y		
	B_105	773141	6420468	Regeneration (moderate resilience)	Western Slopes Dry Sclerophyll Forest			Y
ECA-C	C_101	768377	6416929	Regeneration (moderate resilience)	Western Slopes Dry Sclerophyll Forest	Y*		
	C_102	768940	6417281	Native vegetation (good resilience)	Western Slopes Grassy Woodland	Y		
Regeneration Area 1	R1_101	774053	6419239	Regeneration (moderate resilience)	Western Slopes Grassy Woodland	Y*		

Area	Site ID	Coordinates		Management Zone	Vegetation Class	Survey		
		Easting	Northing			Fauna	Bats	Birds only
Regeneration Area 3	R3_100	770500	6415898	Regeneration (moderate resilience)	Western Slopes Dry Sclerophyll Forest	Y		
Regeneration Area 4	R4_100	770347	6420268	Regeneration (no resilience)	Western Slopes Grassy Woodland			Y
Regeneration Area 5	R5_100	769191	6421422	Regeneration (moderate resilience)	Western Slopes Grassy Woodland			Y
	R5_101	769500	6421595	Regeneration (moderate resilience)	Western Slopes Dry Sclerophyll Forest			Y
Regeneration Area 6	R6_101	767406	6420303	Regeneration (no resilience)	Western Slopes Grassy Woodland	Y		
Regeneration Area 7	R7_100	767907	6416557	Regeneration (moderate resilience)	Western Slopes Grassy Woodland	Y	Y	
	R7_101	767446	6415726	Regeneration (moderate resilience)	Western Slopes Dry Sclerophyll Forest	Y		
Rehabilitation	R6	769562	6419517	Rehabilitation - Woodland	Western Slopes Dry Sclerophyll Forest	Y		
	R9	769118	6418973	Rehabilitation - Woodland	Western Slopes Dry Sclerophyll Forest	Y		
Reference Sites	Ref_2	224153	6424016	Goulburn River NP	Western Slopes Dry Sclerophyll Forest		Y	
	Ref_3	217853	6424354	Goulburn River NP	Western Slopes Grassy Woodland		Y	
	Ref_5	779353	6419939	WCPL Offset Area	Western Slopes Grassy Woodland		Y	
	Ref_8	781933	6414689	Goulburn River NP	Western Slopes Grassy Woodland		Y	
	Ref_10	220576	6428690	Goulburn River NP	Western Slopes Grassy Woodland		Y	
	Ref_14	782174	6421967	Goulburn River NP	Western Slopes Grassy Woodland		Y	

*Sites that used pitfall traps instead of funnel trap

Appendix C – Flora species list (autumn 2016 and spring 2016)

Family	Scientific Name	Native / Exotic
Fabaceae	<i>Acacia decora</i>	Native
Fabaceae	<i>Acacia difformis</i>	Native
Fabaceae	<i>Acacia doratoxylon</i>	Native
Fabaceae	<i>Acacia implexa</i>	Native
Fabaceae	<i>Acacia leucolobia</i>	Native
Fabaceae	<i>Acacia linearifolia</i>	Native
Fabaceae	<i>Acacia montana</i>	Native
Fabaceae	<i>Acacia neriifolia</i>	Native
Fabaceae	<i>Acacia penninervis</i>	Native
Fabaceae	<i>Acacia sp.</i>	Native
Fabaceae	<i>Acacia terminalis subsp. aurea</i>	Native
Fabaceae	<i>Acacia triptera</i>	Native
Fabaceae	<i>Acacia ulicifolia</i>	Native
Fabaceae	<i>Acacia uncinata</i>	Native
Fabaceae	<i>Acacia verniciflua</i>	Native
Rosaceae	<i>Acaena agnipila</i>	Native
Rosaceae	<i>Acaena ovina</i>	Native
Rosaceae	<i>Acaena sp.</i>	Native
Polygonaceae	<i>Acetosella vulgaris</i>	Exotic
Epacridaceae	<i>Acrotriche rigida</i>	Native
Poaceae	<i>Aira sp.</i>	Exotic
Lamiaceae	<i>Ajuga australis</i>	Native
Casuarinaceae	<i>Allocasuarina diminuta subsp. diminuta</i>	Native
Casuarinaceae	<i>Allocasuarina gymnanthera</i>	Native
Casuarinaceae	<i>Allocasuarina luehmannii</i>	Native
Casuarinaceae	<i>Allocasuarina sp.</i>	Native
Amaranthaceae	<i>Alternanthera pungens</i>	Exotic
Loranthaceae	<i>Amyema miquelii</i>	Native
Myrsinaceae	<i>Anagallis arvensis</i>	Exotic
Myrtaceae	<i>Angophora floribunda</i>	Native
Asteraceae	<i>Arctotheca calendula</i>	Exotic
Caryophyllaceae	<i>Arenaria serpyllifolia</i>	Exotic
Poaceae	<i>Aristida leichhardtiana</i>	Native
Poaceae	<i>Aristida ramosa</i>	Native
Poaceae	<i>Aristida sp.</i>	Native
Poaceae	<i>Aristida vagans</i>	Native
Poaceae	<i>Aristida warburgii</i>	Native
Anthericaceae	<i>Arthropodium minus</i>	Native

Anthericaceae	<i>Arthropodium sp.</i>	Native
Poaceae	<i>Arundinella nepalensis</i>	Native
Rubiaceae	<i>Asperula conferta</i>	Native
Asteraceae	<i>Asteraceae sp.</i>	Native/Exotic
Ericaceae	<i>Astroloma humifusum</i>	Native
Chenopodiaceae	<i>Atriplex semibaccata</i>	Native
Poaceae	<i>Austrodanthonia racemosa var. obtusata</i>	Native
Poaceae	<i>Austrostipa scabra</i>	Native
Poaceae	<i>Austrostipa scabra subsp. falcata</i>	Native
Poaceae	<i>Austrostipa sp.</i>	Native
Poaceae	<i>Austrostipa verticillata</i>	Native
Asteraceae	<i>Bidens bipinnata</i>	Exotic
Pittosporaceae	<i>Billardiera scandens</i>	Native
Rutaceae	<i>Boronia rubiginosa</i>	Native
Fabaceae	<i>Bossiaea buxifolia</i>	Native
Fabaceae	<i>Bossiaea prostrata</i>	Native
Poaceae	<i>Bothriochloa macra</i>	Native
Malvaceae	<i>Brachychiton populneus</i>	Native
Ericaceae	<i>Brachyloma daphnoides</i>	Native
Brassicaceae	<i>Brassica sp.</i>	Exotic
Poaceae	<i>Briza minor</i>	Exotic
Poaceae	<i>Bromus catharticus</i>	Exotic
Poaceae	<i>Bromus hordeaceus</i>	Exotic
Poaceae	<i>Bromus molliformis</i>	Exotic
Poaceae	<i>Bromus sp.</i>	Native/Exotic
Acanthaceae	<i>Brunoniella australis</i>	Native
Asphodelaceae	<i>Bulbine bulbosa</i>	Native
Asphodelaceae	<i>Bulbine sp.</i>	Native
Pittosporaceae	<i>Bursaria longisepala</i>	Native
Pittosporaceae	<i>Bursaria spinosa</i>	Native
Orchidaceae	<i>Caladenia fuscata</i>	Native
Orchidaceae	<i>Caladenia sp.</i>	Native
Orchidaceae	<i>Calendula sp.</i>	Native
Cupressaceae	<i>Callitris endlicheri</i>	Native
Asteraceae	<i>Calotis cuneata</i>	Native
Asteraceae	<i>Calotis cuneifolia</i>	Native
Asteraceae	<i>Calotis lappulacea</i>	Native
Myrtaceae	<i>Calytrix tetragona</i>	Native
Cyperaceae	<i>Carex appressa</i>	Native
Cyperaceae	<i>Carex inversa</i>	Native
Cyperaceae	<i>Carex sp.</i>	Native/Exotic
Asteraceae	<i>Carthamus lanatus</i>	Exotic
Asteraceae	<i>Cassinia arcuata</i>	Native

Asteraceae	<i>Cassinia cunninghami</i>	Native
Asteraceae	<i>Cassinia quinquefaria</i>	Native
Asteraceae	<i>Cassinia sp.</i>	Native/Exotic
Lauraceae	<i>Cassytha pubescens</i>	Native
Asteraceae	<i>Centaurea melitensis</i>	Exotic
Asteraceae	<i>Centaurea solstitialis</i>	Exotic
Gentianaceae	<i>Centaurium erythraea</i>	Exotic
Gentianaceae	<i>Centaurium sp.</i>	Exotic
Caryophyllaceae	<i>Cerastium glomeratum</i>	Exotic
Caryophyllaceae	<i>Cerastium sp.</i>	Exotic
Caryophyllaceae	<i>Cerastium vulgare</i>	Exotic
Euphorbiaceae	<i>Chamaesyce drummondii</i>	Native
Pteridaceae	<i>Cheilanthes distans</i>	Native
Pteridaceae	<i>Cheilanthes sieberi</i>	Native
Pteridaceae	<i>Cheilanthes sp.</i>	Native
Chenopodiaceae	<i>Chenopodium album</i>	Exotic
Chenopodiaceae	<i>Chenopodium carinatum</i>	Native
Poaceae	<i>Chloris gayana</i>	Exotic
Poaceae	<i>Chloris truncata</i>	Native
Poaceae	<i>Chloris ventricosa</i>	Native
Asteraceae	<i>Chondrilla juncea</i>	Exotic
Fabaceae	<i>Chorizema parviflorum</i>	Native
Asteraceae	<i>Chrysocephalum apiculatum</i>	Native
Asteraceae	<i>Chrysocephalum semipapposum</i>	Native
Asteraceae	<i>Chrysocephalum sp.</i>	Native
Asteraceae	<i>Cirsium vulgare</i>	Exotic
Poaceae	<i>Cleistochloa rigida</i>	Native
Ranunculaceae	<i>Clematis glycinoides</i>	Native
Convolvulaceae	<i>Convolvulus erubescens</i>	Native
Asteraceae	<i>Conyza bonariensis</i>	Exotic
Asteraceae	<i>Conyza sp.</i>	Exotic
Myrtaceae	<i>Corymbia trachyphloia</i>	Native
Asteraceae	<i>Cotula australis</i>	Native
Asteraceae	<i>Cotula sp.</i>	Native
Crassulaceae	<i>Crassula sieberiana</i>	Native
Crassulaceae	<i>Crassula sp.</i>	Native
Rhamnaceae	<i>Cryptandra spinosa</i>	Native
Apiaceae	<i>Cyclospermum leptophyllum</i>	Exotic
Asteraceae	<i>Cymbonotus lawsonianus</i>	Native
Asteraceae	<i>Cymbonotus sp.</i>	Native
Poaceae	<i>Cymbopogon refractus</i>	Native
Poaceae	<i>Cynodon dactylon</i>	Native
Poaceae	<i>Cynodon sp.</i>	Native
Boraginaceae	<i>Cynoglossum australe</i>	Native

