ABN: 69 107 169 102

Werris Creek Coal Pty Limited

BIODIVERSITY IMPACT ASSESSMENT

For

Werris Creek Coal Mine Life of Mine Project

Prepared by:

EcoLogical Australia Pty Ltd

Specialist Consultant Studies Compendium

Volume 2, Part 5

December 2010

This page has intentionally been left blank

ABN: 69 107 169 102

Werris Creek Coal Pty Limited

BIODIVERSITY IMPACT ASSESSMENT

for

Werris Creek Coal Mine
Life of Mine Project

Prepared for:

R.W. Corkery & Co. Pty Limited
1st Floor, 12 Dangar Road
PO Box 239
BROOKLYN NSW 2083

Tel: (02) 9985 8511
Fax: (02) 9985 8208
Email: brooklyn@rwcorkery.com

On behalf of:

Werris Creek Coal Pty Limited
ABN: 69 107 169 103
PO Box 600
GUNNEDAH NSW 2380

Tel: (02) 6768 7071
Fax: (02) 6768 7072
Email: bcullen@whitehavencoal.com.au

Prepared by:

Eco Logical Australia Pty Ltd
PO Box 12
Sutherland NSW 1499

Tel: (02) 8536 8600
Fax: (02) 9542 5622
Email: lukem@ecoaus.com.au
Email: roberth@ecoaus.com.au

December 2010

This Copyright is included for the protection of this document

CONTENTS

Page

EXECUTIVE SUMMARY 5-9

1 INTRODUCTION 5-13
- 1.1 Background 5-13
- 1.2 BIA Compliance with Director – Generals Requirements 5-14
- 1.3 Report Objectives 5-14

2 STUDY AREA 5-20
- 2.1 Site Location 5-20
- 2.2 Landscape History 5-21
- 2.3 Soils and Geology 5-21
- 2.4 Vegetation Communities 5-23
- 2.5 Rivers, Creeks and Watercourses 5-24
- 2.6 Groundwater Dependant Ecosystems 5-24
- 2.7 Surrounding Reserves 5-24
- 2.8 Climate 5-25

3 DESCRIPTION OF THE PROJECT 5-26

4 LEGISLATIVE CONTEXT 5-31
- 4.1 Commonwealth legislation 5-31
- 4.2 International Agreements 5-31
- 4.3 New South Wales Legislation 5-32

5 METHODOLOGIES 5-36
- 5.1 Data Audit and Literature Review 5-36
- 5.2 Field Assessment Overview 5-37
  - 5.2.1 Preliminary Field Assessment 5-37
  - 5.2.2 Field Survey Overview 5-37
  - 5.2.3 Weather 5-40
- 5.3 Vegetation Communities 5-40
- 5.4 Flora 5-41
- 5.5 Fauna 5-41
  - 5.5.1 Avifauna 5-43
  - 5.5.2 Mammals 5-45
  - 5.5.3 Reptiles 5-46
  - 5.5.4 Amphibians 5-47
- 5.6 Groundwater Dependant Ecosystem 5-47
- 5.7 Survey Limitations 5-47
  - 5.7.1 Flora 5-47
  - 5.7.2 Fauna 5-47

CONTENTS

Page

6 SURVEY RESULTS 5-48
6.1 Data Audit and Literature Review 5-48
6.2 Vegetation Communities 5-49
6.2.1 White Box Grassy woodland of the Nandewar and Brigalow Belt South Bioregions 5-49
6.2.2 Bluegrass – Spear Grass – Redleg Grass derived grasslands of the Nandewar Bioregion 5-50
6.2.3 Brigalow – Belah woodland on alluvial often gilgaied clay soils mainly in the Brigalow Belt South Bioregion 5-51
6.2.4 Cropped/cultivated paddocks (Cleared Land) 5-52
6.2.5 Threatened Ecological Communities 5-52
6.3 Flora 5-53
6.3.1 Noxious Weeds 5-53
6.3.2 Threatened Flora 5-56
6.4 Fauna 5-56
6.4.1 Fauna Habitat 5-56
6.4.2 Avifauna 5-58
6.4.3 Mammals 5-59
6.4.4 Reptiles 5-60
6.4.5 Amphibians 5-61
6.4.6 Migratory Fauna 5-61
6.5 Groundwater Dependant Ecosystems 5-61
7 IMPACT ASSESSMENT 5-65
7.1 Introduction 5-65
7.2 Avoidance and Minimisation Measures 5-65
7.3 Mitigation Measures 5-66
7.3.1 Rehabilitation / Revegetation 5-67
7.4 Residual Impacts 5-70
7.4.1 Direct Impacts 5-70
7.4.2 Indirect Impacts 5-70
7.4.3 Cumulative Impacts 5-71
7.5 Assessment of Impacts to Threatened Species and Ecological CommunIties 5-71
7.6 Offsets 5-71
8 BIODIVERSITY OFFSET STRATEGY 5-73
8.1 Introduction 5-73
8.2 Offsetting Options 5-73
8.2.1 Offset Principles 5-73
8.2.2 Offset Options 5-74