Boraginaceae	<i>Cynoglossum sp.</i>	Exotic
Cyperaceae	<i>Cyperus gracilis</i>	Native
Apiaceae	<i>Daucus glochidiatus</i>	Native
Fabaceae	<i>Daviesia genistifolia</i>	Native
Fabaceae	<i>Daviesia sp.</i>	Native
Fabaceae	<i>Daviesia ulicifolia</i>	Native
Fabaceae	<i>Desmodium brachypodum</i>	Native
Fabaceae	<i>Desmodium sp.</i>	Native
Fabaceae	<i>Desmodium varians</i>	Native
Phormiaceae	<i>Dianella revoluta</i>	Native
Phormiaceae	<i>Dianella sp.</i>	Native
Poaceae	<i>Dichanthium setosum</i>	Native
Poaceae	<i>Dichelachne micrantha</i>	Native
Poaceae	<i>Dichelachne sp.</i>	Native
Convolvulaceae	<i>Dichondra repens</i>	Native
Convolvulaceae	<i>Dichondra sp.</i>	Native
Convolvulaceae	<i>Dichondra sp. A</i>	Native
Anthericaceae	<i>Dichopogon fimbriatus</i>	Native
Anthericaceae	<i>Dichopogon sp.</i>	Native
Anthericaceae	<i>Dichopogon strictus</i>	Native
Poaceae	<i>Digitaria brownii</i>	Native
Poaceae	<i>Digitaria diffusa</i>	Native
Poaceae	<i>Digitaria eriantha subsp. eriantha</i>	Exotic
Poaceae	<i>Digitaria ramularis</i>	Native
Poaceae	<i>Digitaria sp.</i>	Native
Sapindaceae	<i>Dodonaea triangularis</i>	Native
Sapindaceae	<i>Dodonaea viscosa subsp. cuneata</i>	Native
Droseraceae	<i>Drosera hookeri</i>	Native
Droseraceae	<i>Drosera peltata</i>	Native
Poaceae	<i>Echinochloa crus-galli</i>	Exotic
Poaceae	<i>Echinopogon sp.</i>	Native
Boraginaceae	<i>Echium plantagineum</i>	Exotic
Boraginaceae	<i>Echium vulgare</i>	Exotic
Chenopodiaceae	<i>Einadia hastata</i>	Native
Chenopodiaceae	<i>Einadia nutans</i>	Native
Chenopodiaceae	<i>Einadia polygonoides</i>	Native
Chenopodiaceae	<i>Einadia sp.</i>	Native
Chenopodiaceae	<i>Einadia trigonos</i>	Native
Poaceae	<i>Elymus scaber</i>	Native
Poaceae	<i>Enneapogon nigricans</i>	Native
Poaceae	<i>Entolasia marginata</i>	Native
Poaceae	<i>Entolasia stricta</i>	Native
Poaceae	<i>Eragrostis brownii</i>	Native
Poaceae	<i>Eragrostis curvula</i>	Exotic

Poaceae	<i>Eragrostis curvula cv. Conferta</i>	Exotic
Poaceae	<i>Eragrostis leptostachya</i>	Native
Poaceae	<i>Eragrostis sp.</i>	Native/Exotic
Myoporaceae	<i>Eremophila debilis</i>	Native
Geraniaceae	<i>Erodium botrys</i>	Exotic
Geraniaceae	<i>Erodium cicutarium</i>	Exotic
Geraniaceae	<i>Erodium crinitum</i>	Native
Geraniaceae	<i>Erodium moschatum</i>	Native
Geraniaceae	<i>Erodium sp.</i>	Native
Myrtaceae	<i>Eucalyptus albens</i>	Native
Myrtaceae	<i>Eucalyptus blakelyi</i>	Native
Myrtaceae	<i>Eucalyptus bridgesiana</i>	Native
Myrtaceae	<i>Eucalyptus crebra</i>	Native
Myrtaceae	<i>Eucalyptus dealbata</i>	Native
Myrtaceae	<i>Eucalyptus dwyeri</i>	Native
Myrtaceae	<i>Eucalyptus fibrosa</i>	Native
Myrtaceae	<i>Eucalyptus melliodora</i>	Native
Myrtaceae	<i>Eucalyptus microcarpa</i>	Native
Myrtaceae	<i>Eucalyptus punctata</i>	Native
Myrtaceae	<i>Eucalyptus sp.</i>	Native
Myrtaceae	<i>Eucalyptus sparsifolia</i>	Native
Asteraceae	<i>Euchiton sp.</i>	Native
Asteraceae	<i>Euchiton sphaericus</i>	Native
Poaceae	<i>Eulalia aurea</i>	Native
Santalaceae	<i>Exocarpos strictus</i>	Native
Cyperaceae	<i>Fimbristylis dichotoma</i>	Native
Cyperaceae	<i>Gahnia aspera</i>	Native
Cyperaceae	<i>Gahnia sp.</i>	Native/Exotic
Rubiaceae	<i>Galium divaricatum</i>	Exotic
Rubiaceae	<i>Galium leptogonium</i>	Native
Rubiaceae	<i>Galium sp.</i>	Native
Asteraceae	<i>Gamochaeta antillana</i>	Exotic
Asteraceae	<i>Gamochaeta coarctata</i>	Exotic
Asteraceae	<i>Gamochaeta sp.</i>	Exotic
Geraniaceae	<i>Geranium solanderi</i>	Native
Geraniaceae	<i>Geranium solanderi var. solanderi</i>	Native
Geraniaceae	<i>Geranium sp.</i>	Native
Orchidaceae	<i>Glossodia major</i>	Native
Orchidaceae	<i>Glossodia minor</i>	Native
Fabaceae	<i>Glycine clandestina</i>	Native
Fabaceae	<i>Glycine tabacina</i>	Native
Fabaceae	<i>Gompholobium huegelii</i>	Native
Fabaceae	<i>Gompholobium sp.</i>	Native
Haloragaceae	<i>Gonocarpus elatus</i>	Native

Goodeniaceae	<i>Goodenia hederacea</i>	Native
Goodeniaceae	<i>Goodenia ovata</i>	Native
Goodeniaceae	<i>Goodenia paniculata</i>	Native
Goodeniaceae	<i>Goodenia pinnatifida</i>	Native
Goodeniaceae	<i>Goodenia rotundifolia</i>	Native
Goodeniaceae	<i>Goodenia sp.</i>	Native
Proteaceae	<i>Grevillea sericea</i>	Native
Proteaceae	<i>Grevillea sericea subsp. sericea</i>	Native
Proteaceae	<i>Hakea dactyloides</i>	Native
Haloragaceae	<i>Halogaris sp.</i>	Native
Haloragaceae	<i>Haloragis heterophylla</i>	Native
Fabaceae	<i>Hardenbergia violacea</i>	Native
Boraginaceae	<i>Heliotropium amplexicaule</i>	Exotic
Dilleniaceae	<i>Hibbertia monogyna</i>	Native
Dilleniaceae	<i>Hibbertia obtusifolia</i>	Native
Dilleniaceae	<i>Hibbertia riparia</i>	Native
Dilleniaceae	<i>Hibbertia sp.</i>	Native
Brassicaceae	<i>Hirschfeldia incana</i>	Exotic
Fabaceae	<i>Hovea apiculata</i>	Native
Fabaceae	<i>Hovea lanceolata</i>	Native
Apiaceae	<i>Hydrocotyle laxiflora</i>	Native
Clusiaceae	<i>Hypericum gramineum</i>	Native
Clusiaceae	<i>Hypericum perforatum</i>	Exotic
Asteraceae	<i>Hypochaeris glabra</i>	Exotic
Asteraceae	<i>Hypochaeris radicata</i>	Exotic
Hypoxidaceae	<i>Hypoxis hygrometrica</i>	Native
Poaceae	<i>Joycea pallida</i>	Native
Juncaceae	<i>Juncus sp.</i>	Native
Juncaceae	<i>Juncus usitatus</i>	Native
Myrtaceae	<i>Kunzea ambigua</i>	Native
Poaceae	<i>Lachnagrostis filiformis</i>	Native
Asteraceae	<i>Lactuca saligna</i>	Exotic
Asteraceae	<i>Lactuca serriola</i>	Exotic
Asteraceae	<i>Lactuca sp.</i>	Exotic
Asteraceae	<i>Lagenophora stipitata</i>	Native
Lamiaceae	<i>Lamium sp.</i>	Exotic
Anthericaceae	<i>Laxmannia gracilis</i>	Native
Brassicaceae	<i>Lepidium africanum</i>	Exotic
Brassicaceae	<i>Lepidium bonariense</i>	Exotic
Brassicaceae	<i>Lepidium pseudohyssopifolium</i>	Native
Brassicaceae	<i>Lepidium sp.</i>	Native
Cyperaceae	<i>Lepidosperma gunnii</i>	Native
Cyperaceae	<i>Lepidosperma laterale</i>	Native
Myrtaceae	<i>Leptospermum sp.</i>	Native

Myrtaceae	<i>Leptospermum sphaerocarpum</i>	Native
Myrtaceae	<i>Leptospermum trinervium</i>	Native
Ericaceae	<i>Leucopogon muticus</i>	Native
Ericaceae	<i>Leucopogon sp.</i>	Native/Exotic
Linaceae	<i>Linum marginale</i>	Native
Linaceae	<i>Linum sp.</i>	Native/Exotic
Linaceae	<i>Linum trigynum</i>	Exotic
Ericaceae	<i>Lissanthe strigosa</i>	Native
Poaceae	<i>Lolium perenne</i>	Exotic
Poaceae	<i>Lolium rigidum</i>	Exotic
Poaceae	<i>Lolium sp.</i>	Exotic
Lomandraceae	<i>Lomandra confertifolia</i>	Native
Lomandraceae	<i>Lomandra filiformis</i>	Native
Lomandraceae	<i>Lomandra filiformis subsp. coriacea</i>	Native
Lomandraceae	<i>Lomandra filiformis subsp. filiformis</i>	Native
Lomandraceae	<i>Lomandra glauca</i>	Native
Lomandraceae	<i>Lomandra longifolia</i>	Native
Lomandraceae	<i>Lomandra multiflora</i>	Native
Lomandraceae	<i>Lomandra sp.</i>	Native
Fabaceae	<i>Lotus australis</i>	Native
Zamiaceae	<i>Macrozamia communis</i>	Native
Zamiaceae	<i>Macrozamia sp.</i>	Native
Malvaceae	<i>Malva parviflora</i>	Exotic
Lamiaceae	<i>Marrubium vulgare</i>	Exotic
Fabaceae	<i>Medicago minima</i>	Exotic
Fabaceae	<i>Medicago sativa</i>	Exotic
Fabaceae	<i>Medicago sp.</i>	Exotic
Epacridaceae	<i>Melichrus erubescens</i>	Native
Epacridaceae	<i>Melichrus urceolatus</i>	Native
Lamiaceae	<i>Mentha satureioides</i>	Native
Poaceae	<i>Microlaena stipoides</i>	Native
Orchidaceae	<i>Microtis sp.</i>	Native
Orchidaceae	<i>Microtis unifolia</i>	Native
Malvaceae	<i>Modiola caroliniana</i>	Exotic
Ericaceae	<i>Monotoca sp.</i>	Native
Oleaceae	<i>Notelaea linearis</i>	Native
Onagraceae	<i>Oenothera mollissima</i>	Exotic
Onagraceae	<i>Oenothera stricta</i>	Exotic
Asteraceae	<i>Olearia viscidula</i>	Native
Lamiaceae	<i>Oncinocalyx betchei</i>	Native
Rubiaceae	<i>Opercularia diphylla</i>	Native
Rubiaceae	<i>Opercularia hispida</i>	Native
Rubiaceae	<i>Opercularia sp.</i>	Native
Ophioglossaceae	<i>Ophioglossum sp.</i>	Native

Cactaceae	<i>Opuntia sp.</i>	Exotic
Cactaceae	<i>Opuntia stricta</i>	Exotic
Fabaceae	<i>Ornithopus compressus</i>	Exotic
Oxalidaceae	<i>Oxalis perennans</i>	Native
Oxalidaceae	<i>Oxalis sp.</i>	Native
Oxalidaceae	<i>Oxalis sp. A</i>	Native
Oxalidaceae	<i>Oxalis sp. B</i>	Native
Poaceae	<i>Panicum effusum</i>	Native
Poaceae	<i>Panicum queenslandicum</i>	Native
Poaceae	<i>Panicum simile</i>	Native
Poaceae	<i>Panicum sp.</i>	Native
Orobanchaceae	<i>Parentucellia sp.</i>	Exotic
Caryophyllaceae	<i>Paronychia brasiliiana</i>	Exotic
Poaceae	<i>Paspalidium sp.</i>	Native/Exotic
Poaceae	<i>Paspalum dilatatum</i>	Exotic
Poaceae	<i>Paspalum sp.</i>	Exotic
Iridaceae	<i>Patersonia sericea</i>	Native
Poaceae	<i>Pennisetum clandestinum</i>	Exotic
Polygonaceae	<i>Persicaria prostrata</i>	Native
Proteaceae	<i>Persoonia linearis</i>	Native
Caryophyllaceae	<i>Petrorhagia nanteuilii</i>	Exotic
Caryophyllaceae	<i>Petrorhagia sp.</i>	Exotic
Poaceae	<i>Phalaris aquatica</i>	Exotic
Poaceae	<i>Phalaris minor</i>	Exotic
Poaceae	<i>Phalaris sp.</i>	Exotic
Rutaceae	<i>Phebalium squamulosum</i>	Native
Rutaceae	<i>Phebalium squamulosum subsp. gracile</i>	Native
Euphorbiaceae	<i>Phyllanthus hirtellus</i>	Native
Euphorbiaceae	<i>Phyllanthus occidentalis</i>	Native
Phyllanthaceae	<i>Phyllanthus sp.</i>	Native/Exotic
Phyllanthaceae	<i>Phyllanthus virgatus</i>	Native
Thymelaeaceae	<i>Pimelea curviflora</i>	Native
Thymelaeaceae	<i>Pimelea curviflora var. sericea</i>	Native
Plantaginaceae	<i>Plantago debilis</i>	Native
Plantaginaceae	<i>Plantago gaudichaudii</i>	Native
Plantaginaceae	<i>Plantago hispida</i>	Native
Plantaginaceae	<i>Plantago lanceolata</i>	Exotic
Plantaginaceae	<i>Plantago sp.</i>	Native
Plantaginaceae	<i>Plantago varia</i>	Native
Apiaceae	<i>Platysace ericoides</i>	Native
Apiaceae	<i>Platysace sp.</i>	Native
Poaceae	<i>Poa sieberiana</i>	Native
Poaceae	<i>Poa sp.</i>	Native/Exotic
Asteraceae	<i>Podolepis neglecta</i>	Native

Asteraceae	<i>Podolepis sp.</i>	Native
Fabaceae	<i>Podolobium ilicifolium</i>	Native
Caryophyllaceae	<i>Polycarpon sp.</i>	Exotic
Caryophyllaceae	<i>Polycarpon tetraphyllum</i>	Exotic
Polygonaceae	<i>Polygonum aviculare</i>	Exotic
Rubiaceae	<i>Pomax umbellata</i>	Native
Phyllanthaceae	<i>Poranthera microphylla</i>	Native
Orchidaceae	<i>Pterostylis bicolor</i>	Native
Orchidaceae	<i>Pterostylis mutica</i>	Native
Orchidaceae	<i>Pterostylis revoluta</i>	Native
Orchidaceae	<i>Pterostylis sp.</i>	Native
Fabaceae	<i>Pultenaea cinerascens</i>	Native
Fabaceae	<i>Pultenaea sp.</i>	Native
Rubiaceae	<i>Richardia stellaris</i>	Exotic
Iridaceae	<i>Romulea rosea</i>	Exotic
Rosaceae	<i>Rosa rubiginosa</i>	Exotic
Rosaceae	<i>Rubus anglocandicans</i>	Exotic
Polygonaceae	<i>Rumex brownii</i>	Native
Polygonaceae	<i>Rumex sp.</i>	Native
Poaceae	<i>Rytidosperma caespitosum</i>	Native
Poaceae	<i>Rytidosperma fulvum</i>	Native
Poaceae	<i>Rytidosperma monticola</i>	Native
Poaceae	<i>Rytidosperma racemosum</i>	Native
Poaceae	<i>Rytidosperma setaceum</i>	Native
Poaceae	<i>Rytidosperma sp.</i>	Native
Poaceae	<i>Rytidosperma sp. A</i>	Native
Poaceae	<i>Rytidosperma sp. B</i>	Native
Chenopodiaceae	<i>Salsola australis</i>	Native
Lamiaceae	<i>Salvia verbenaca</i>	Exotic
Lamiaceae	<i>Scutellaria mollis</i>	Native
Asteraceae	<i>Senecio madagascariensis</i>	Exotic
Asteraceae	<i>Senecio pinnatifolius var. pinnatifolius</i>	Exotic
Asteraceae	<i>Senecio quadridentatus</i>	Native
Asteraceae	<i>Senecio sp.</i>	Native
Asteraceae	<i>Senecio sp. B</i>	Native
Poaceae	<i>Setaria parviflora</i>	Exotic
Poaceae	<i>Setaria sp.</i>	Native/Exotic
Malvaceae	<i>Sida corrugata</i>	Native
Malvaceae	<i>Sida cunninghamii</i>	Native
Malvaceae	<i>Sida rigida</i>	Native/Exotic
Malvaceae	<i>Sida sp.</i>	Native
Asteraceae	<i>Sigesbeckia orientalis</i>	Native
Asteraceae	<i>Sigesbeckia sp.</i>	Native
Caryophyllaceae	<i>Silene gallica</i>	Exotic

Iridaceae	<i>Sisyrinchium sp.</i>	Exotic
Solanaceae	<i>Solanum aviculare</i>	Native
Solanaceae	<i>Solanum campanulatum</i>	Native
Solanaceae	<i>Solanum cinereum</i>	Native
Solanaceae	<i>Solanum nigrum</i>	Exotic
Solanaceae	<i>Solanum prinophyllum</i>	Native
Solanaceae	<i>Solanum sp.</i>	Native
Asteraceae	<i>Solenogyne bellioides</i>	Native
Asteraceae	<i>Solenogyne gunnii</i>	Native
Asteraceae	<i>Sonchus oleraceus</i>	Exotic
Asteraceae	<i>Sonchus sp.</i>	Exotic
Poaceae	<i>Sporobolus creber</i>	Native
Poaceae	<i>Sporobolus elongatus</i>	Native
Poaceae	<i>Sporobolus sp.</i>	Native
Stackhousiaceae	<i>Stackhousia monogyna</i>	Native
Stackhousiaceae	<i>Stackhousia viminea</i>	Native
Caryophyllaceae	<i>Stellaria media</i>	Exotic
Caryophyllaceae	<i>Stellaria sp.</i>	Native
Epacridaceae	<i>Styphelia triflora</i>	Native
Fabaceae	<i>Swainsona monticola</i>	Native
Asteraceae	<i>Tagetes minuta</i>	Exotic
Asteraceae	<i>Taraxacum officinale</i>	Exotic
Fabaceae	<i>Templetonia stenophylla</i>	Native
Poaceae	<i>Themeda australis</i>	Native
Poaceae	<i>Themeda triandra</i>	Native
Asteraceae	<i>Tolpis barbata</i>	Exotic
Zygophyllaceae	<i>Tribulus terrestris</i>	Exotic
Anthericaceae	<i>Tricoryne elatior</i>	Native
Fabaceae	<i>Trifolium angustifolium</i>	Exotic
Fabaceae	<i>Trifolium arvense</i>	Exotic
Fabaceae	<i>Trifolium campestre</i>	Exotic
Fabaceae	<i>Trifolium glomeratum</i>	Exotic
Fabaceae	<i>Trifolium repens</i>	Exotic
Fabaceae	<i>Trifolium scabrum</i>	Exotic
Fabaceae	<i>Trifolium sp.</i>	Exotic
Fabaceae	<i>Trifolium striatum</i>	Exotic
Fabaceae	<i>Trifolium subterraneum</i>	Exotic
Asteraceae	<i>Triptilodiscus pygmaeus</i>	Native
Urticaceae	<i>Urtica urens</i>	Exotic
Scrophulariaceae	<i>Verbascum thapsus</i>	Exotic
Scrophulariaceae	<i>Verbascum virgatum</i>	Exotic
Verbenaceae	<i>Verbena bonariensis</i>	Exotic
Verbenaceae	<i>Verbena sp.</i>	Exotic
Scrophulariaceae	<i>Veronica plebeia</i>	Native

Scrophulariaceae	<i>Veronica sp.</i>	Native
Asteraceae	<i>Vittadinia cuneata</i>	Native
Asteraceae	<i>Vittadinia cuneata var. cuneata</i>	Native
Asteraceae	<i>Vittadinia gracilis</i>	Native
Asteraceae	<i>Vittadinia muelleri</i>	Native
Asteraceae	<i>Vittadinia sp.</i>	Native
Poaceae	<i>Vulpia sp.</i>	Exotic
Campanulaceae	<i>Wahlenbergia luteola</i>	Native
Campanulaceae	<i>Wahlenbergia sp.</i>	Native
Colchicaceae	<i>Wurmbea dioica</i>	Native
Xanthorrhoeaceae	<i>Xanthorrhoea sp.</i>	Native
Fabaceae	<i>Zornia dyctiocarpa</i>	Native
Fabaceae	<i>Zornia sp.</i>	Native

Appendix D – Vegetation structure data

Table D-1: Autumn 2016 Vegetation Structure Data

Management Domain	Site number	Stratum	Lower height (m)	Upper height (m)	Percent cover (%)	Dominant species (*exotic)
BOA-D	D_101	U1	10	14	10	<i>Eucalyptus crebra</i> , <i>Eucalyptus moluccana</i>
		M1	1	1.5	5	<i>Acacia triptera</i> , <i>Acacia montana</i> , <i>Acrotriche rigida</i>
		L1	0.1	0.5	5	<i>Austrostipa densiflora</i> , <i>Gahnia aspera</i>
	D_103	U1	8	10	5	<i>Eucalyptus sideroxylon</i>
		U2	4	6	5	<i>Allocasuarina gymnanthera</i>
		M1	2	4	40	<i>Melaleuca erubescens</i> , <i>Melaleuca uncinata</i> , <i>Kunzea ambigua</i>
		M2	0.5	2	20	<i>Acacia triptera</i>
		L1	0.1	0.5	1	<i>Digitaria</i> sp.
	BOA	E_100	U1	8	12	15
M1			2	4	2	<i>Allocasuarina gymnanthera</i> , <i>Callitris endlicheri</i> , <i>Persoonia linearis</i>
M2			1	1.5	15	<i>Acacia triptera</i> , <i>Acrotriche rigida</i> , <i>Leucopogon muticus</i>
L1			0.25	.5	<1	<i>Aristida ramosa</i> , <i>Digitaria</i> sp.
L1			0.1	0.2	<1	<i>Lomandra glauca</i> , <i>Lomandra multiflora</i>
BOA-E	E_105	L1	0.5	1	30	<i>Aristida</i> sp., <i>Bothriochloa macra</i> , <i>Sporobolus creber</i>
	E_106	U1	10	12	5	<i>Eucalyptus albens</i> , <i>Eucalyptus dealbata</i>
		L1	0.5	1	50	<i>Aristida</i> sp., <i>Bothriochloa macra</i>
		L2	0.05	0.1	1	<i>Vittadinia muelleri</i>
ECA-A	A_102	M1	1	2	20	<i>Cassinia arcuata</i>
		L1	0.1	0.5	30	<i>Aristida vagans</i> , <i>Panicum effusum</i> , <i>Sporobolus creber</i>
	A_103	U1	12	14	15	<i>Angophora floribunda</i> , <i>Eucalyptus blakelyi</i> , <i>Eucalyptus melliodora</i>
		M1	0.5	1.5	15	<i>Cassinia arcuata</i>
		L1	0.1	0.25	10	<i>Aristida vagans</i>

Management Domain	Site number	Stratum	Lower height (m)	Upper height (m)	Percent cover (%)	Dominant species (*exotic)
ECA-B	B_103	U1	12	14	20	<i>Angophora floribunda</i> , <i>Eucalyptus sparsifolia</i>
		M1	2	3	<1	<i>Persoonia linearis</i>
		M2	1	5	1	<i>Acrotriche rigida</i> , <i>Cassinia cunninghamii</i>
		L1	0.5	0.75	1	<i>Gahnia aspera</i>
		L2	0.1	0.25	1	<i>Rytidosperma</i> sp., <i>Stellaria pungens</i>
	B_106	L1	0.01	0.5	25	<i>Aristida ramosa</i> , <i>Carex appressa</i>
ECA	C_101	L	0.1	0.5	70	<i>Bothriochloa macra</i> , <i>Microlaena stipoides</i>
Regeneration Area	R1_100	L	0.1	1	50	* <i>Chloris gayana</i> , * <i>Eragrostis curvula</i> , <i>Sporobolus creber</i>
	R3_100	L	0.1	1	40	<i>Bothriochloa macra</i> , <i>Sporobolus creber</i>
	R5_100	L	0.5	1	60	<i>Aristida</i> sp., <i>Bothriochloa macra</i> , <i>Sporobolus creber</i>
	R6_101	L1	0.5	1	4	* <i>Coryza</i> sp., * <i>Verbena bonariensis</i>
		L2	0.1	0.5	50	<i>Chloris truncata</i> , * <i>Eragrostis curvula</i> *, <i>Sporobolus creber</i>
	R6_101	L1	0.5	1	4	* <i>Coryza</i> sp., * <i>Verbena bonariensis</i>
		L2	0.1	0.5	50	<i>Chloris truncata</i> , * <i>Eragrostis curvula</i> , <i>Sporobolus creber</i>
	R7_100	L	0.1	0.5	75	<i>Aristida</i> sp., <i>Bothriochloa macra</i> , <i>Sporobolus creber</i>
	R8_100	L	0.1	0.75	80	<i>Bothriochloa macra</i> , <i>Digitaria</i> sp., <i>Sporobolus creber</i>
R9_101	L	0.5	1	75	<i>Digitaria brownii</i> , <i>Eragrostis brownii</i> , <i>Sporobolus creber</i>	
Rehabilitation Area	R6	M	1	3	2	<i>Acacia linearifolia</i> , <i>Acacia leucolobia</i> , <i>Eucalyptus albens</i>
		L	0.25	1	40	* <i>Chloris gayana</i> , * <i>Eragrostis curvula</i>
	R9	M1	2	2.5	10	<i>Acacia implexa</i> , <i>Eucalyptus albens</i>
		M2	1	2	15	<i>Acacia verniciflua</i> , <i>Eucalyptus crebra</i> , <i>Eucalyptus bridgesiana</i>
		L	0.01	1	20	<i>Cynodon dactylon</i> , * <i>Digitaria eriantha</i>

Table D-2 Spring 2016 Vegetation Structure Data

Management Domain	Site number	Stratum	Lower height (m)	Upper height (m)	Percent cover (%)	Dominant species (*exotic)	
BOA- D	D_100	U1	10	12	5	<i>Eucalyptus crebra</i>	
		U2	8	10	5	<i>Callitris endlicheri</i>	
		M1	3	6	20	<i>Kunzea ambigua</i> , <i>Callitris endlicheri</i>	
		M2	1	2.5	3	<i>Leucopogon muticus</i> , <i>Acrotriche rigida</i>	
		L1	0.25	0.75	10	<i>Acrotriche rigida</i> , <i>Gahnia aspera</i>	
		L2	0.01	0.1	2	<i>Goodenia hederacea</i> , <i>Lomandra filiformis</i>	
	D_102	U1	10	12	5	<i>Eucalyptus albens</i>	
		U2	5	7	<1	<i>Brachychiton populneus</i>	
		L1	0.01	0.1	55	<i>Gahnia aspera</i> , <i>Microlaena stipoides</i> , <i>Dichondra repens</i> , <i>Hydrocotyle laxiflora</i>	
	BOA-E	E_101	U1	8	10	2	<i>Eucalyptus blakelyi</i> , <i>Callitris endlicheri</i>
			M1	1.5	5	4	<i>Eucalyptus blakelyi</i> , <i>Cassinia arcuata</i> , <i>Callitris endlicheri</i> , <i>Acacia linearifolia</i>
		E102	L	0.01	0.25	90	<i>Aristida ramosa</i> , * <i>Hypochaeris radicata</i> , * <i>Cerastium glomeratum</i> , * <i>Trifolium sp.</i>
E104		U	5	8	11	<i>Eucalyptus albens</i>	
		L	0.01	0.5	55	<i>Austrostipa scabra</i> , <i>Crassula sieberiana</i> , * <i>Anagallis arvensis</i>	
ECA-A		A_100	L1	0.01	0.4	20	<i>Plantago sp.</i> , <i>Trifolium repens</i> , <i>Bothriochloa sp.</i> , <i>Verbena sp.</i>
	A_104	U1	8	10	5	<i>Eucalyptus crebra</i>	
		U2	5	8	<1	<i>Callitris endlicheri</i>	
		M1	2	4	20	<i>Callitris endlicheri</i>	
		M2	1	1.5	5	<i>Cassinia arcuata</i> , <i>Acacia ulicifolia</i>	
		L1	0.3	0.8	5	<i>Microlaena stipoides</i> , <i>Aristida vagans</i>	
		L2	0.1	0.3	<1	<i>Hydrocotyle laxiflora</i> , <i>Cheilanthes sieberi</i>	

Management Domain	Site number	Stratum	Lower height (m)	Upper height (m)	Percent cover (%)	Dominant species (*exotic)
ECA-B	B_100	U1	12	15	30	<i>Eucalyptus melliodora</i> , <i>Eucalyptus blakelyi</i>
		M1	1	2	15	<i>Cassinia arcuata</i> , <i>Exocarpos strictus</i>
		L1	0.01	0.7	5	<i>Aristida sp.</i> , <i>Hydrocotyle laxiflora</i> , <i>Microlaena stipoides</i>
	B_101	L1	0.01	0.7	50	<i>Aristida ramosa</i> , <i>Lomandra multiflora</i> , <i>Cheilanthes sieberi</i> , <i>Hypochaeris sp.</i>
	B105	L	0.01	0.5	85	* <i>Hypochaeris radicata</i> , * <i>Cerastium glomeratum</i>
ECA-C	C_102	U1	10	12	10	<i>Eucalyptus albens</i> , <i>Angophora floribunda</i>
		U2	8	16	10	<i>Eucalyptus punctata</i> , <i>Callitris endlicheri</i>
		M1	4	6	5	<i>Acacia linearifolia</i>
		M2	0.3	1.2	5	<i>Cassinia cunninghami</i> , <i>Acrotriche rigida</i>
		L1	0.1	0.3	<1	<i>Lomandra sp.</i>
		L2	0.02	0.1	<1	<i>Cheilanthes sieberi</i>
Regeneration Area	R1_101	L	0.01	0.4	90	* <i>Hypochaeris radicata</i> , * <i>Trifolium repens</i> , * <i>Trifolium campestre</i> , <i>Aristida ramosa</i>
	R2_101	L	0.01	0.2	90	* <i>Vulpia sp.</i> , * <i>Hypochaeris radicata</i> , <i>Aristida ramosa</i> , * <i>Trifolium repens</i>
	R4_100	L	0.01	0.2	75	<i>Cotula australis</i> , <i>Crassula sieberiana</i>
	R5_101	L	0.01	0.4	98	<i>Aristida ramosa</i> , * <i>Hypochaeris radicata</i> , * <i>Trifolium sp.</i>
	R7_101	L1	0.3	0.4	30	* <i>Trifolium repens</i> , * <i>Hypochaeris radicata</i>
		L2	0.1	0.3	50	<i>Microlaena stipoides</i> , <i>Aristida vagans</i>
	R9_100	U1	5	9	2	<i>Eucalyptus melliodora</i>
		M	0.7	2	25	<i>Cassinia arcuata</i>
		L	0.01	0.6	30	<i>Aristida ramosa</i> , <i>Aristida vagans</i> , <i>Gahnia aspera</i>
Rehabilitation Area	R1_C	U1	5	7	10	<i>Acacia linearifolia</i> , <i>Eucalyptus punctata</i> , <i>Eucalyptus blakelyi</i>
		M1	1	2	3	<i>Acacia leucolobia</i> , <i>Eucalyptus sp.</i> , <i>Cassinia arcuata</i>

Management Domain	Site number	Stratum	Lower height (m)	Upper height (m)	Percent cover (%)	Dominant species (*exotic)	
		L1	0.25	1	50	<i>*Eragrostis curvula</i>	
	R5_C	L1	0.1	0.5	25	<i>Cassinia arcuata</i> , <i>*Phalaris aquatica</i> , <i>Cotula australis</i> , <i>*Trifolium sp.</i>	
	R8	L1	0.01	0.5	80	<i>Plantago sp.</i> , <i>*Trifolium sp.</i> , <i>Digitaria sp.</i> , <i>Erodium crinitum</i>	
	R10	M1	1	2	<1	<i>Acacia linearifolia</i> , <i>Acacia decora</i>	
		L1	0.1	0.3	20	<i>*Digitaria eriantha</i> , <i>*Eragrostis curvula</i> , <i>Cynodon dactylon</i>	
		L2	0.01	0.1	15	<i>*Hypochaeris radicata</i> , <i>*Plantago lanceolata</i> , <i>*Trifolium sp.</i>	
	R11	M1	0.5	1.5	<1	<i>Acacia sp.</i>	
		L1	0.1	0.5	40	<i>*Pennisetum clandestinum</i> , <i>*Phalaris aquatica</i> , <i>*Erodium crinitum</i> , <i>*Digitaria eriantha</i>	
	R2_C	U1	4	7	8	<i>Acacia linearifolia</i> , <i>Eucalyptus albens</i>	
		M1	1	3	3	<i>Eucalyptus blakelyi</i> , <i>Eucalyptus punctata</i> , <i>Eucalyptus crebra</i>	
		L1	0.1	0.5	50	<i>*Eragrostis curvula</i> , <i>*Phalaris aquatica</i>	
	R3_C	L1	0.5	0.9	1	<i>Cassinia arcuata</i>	
		L2	0.01	0.5	44	<i>*Trifolium sp.</i> , <i>*Phalaris aquatica</i> , <i>*Chloris gayana</i>	
	Reference Site	Ref_1	M1	0.75	1.2	<1	<i>Eucalyptus blakelyi</i> , <i>Angophora floribunda</i>
			L1	0.01	0.7	75	<i>Aristida ramosa</i> , <i>Austrostipa scabra</i> , <i>*Hypochaeris radicata</i>
		Ref_2	U1	8	10	20	<i>Eucalyptus microcarpa</i>
M1			1	4	25	<i>Cassinia sp.</i> , <i>Acacia difformis</i>	
L1			0.1	0.8	15	<i>Austrostipa scabra</i> , <i>Aristida sp.</i> , <i>Microlaena stipoides</i>	
L2			0	0.1	1	<i>Dichondra repens</i>	
Ref_3		U1	9	12	25	<i>Eucalyptus fibrosa</i> , <i>Eucalyptus sparsifolia</i>	
		M1	3	6	<1	<i>Allocasuarina gymnanthera</i> , <i>Eucalyptus fibrosa</i>	
		M2	1	2	<1	<i>Dodonaea viscosa</i> , <i>Leucopogon muticus</i>	

Management Domain	Site number	Stratum	Lower height (m)	Upper height (m)	Percent cover (%)	Dominant species (*exotic)
		L1	0.5	1	5	<i>Dodonaea viscosa</i> , <i>Microlaena stipoides</i>
		L2	0.1	0.5	<1	<i>Lomandra sp.</i> , <i>Goodenia hederacea</i>
	Ref_4	U1	8	12	20	<i>Eucalyptus crebra</i>
		M1	1.5	4	2	<i>Acacia implexa</i>
		L1	0.01	0.8	60	<i>Microlaena stipoides</i> , <i>Aristida sp.</i> , <i>Austrostipa sp.</i>
	Ref_5	U1	8	10	15	<i>Acacia doratoxylon</i> , <i>Eucalyptus crebra</i> , <i>Corymbia trachyphloia</i>
		M1	3.5	4	5	<i>Persoonia linearis</i> , <i>Leucopogon muticus</i>
		M2	1.5	3.5	5	<i>Acrotriche rigida</i> , <i>Leucopogon muticus</i>
		L1	0.1	0.5	5	<i>Microlaena stipoides</i> , <i>Lomandra sp.</i>
	Ref_6	U1	5	12	20	<i>Eucalyptus dwyeri</i> , <i>Eucalyptus fibrosa</i> , <i>Corymbia trachyphloia</i>
		M1	1	2	2	<i>Callitris endlicheri</i> , <i>Eucalyptus fibrosa</i> , <i>Leptospermum trinervium</i>
		M2	0.5	1.5	30	<i>Dodonaea triangularis</i> , <i>Phebalium squamulosum</i> , <i>Boronia sp.</i>
		L1	0.1	0.5	8	<i>Cleistochloa rigida</i>
	Ref_7	U1	10	12	15	<i>Eucalyptus crebra</i> , <i>Eucalyptus albens</i>
		U2	8	10	5	<i>Acacia linearifolia</i>
		M1	2	5	10	<i>Allocasuarina gymnanthera</i>
		M2	1	1.5	15	<i>Dichondra sp.</i>
		L1	0.01	0.1	10	<i>Microlaena stipoides</i> , <i>Cheilanthes sieberi</i> , <i>Digitaria sp.</i> , <i>Dichondra sp.</i>
	Ref_8	U1	10	12	25	<i>Eucalyptus albens</i>
		U2	5	8	2	<i>Callitris endlicheri</i>
M1		1.5	2.5	15	<i>Cassinia quinquefaria</i> , <i>Bursaria spinosa</i>	
L1		0.2	0.5	30	<i>Gahnia aspera</i> , <i>Austrostipa sp.</i>	

Management Domain	Site number	Stratum	Lower height (m)	Upper height (m)	Percent cover (%)	Dominant species (*exotic)
		L2	0.1	0.2	2	<i>Dichondra sp.</i> , <i>Hydrocotyle laxiflora</i>
	Ref_9	U1	8	14	30	<i>Eucalyptus punctata</i> , <i>Callitris endlicheri</i> , <i>Eucalyptus sparsifolia</i> , <i>Eucalyptus fibrosa</i>
		M1	2	5	10	<i>Acacia sp.</i> , <i>Callitris endlicheri</i> , <i>Leptospermum trinervium</i>
		M2	1	2	10	<i>Leucopogon muticus</i> , <i>Dodonaea viscosa</i>
		L1	0.5	1	5	<i>Entolasia stricta</i>
	Ref_10	U1	10	15	15	<i>Eucalyptus albens</i> , <i>Callitris endlicheri</i> , <i>Allocasuarina gymnanthera</i>
		M1	5	8	3	<i>Callitris endlicheri</i> , <i>Allocasuarina gymnanthera</i> , <i>Acacia linearifolia</i>
		M2	1	2	10	<i>Acrotriche rigida</i> , <i>Leucopogon muticus</i> , <i>Dodonaea viscosa</i>
		L1	0.5	1	20	<i>Acrotriche rigida</i> , <i>Gahnia aspera</i>
		L2	0.1	0.5	2	<i>Cheilanthes sieberi</i> , <i>Austrostipa scabra</i>
	Ref_11	U1	12	15	10	<i>Angophora floribunda</i> , <i>Eucalyptus melliodora</i> , <i>Eucalyptus bridgesiana</i>
		L1	0.01	0.7	80	<i>Lomandra sp.</i> , <i>Microlaena stipoides</i> , <i>Aristida ramosa</i> , <i>Dichondra repens</i>
	Ref_12	U1	8	10	15	<i>Eucalyptus albens</i>
		L1	0.1	0.5	60	<i>Microlaena stipoides</i> , <i>Aristida sp.</i> , <i>Austrostipa sp.</i>

Appendix E — Interim Performance Targets / Benchmark Values

Table C-1: Vegetation class benchmark condition state (WCPL 2016)

Vegetation Class	Site Attribute									
	NSR (count)	NOC	NMS	NGCG	NGCS	NGCO	EC	NTH (count)	OR	FL (m)
Western Slopes Dry Sclerophyll Forests	≥32	15 - 40	10 – 55	3 - 10	5 - 15	5 - 25	<5%	≥3	1	≥70
Coastal Valley Grassy Woodlands	≥23	10 - 45	5 – 60	5 - 45	2 - 10	5 -35	<5%	≥2	1	≥50

Table C-2: Interim Performance Targets for Western Slopes Dry Sclerophyll Forests

Management Period	Interim Performance Target (site value score)	Site Attributes (% cover)									
		NSR (count)	NOC	NMS	NGCG	NGCS	NGCO	EC	NTH (count)	OR	FL (m)
Low Condition Vegetation											
Year 0 (Baseline)	6	<8	0	0	1	0	0	60	0	0	0
Years 1-5	34	12	0	3-10	1-2	1-5	1-3	60	0	1	10
Benchmark	>78	≥32	15-40	10-55	3-10	5-15	5-25	<5	≥3	1	≥70
Moderate to Good Condition Vegetation											
Year 0 (Baseline)	34	12	0	10	<3	<5	<4	60	0	1	10
Years 1-5	45	16	0	10-55	3-10	5-15	5-25	40	0	1	10
Benchmark	>78	≥32	15-40	10-55	3-10	5-15	5-25	<5	≥3	1	≥70
High Condition Vegetation											
Year 0 (Baseline)	70	18-32	15-40	10-55	3 -10	5-15	5-25	≤5	0	1	≥70
Years 1-20	70	18-32	15-40	10-55	3 -10	5-15	5-25	≤5	0	1	≥70
Benchmark	>78	≥32	15-40	10-55	3 -10	5-15	5-25	≤5	≥3	1	≥70

Table C-3: Interim Performance Targets for Western Slopes Grassy Woodlands

Management period	Interim Performance Target (Site value score)	Site Attributes (% cover)									
		NSR (count)	NOC	NMS	NGCG	NGCS	NGCO	EC	NTH (count)	OR	FL (m)
Low Condition Vegetation											
Year 0 (Baseline)	7	<9	0	0	5	0	0	60	0	0	0
Years 1-5	34	12	0	<4	60+	<2	<2	60	0	1	10
Benchmark	>78	≥23	10-45	5-60	5-45	2-10	5-35	<5	≥2	1	≥50
Moderate to Good Condition Vegetation											
Year 0 (Baseline)	34	12	0	≤3	60+	<2	<2	60	0	1	10
Years 1-5	45	12	0	5-60	45-60	<2	<2	40	0	1	10
Benchmark	>78	≥23	10-45	5-60	5-45	2-10	5-35	<5	≥2	1	≥50
High Condition Vegetation											
Year 0 (Baseline)	70	20-22	10-45	5-60	5-45	2-10	5-35	≤20	0	1	≥50
Years 1-20	70	20-23	10-45	5-60	5-45	2-10	5-35	≤20	0	1	≥50
Benchmark	>78	≥23	10-45	5-60	5-45	2-10	5-35	<5	≥2	1	≥50

Appendix F – Fauna species list

Species name	Common name	TSC Act	EPBC Act
Bird			
<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater	P	
<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill	P	
<i>Acanthiza lineata</i>	Striated Thornbill	P	
<i>Acanthiza nana</i>	Yellow Thornbill	P	
<i>Acanthiza pusilla</i>	Brown Thornbill	P	
<i>Acanthiza reguloides</i>	Buff-rumped Thornbill	P	
<i>Acanthorhynchus tenuirostris</i>	Eastern Spinebill	P	
<i>Accipiter fasciatus</i>	Brown Goshawk	P	
<i>Acrocephalus australis</i>	Australian Reed-Warbler	P	
<i>Aegotheles cristatus</i>	Australian Owlet-nightjar	P	
<i>Alisterus scapularis</i>	Australian King-Parrot	P	
<i>Anthochaera carunculata</i>	Red Wattlebird	P	
<i>Anthus novaeseelandiae</i>	Australasian Pipit	P	
<i>Aquila audax</i>	Wedge-tailed Eagle	P	
<i>Artamus cyanopterus</i>	Dusky Woodswallow	V	
<i>Artamus sp.</i>	Woodswallow sp.	P	
<i>Cacatua galerita</i>	Sulphur-crested Cockatoo	P	
<i>Cacomantis flabelliformis</i>	Fan-tailed Cuckoo	P	
<i>Cacomantis pallidus</i>	Pallid Cuckoo	P	
<i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo	V	
<i>Chalcites basalis</i>	Horsfield's Bronze-Cuckoo	P	
<i>Chalcites lucidus</i>	Shining Bronze-Cuckoo	P	
<i>Chenonetta jubata</i>	Australian Wood Duck	P	
<i>Chthonicola sagittata</i>	Speckled Warbler	V	
<i>Cinclosoma punctatum</i>	Spotted Quail-thrush	P	
<i>Cisticola exilis</i>	Golden-headed Cisticola	P	
<i>Climacteris picumnus victoriae</i>	Brown Treecreeper eastern subsp.	V	
<i>Colluricincla harmonica</i>	Grey Shrike-thrush	P	
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike	P	
<i>Coracina papuensis</i>	White-bellied Cuckoo-shrike	P	
<i>Corcorax melanorhamphos</i>	White-winged Cough	P	
<i>Cormobates leucophaea</i>	White-throated Treecreeper	P	
<i>Corvus coronoides</i>	Australian Raven	P	
<i>Cracticus nigrogularis</i>	Pied Butcherbird	P	
<i>Cracticus tibicen</i>	Australian Magpie	P	
<i>Cracticus torquatus</i>	Grey Butcherbird	P	
<i>Dacelo novaeguineae</i>	Laughing Kookaburra	P	
<i>Daphoenositta chrysoptera</i>	Varied Sittella	V	
<i>Dicaeum hirundinaceum</i>	Mistletoebird	P	

<i>Dromaius novaehollandiae</i>	Emu	P	
<i>Egretta novaehollandiae</i>	White-faced Heron	P	
<i>Entomyzon cyanotis</i>	Blue-faced Honeyeater	P	
<i>Eolophus roseicapillus</i>	Galah	P	
<i>Eopsaltria australis</i>	Eastern Yellow Robin	P	
<i>Falco cenchroides</i>	Nankeen Kestrel	P	
<i>Falco longipennis</i>	Australian Hobby	P	
<i>Gerygone albogularis</i>	White-throated Gerygone	P	
<i>Gerygone fusca</i>	Western Gerygone	P	
<i>Glossopsitta concinna</i>	Musk Lorikeet	P	
<i>Glossopsitta pusilla</i>	Little Lorikeet	V	
<i>Grallina cyanoleuca</i>	Magpie-lark	P	
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	P	
<i>Hirundo neoxena</i>	Welcome Swallow	P	
<i>Leucosarcia picata</i>	Wonga Pigeon	P	
<i>Lichenostomus chrysops</i>	Yellow-faced Honeyeater	P	
<i>Lichenostomus fuscus</i>	Fuscous Honeyeater	P	
<i>Lichenostomus leucotis</i>	White-eared Honeyeater	P	
<i>Lichenostomus melanops</i>	Yellow-tufted Honeyeater	P	
<i>Lichenostomus penicillatus</i>	White-plumed Honeyeater	P	
<i>Macropus giganteus</i>	Eastern Grey Kangaroo	P	
<i>Malurus cyaneus</i>	Superb Fairy-wren	P	
<i>Malurus lamberti</i>	Variiegated Fairy-wren	P	
<i>Manorina melanocephala</i>	Noisy Miner	P	
<i>Melanodryas cucullata</i>	Hooded Robin	V	
<i>Melithreptus brevirostris</i>	Brown-headed Honeyeater	P	
<i>Melithreptus gularis</i>	Black-chinned Honeyeater	P	
<i>Melithreptus lunatus</i>	White-naped Honeyeater	P	
<i>Menura novaehollandiae</i>	Superb Lyrebird	P	
<i>Microeca fascinans</i>	Jacky Winter	P	
<i>Myiagra inquieta</i>	Restless Flycatcher	P	
<i>Neochmia temporalis</i>	Red-browed Finch	P	
<i>Neophema pulchella</i>	Turquoise Parrot	P	
<i>Nesoptilotis leucotis</i>	White-eared Honeyeater	P	
<i>Ocyphaps lophotes</i>	Crested Pigeon	P	
<i>Oriolus sagittatus</i>	Olive-backed Oriole	P	
<i>Pachycephala pectoralis</i>	Golden Whistler	P	
<i>Pachycephala rufiventris</i>	Rufous Whistler	P	
<i>Pardalotus punctatus</i>	Spotted Pardalote	P	
<i>Pardalotus striatus</i>	Striated Pardalote	P	
<i>Petrochelidon nigricans</i>	Tree Martin	P	
<i>Phaps chalcoptera</i>	Common Bronzewing	P	
<i>Philemon corniculatus</i>	Noisy Friarbird	P	
<i>Platycercus elegans</i>	Crimson Rosella	P	
<i>Platycercus eximius</i>	Eastern Rosella	P	

<i>Plectorhyncha lanceolata</i>	Striped Honeyeater	P	
<i>Pomatostomus superciliosus</i>	White-browed Babbler	P	
<i>Pomatostomus temporalis</i>	Grey-crowned Babbler	P	
<i>Psephotus haematonotus</i>	Red-rumped Parrot	P	
<i>Psophodes olivaceus</i>	Eastern Whipbird	P	
<i>Ptilonorhynchus violaceus</i>	Satin Bowerbird	P	
<i>Rhipidura albiscapa</i>	Grey Fantail	P	
<i>Rhipidura leucophrys</i>	Willie Wagtail	P	
<i>Smicrornis brevirostris</i>	Weebill	P	
<i>Stagonopleura guttata</i>	Diamond Firetail	V	
<i>Strepera graculina</i>	Pied Currawong	P	
<i>Sturnus vulgaris</i>	Common Starling		
<i>Taeniopygia bichenovii</i>	Double-barred Finch	P	
<i>Vanellus miles</i>	Masked Lapwing	P	
<i>Zosterops lateralis</i>	Silvereeye	P	
Amphibian			
<i>Crinia signifera</i>	Clicking Froglet	P	
<i>Limnodynastes dumerilii</i>	Eastern Pobblebonk	P	
<i>Limnodynastes tasmaniensis</i>	Spotted Marsh Frog	P	
<i>Litoria peronii</i>	Emerald-spotted Tree Frog	P	
<i>Uperoleia laevigata</i>	Eastern Gungan	P	
<i>Uperoleia laevigata</i>	Smooth Toadlet	P	
Mammal			
<i>Dama dama</i>	Fallow Deer		
<i>Macropus robustus</i>	Common Wallaroo	P	
<i>Macropus rufogriseus</i>	Red-necked Wallaby	P	
<i>Oryctolagus cuniculus</i>	Rabbit		
<i>Sus scrofa</i>	Pig		
<i>Vombatus ursinus</i>	Common Wombat	P	
Reptile			
<i>Carlia tetradactyla</i>	Southern Rainbow-skink	P	
<i>Egernia whitii</i>	White's Skink	P	
<i>Lygisaurus foliorum</i>	Tree-based Litter-skink	P	
<i>Parasuta dwyeri</i>	Dwyer's Snake	P	
<i>Pogona barbata</i>	Eastern Bearded Dragon	P	
<i>Pseudonaja textilis</i>	Eastern Brown Snake	P	
<i>Varanus varius</i>	Lace Monitor	P	
Microbat			
<i>Chalinolobus morio</i>	Chocolate Wattled Bat	P	
<i>Rhinolophus megaphyllus</i>	Eastern Horseshoe Bat	P	
<i>Vespadelus darlingtoni</i> / <i>Vespadelus regulus</i> / <i>Vespadelus vulturnus</i>	Large Forest Bat / Southern Forest Bat / Little Forest Bat	P	
<i>Chalinolobus gouldii</i>	Gould's Wattled Bat	P	
<i>Miniopterus orianae oceanensis</i>	Eastern Bentwing Bat	V	
<i>Mormopterus (Ozimops) planiceps</i>	South-eastern Freetail Bat	P	

<i>Scotorepens balstoni</i>	Inland Broad-nosed Bat	P	
<i>Austronomus australis</i>	White-Striped Freetail Bat	P	
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V	V
<i>Mormopterus (Ozimops) petersi</i>	Inland Freetail Bat	P	
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheathtail Bat	V	
<i>Nyctophilus spp.</i>	Large-eared Bats	P	
<i>Vespadelus pumilus</i>	Eastern Forest Bat	P	
<i>Myotis macropus</i>	Large-footed Myotis	V	

P = protected, V = vulnerable

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**WILPINJONG COAL MINE
SITE INSPECTION OF ECA &
REGENERATION AREAS**

DOCUMENT NO. WCPL_01_16

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General Description:	Site inspection of ECA & Regeneration area to identify erosion sites for remediation and waste sites for removal.
Report To:	Karin Fogarty
Prepared By:	Stephen Bragg
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1.0	2/2/2017	Original Draft	Stephen Bragg	KF	
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Disclaimer

This document was prepared for the sole use of Wilpinjong Coal Pty Limited (WCPL) and the regulatory agencies that are directly involved with this operation. No other party should rely on the information contained herein without the prior written consent of Pacific Environmental. It has been prepared on the basis of information provided by WCPL and also from information collected from site inspections and discussion with the relevant landowner undertaken during March 2016 and July 2016 or provided following further request for information.

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1.0 Introduction

Wilpinjong Coal Pty Limited (WCPL) have prepared and implemented a Biodiversity Management Plan (BMP)¹ to:

- Address the requirements detailed in Project Approval 05-0021 for biodiversity management; and
- Provides management actions for those areas of the Project (**Figure 1**).

WCPL engaged Pacific Environmental Pty Ltd (PE) to complete an assessment of waste and potential erosion sites within several of the Environmental Conservation Areas (ECAs) and Regeneration Areas (Regen Areas), as required by the BMP's Three Year Management Schedule.

The site inspections to identify potential waste and erosion sites was undertaken utilising high definition aerial imagery flown during December 2016 and visual ground inspections within selected ECA's on 13 December 2016. The visual inspections also provided an opportunity to identify weed infestations, redundant fencing/gates, signage requirements and status of access tracks. Other data was provided to PE by WCPL from inspections in ECA's during May 2016.

1.1 Purpose & Scope

The purpose and scope of the site inspections within selected ECAs and Regeneration Areas was to identify erosion sites and compile a waste² register (e.g. dumped waste, disused buildings and redundant farm equipment etc.) for removal³ and inform management actions regarding management strategies⁴.

The waste register will assist WCPL in developing a scope of works to perspective contractors to undertake removal of the various waste streams.

1.2 Structure of this Report

The remaining Report has been structured in the following sections:

- Section 1** Introduction, purpose and scope;
- Section 2** Site Inspections
- Section 3** Results
- Section 4** Summary
- Section 5** References

¹ Condition 38, Schedule 3 of PA05-0021

² This Report does not attempt to accurately classify the waste identified and should not be relied upon as further investigations by WCPL to classify waste identified within the Study Area is required.

³ This Report does not permit the removal of waste and/or the removal of infrastructure such as power lines. All removal and handling of wastes will be undertaken by WCPL in accordance with relevant waste legislation and guidelines. The removal of infrastructure such as power lines will be undertaken by WCPL in consultation with relevant site personnel and relevant power authority.

⁴ The visual inspections also provided an opportunity to identify weed infestations, redundant fencing/gates, signage requirements and status of access tracks.

Figure 1 Study Area

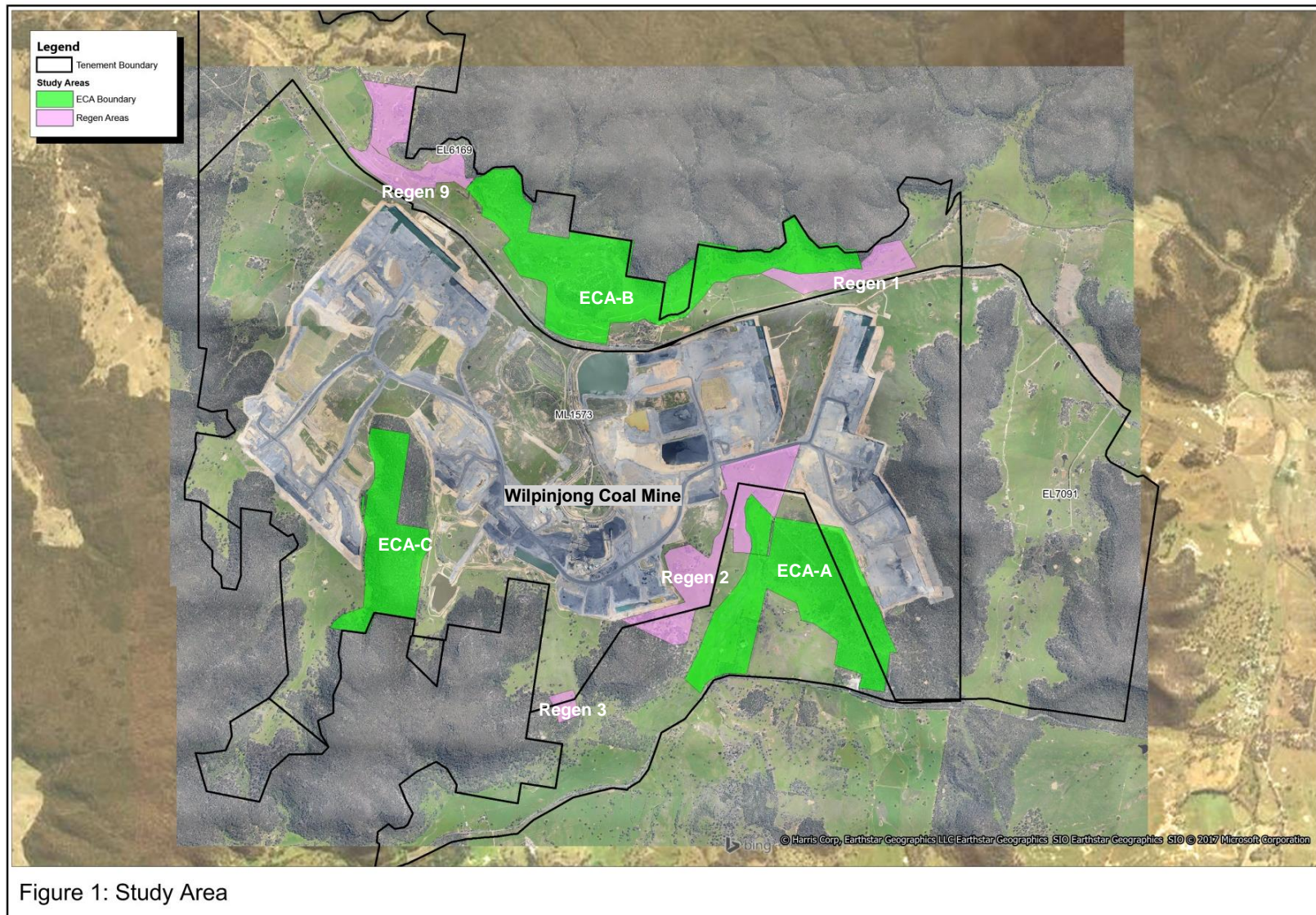


Figure 1: Study Area

Figure 2 ECA-B and Regen Areas 1 & 9

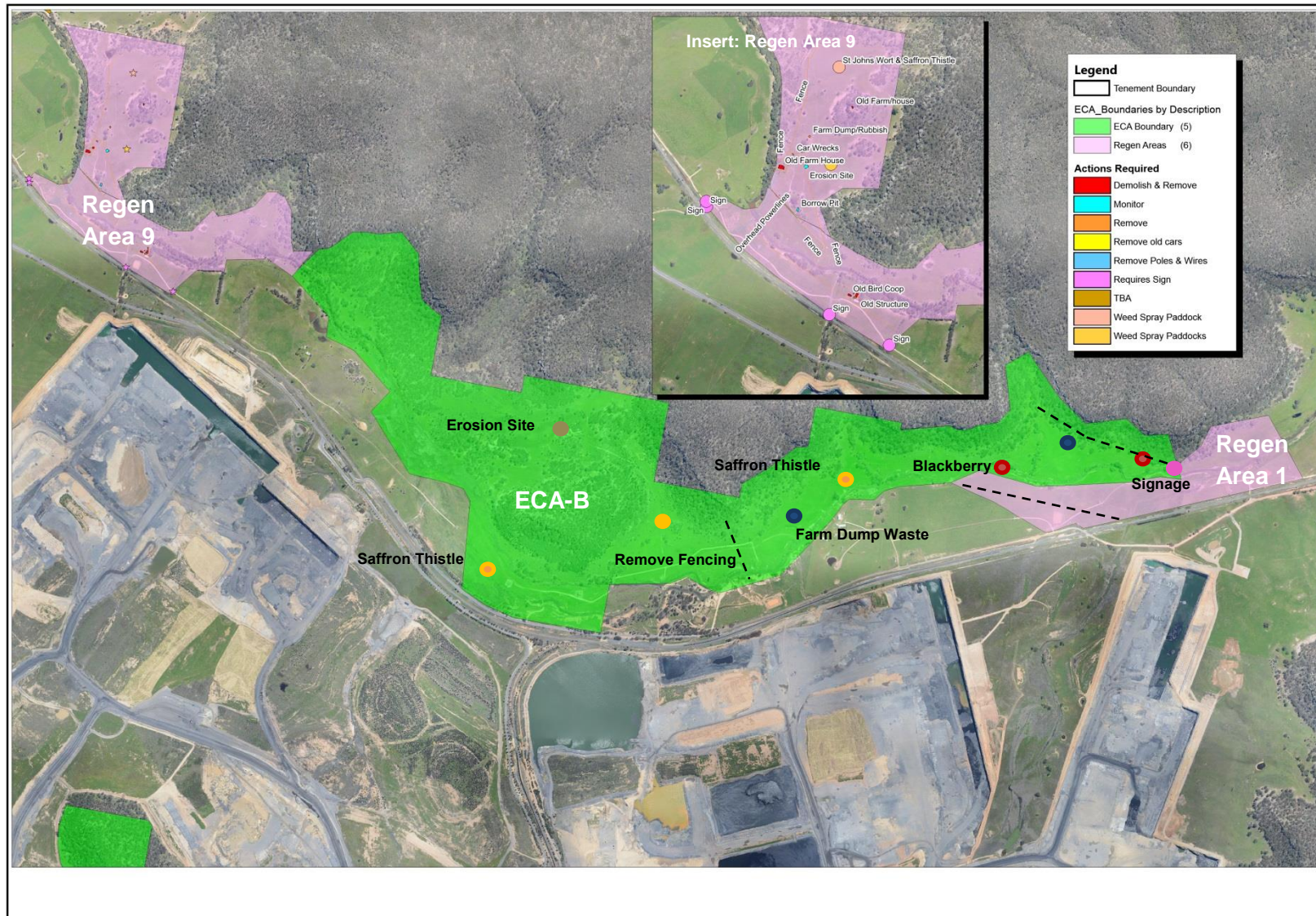
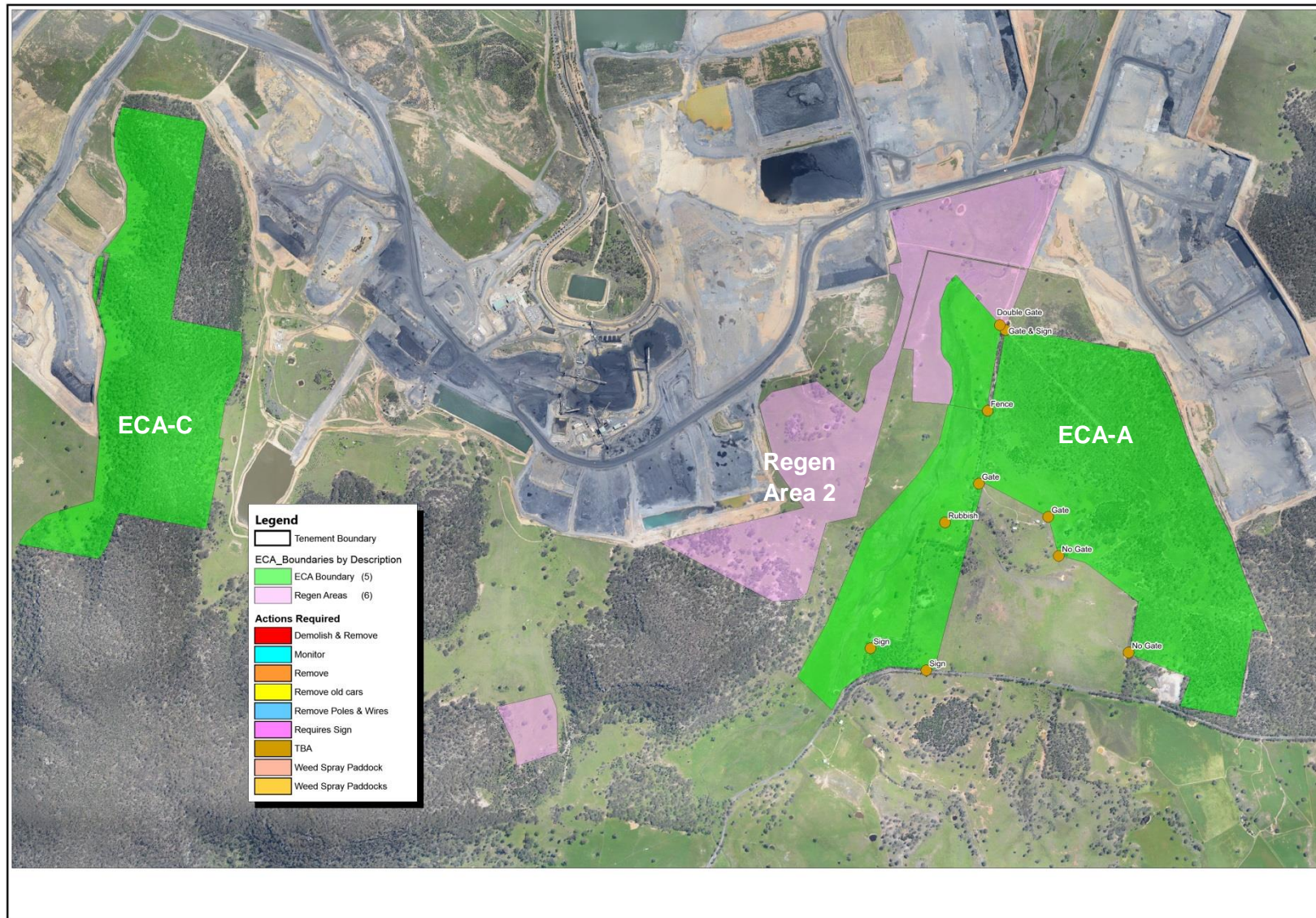


Figure 3 ECA-A, ECA-C and Regen Areas 2 & 3



2.0 Site Assessments

2.1 Site Inspections

As previously outlined, the purpose of the site inspection was to identify potential (and verify) waste and erosion sites. This was undertaken utilising high definition aerial imagery flown during December 2016 and visual ground inspections within ECA-B and Regen Areas 1 & 9 on the 13 December 2016. Other data was provided to PE by WCPL from inspections within ECA-A during May 2016

Table 1 identifies the location of waste and erosion features encountered during the site inspection within ECA-B, Regen Area 9 and Regen Area 1 on the 13 December 2016.

Opportunistic weed sightings were also noted and identified in **Figure 2** for potential weed control activities.

2.2 Aerial Imagery

To assist in the site inspection and locate potential erosion and waste features in the landscape, high definition aerial imagery flown during December 2016 was also completed.

2.3 Limitations



The following limitations regarding the Report need to be considered, including:

- Site inspections by PE only occurred in ECA-B, Regen Area 9 and Regen Area 1;
- Areas and lengths were generated from WCPL's MapInfo Tables and should only therefore be used as a guide;
- The field inspections and review of high resolution aerial imagery noted many sites affected by various forms of erosion (scalding or paddock erosion), as a result of access tracks, flow lines, poor vegetative cover and previous grazing pressure. Further site investigations would be required to characterise the state of all erosion sites;
- This Report does not attempt to accurately classify the waste identified and should not be relied upon, as further investigations by WCPL to classify waste identified within the Study Area is required;
- This Report does not permit the removal of waste and/or the removal of infrastructure such as power lines. All removal and handling of wastes will be undertaken by WCPL in accordance with relevant waste legislation and guidelines. The removal of infrastructure such as power lines will be undertaken by WCPL in consultation with relevant site personnel and relevant power authority; and
- Other data used in this report was provided by WCPL in relation to ECA-A.


3.0 Results

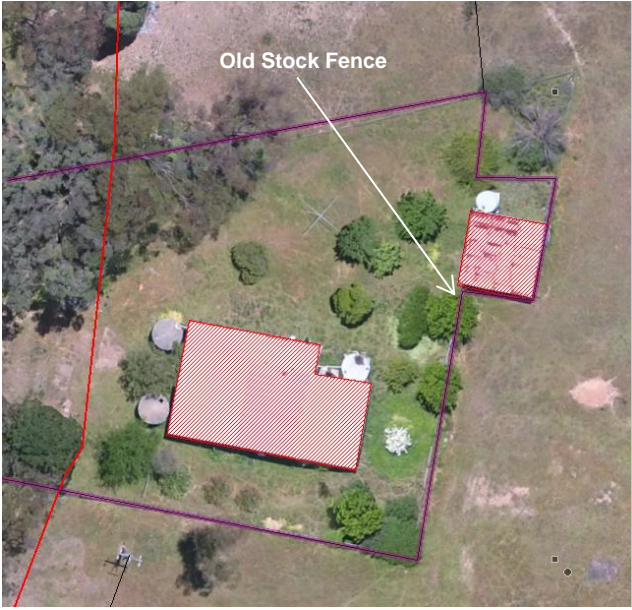
3.1 ECA-B, Regen Areas 1 & 9


Table 1 ECA-B and Regen Areas 1 & 9

Ref.	Feature	Coordinates (GDA 1994 MGA Zone 55)	Photos	
1	Regen Area 9 Old Farm House (House area approx. 166m ²) + 3 x Water Tanks	Refer to Figure 2 X: 768,684 Y: 6,421,862		

Ref.	Feature	Coordinates (GDA 1994 MGA Zone 55)	Photos	
2	Regen Area 9 Car Wrecks (Approx. 3 x car wrecks)	Refer to Figure 2 X: 768,726 Y: 6,421,907		

Ref.	Feature	Coordinates (GDA 1994 MGA Zone 55)	Photos	
3	<p>Regen Area 9</p> <p>Old Farm Shed</p> <p>(Shed area approx. 70m²) + Water Tank at rear</p>	<p>Refer to Figure 2</p> <p>X: 768,704 Y: 6,421,877</p>		

Ref.	Feature	Coordinates (GDA 1994 MGA Zone 55)	Photos	
4	<p>Regen Area 9</p> <p>Old Stock Fencing</p> <p>(Fence length approx. 180m)</p>	Refer to Figure 2		

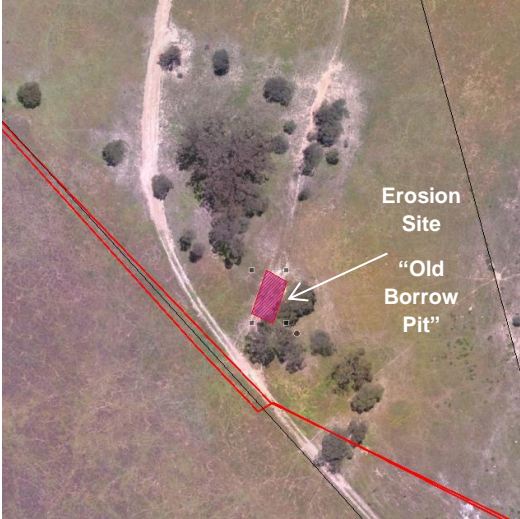

Ref.	Feature	Coordinates (GDA 1994 MGA Zone 55)	Photos	
5	<p>Regen Area 9</p> <p>Old Stock Fencing</p> <p>(Fence lengths approx. 1,183m)</p>	Refer to Figure 2		

Ref.	Feature	Coordinates (GDA 1994 MGA Zone 55)	Photos	
6	<p>Regen Area 9</p> <p>Overhead Power Lines to Old Farm House</p> <p>(WCPL to confirm removal)</p> <p>(Power line lengths approx. 923m)</p>	Refer to Figure 2		

Ref.	Feature	Coordinates (GDA 1994 MGA Zone 55)	Photos
7	<p>Regen Area 9</p> <p>Erosion</p> <p>(Area of erosion approx. 166m²)</p> <p>State of Erosion: Active⁵</p>	<p>Refer to Figure 2</p> <p>X: 768,773</p> <p>Y: 6,421,864</p>	



⁵ Australian Soil and Landscape Survey Field Handbook (3rd Edition, 2009).

Active = One or both of the following conditions apply of sediment movement; sides and/or floors of erosion form are relatively bare of vegetation.

Ref.	Feature	Coordinates (GDA 1994 MGA Zone 55)	Photos	
8	<p>Regen Area 9</p> <p>Erosion</p> <p>(Area of erosion approx. 77m²)</p> <p>State of Erosion: Partly Stabilised⁶</p>	<p>Refer to Figure 2</p> <p>X: 768,743</p> <p>Y: 6,421,710</p>	 	



⁶ Australian Soil and Landscape Survey Field Handbook (3rd Edition, 2009).



Partly Stabilised = Evidence of some active erosion and some evidence of stabilisation.

Ref.	Feature	Coordinates (GDA 1994 MGA Zone 55)	Photos	
9	<p>Regen Area 9</p> <p>Other examples of Erosion Sites or 'Paddock Scalding'</p> <p>State of Erosion: Partly Stabilised⁷</p>	Refer to Figure 2		

⁷ Australian Soil and Landscape Survey Field Handbook (3rd Edition, 2009).

Partly Stabilised = Evidence of some active erosion and some evidence of stabilisation.

Ref.	Feature	Coordinates (GDA 1994 MGA Zone 55)	Photos	
10	<p>Regen Area 9</p> <p>Dumped Waste</p> <p>(Area of waste approx. 45m²)</p>	<p>Refer to Figure 2</p> <p>X: 768,785</p> <p>Y: 6,421,972</p>		



Ref.	Feature	Coordinates (GDA 1994 MGA Zone 55)	Photos	
11	<p>Regen Area 9 Old Fibro⁸ Hut (Area of shed approx. 35m²) State of Erosion: Partly Stabilised⁹</p>	<p>Refer to Figure 2 X: 768,940 Y: 6,422,076</p>		

⁸ The outside cladding appears to be old fibro sheeting and possibly containing asbestos.


⁹ *Australian Soil and Landscape Survey Field Handbook (3rd Edition, 2009).*

Partly Stabilised = Evidence of some active erosion and some evidence of stabilisation.

Ref.	Feature	Coordinates (GDA 1994 MGA Zone 55)	Photos	
12	Regen Area 9 Car Wreck	Refer to Figure 2 X: 768,985 Y: 6,421,439		

Ref.	Feature	Coordinates (GDA 1994 MGA Zone 55)	Photos	
13	Regen Area 9 Building Waste¹⁰	Refer to Figure 2		

¹⁰ There was old fibro sheeting dumped and possibly containing asbestos.

Ref.	Feature	Coordinates (GDA 1994 MGA Zone 55)	Photos	
14	<p>ECA-B Old Diesel Tank</p>	<p>Refer to Figure 2</p>		

4.0 Summary

As previously outlined, the purpose of the site inspection was to identify potential (and verify) waste and erosion sites. The visual inspections also provided an opportunity to identify weed infestations, redundant fencing/gates, signage requirements and status of access tracks.

This was undertaken utilising high definition aerial imagery flown during December 2016 and visual ground inspections by PE and WCPL within ECA-B and Regen Areas 1 & 9 on the 13 December 2016. Other data was provided to PE by WCPL from inspections within ECA-A during May 2016.

The field inspections and review of high resolution aerial imagery noted many sites affected by various forms of erosion (scalding or paddock erosion), as a result of access tracks, flow lines, poor vegetative cover and previous grazing pressure. Further site investigations would be required to characterise the state of all erosion sites throughout ECAs and Regen Areas;

This Report does not attempt to accurately classify the waste identified and should not be relied upon, as further investigations by WCPL to classify waste identified within the Study Area is required. There were a number of sites that contained fibro sheeting, either as material on the ground or used in the construction of buildings. All fibro material must be treated as containing asbestos and handled /removed safely and appropriately.

This Report does not permit the removal of waste and/or the removal of infrastructure such as power lines. All removal and handling of wastes will be undertaken by WCPL in accordance with relevant waste legislation and guidelines. The removal of infrastructure such as power lines will be undertaken by WCPL in consultation with relevant site personnel and relevant power authority.

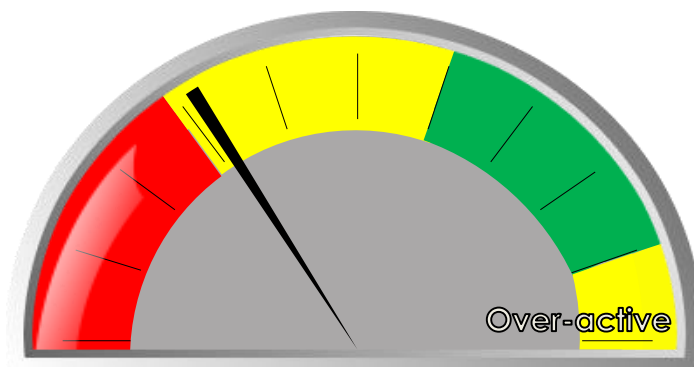
Regen Area 9 is characterised by various forms of erosion (scalding or paddock erosion), as a result of access tracks, flow lines, poor vegetative cover and previous grazing pressure. Further site investigations would be required to characterise the state of all erosion sites within this area and the remaining ECA and Regen Areas.

5.0 References

- *Biodiversity Management Plan (WI_ENV_MNP_0035), Wilpinjong Coal Mine (October 2016) – Version 3*
- *Australian Soil and Landscape Survey Field Handbook (3rd Edition, 2009).*

Customer name	AgVita Analytical Services	Date received	14-12-16
Client name	Michael Ruffels	Agent	Microbiology Laboratories A
Sample name	Wilp Area 1	Advisor	
Crop	Pasture, n.o.c.	Authorised by	Dr Maria Manjarrez
Date sampled	12:00:00 AM	Analysis no.	1349-1-MAWS

Microbial Activity Indicator



Data

	Yours	Guide
Microbial Activity Indicator	35.2	80.0



Key

	Yours	Guide
Soil Basal Respiration (7-28 day)	507.9 mg C/kg soil	1690.0
	1859.0 mg CO ₂ /kg soil	6185.5
Soil Microbial Biomass Carbon	142.0 mg C/kg soil	464.0

Comments

The microbial activity in your sample was fair. This could occur if microbial activity in your soil has been depleted due to an extended bare fallow, practices that deplete soil carbon (C) and/or nitrogen (N) or an extended dry period. It could be increased by adopting management practices that encourage microbial activity. If your soil is low in carbon consider the addition of organic based soil conditioners. If your soil is low in nitrogen consider the addition of N fertiliser. It is very important to take the C:N ratio of your soil into account when adding any fertilisers high in C or N. In most farmed soils it is good practice to aim for a C:N ratio of less than 20:1 (12:1 is optimal for most soils, but may not be practicable for some production systems). Avoid the addition of large amounts of high C fertiliser to soils low in N, and the addition of large amounts of high N fertiliser to soils low in C, as these practices can further deplete Total C and Total N, and microbial activity.

Explanations

The Microbe Activity Wise test measures the activity of soil microbes directly from your sample. It measures the amount of carbon dioxide (CO₂) emitted by microbes to calculate Microbial Activity, Soil Basal Respiration (SBR) and Soil Microbial Biomass Carbon (C) (SMBC). Most soil microbes under aerobic conditions convert carbohydrates into energy and CO₂, which they emit as a waste product, just like animals, plants and humans. This is used to calculate the Microbial Activity Indicator based on known values for soils. Correlations published in scientific journals are used to calculate soil basal respiration (SBR, 7-28 day) and soil microbial biomass C (SMBC). Soil Basal Respiration is the normal, steady rate of respiration in a soil. Soil Microbial Biomass C is the amount of C held in the net microbial biomass. All three values reflect the quantity and quality of soil carbon, and other microbially assistive nutrients in the soil. Plants can use the CO₂ emitted by soil microbes to overcome the often limiting CO₂ in the air around crops. Having a good level of microbial activity in your soil not only helps soil processes, but can also help to improve crop growth. Always compare your results with a control sample. Guide values are included as a help, but because a large number of factors affect microbiology the guide levels may not be optimal for your specific conditions. Visit www.microbelabs.com.au for more information.

Disclaimer

Analysis by Microbiology Laboratories Australia Pty Ltd ACN 145 073 481. The information in this report should be used under consideration of particular production conditions. The guide levels are derived from published data and ongoing research carried out by Microbiology Laboratories Australia. They are intended as a general guide only and do not take into account your specific conditions. Comparison of results with those obtained using other methods may be inaccurate, as accurate interpretation relies on specific sampling and analysis methods. Microbiology Laboratories Australia and its employees or agents will not be liable for any loss or damage arising from the use of the information supplied in this report. Please seek specific guidance and recommendations from a qualified agriculture professional.