CONTENTS

Page

8.3 Offset Area 5-75
8.3.1 Offset Calculations for Vegetation loss at Impact Site 5-75
8.3.2 Area of Vegetation Required at Offset Site (Biobanking Methodology) 5-76
8.3.3 Offset Calculations for loss of threatened fauna habitat at impact site 5-78
8.3.4 EPBC Act Offset Requirements 5-78
8.4 Proposed LOM Project Biodiversity Area 5-78
8.5 Long term Security and ManagEment of PropoSed LOM offset Areas 5-84
8.6 Flora and fauna monitoring 5-84
8.7 Proposed Offset properties 5-84
8.7.1 Railway View 5-86
8.7.2 Marengo Property 5-86
8.7.3 Mine Site 5-88
8.7.4 Eurunderee 5-91
8.8 Biodiversity Offset Strategy 5-91
9 CONCLUSIONS 5-95
GLOSSARY 5-97
REFERENCES 5-99

Appendices

APPENDIX A: DIRECTOR GENERAL'S REQUIREMENTS 5-103
APPENDIX B: QUALIFICATIONS AND EXPERIENCE OF SURVEY & ASSESSMENT TEAM 5-103
APPENDIX C: THREATENED SPECIES LIKELIHOOD OF OCCURRENCE TABLE 5-124
APPENDIX D: FLORA SPECIES LISTS 5-147
APPENDIX E: FAUNA SPECIES LISTS 5-155
APPENDIX F: PART 3A IMPACT ASSESSMENT 5-159
APPENDIX G: EPBC ACT MATTERS OF NES IMPACT ASSESSMENTS 5-179
APPENDIX H: BIOBANKING PLOT DATA 5-187
APPENDIX I: BIOBANKING CREDIT REPORTS 5-189
APPENDIX J: STATEMENT ADDRESSING NSW AND COMMONWEALTH OFFSET CRITERIA 5-203
APPENDIX K: ENVIRONMENTAL HISTORY OF THE RESPONSIBLE PARTY 5-213

List of Figures

Figure 1: Regional Location of Werris Creek Coal Mine, the Project Site 5-15
Figure 2: The Project Site and Disturbance Footprint 5-16
Figure 3: Historic Aerial Imagery of the Project Site....5-22
Figure 4: Existing and Proposed Disturbance Footprint at The Project Site....5-27
Figure 5: Illustrated Mining Method 5-29
Figure 6: Flora and Fauna Survey Effort at the Project Site, between 2004 and 2010....5-39
Figure 7: Overlay of Vegetation Mapping Undertaken at the Project Site by GCNRC (2004) and ELA (2010) 5-42
Figure 8: Typical White Box Grassy Woodlands at the Project Site 5-49
Figure 9: Typical 'Bluegrass – Speargrass – Redleg Grass Derived Native Grassland', at the Project Site. This vegetation type is 'derived' from White Box Grassy Woodlands 5-50
Figure 10: Remnant of Brigalow - Belah Woodland at Project Site....5-51
Figure 11: Extant Vegetation Map of the Project Site 5-54
Figure 12: Regional Extant of the Threatened Ecological Community, 'White Box-Yellow Box-Blakely's Red Gum Woodlands and Derived Native Grasslands' Surrounding the Project Site 5-55
Figure 13: Vegetation Map of the Quipolly Creek Catchment, Showing Potential Groundwater Dependant Ecosystems 5-63
Figure 14: Vegetation Map of the Werris Creek Catchment, Showing Potential Groundwater Dependant Ecosystems 5-64
Figure 15: Restanding Cleared Timber Placed as Stag Trees within the Current Rehabilitation Area 5-67
Figure 16: Conceptual Final Landform and Rehabilitation Plan 5-69
Figure 17: Recolonisation of Derived Native Grasslands by Eucalypts in the Current Biodiversity Offset Area, due to the removal of Cattle Grazing 5-72
Figure 18: Offsetting Options....5-75
Figure 19: Golf Course and Weed Infestation along Werris Creek, a Sub-Regional Biodiversity Corridor 5-79
Figure 20: Location of Proposed Offset Properties and Revegetation Areas. 5-82
Figure 21: Regional Location of offset properties, Regional and Subregional Biodiversity Corridors 5-83
Figure 22: Box-Gum Grassy Woodland, including Derived Native Grassland on "Railway View" Property....5-86
Figure 23: Existing Vegetation and Offset at the Railway View property, East of the Project Site 5-87
Figure 24: Habitat Features available on "Marengo" Property (Stags, Coarse Woody Debris and Rocky Substrates. The fourth image, looking west from "Marengo", Shows the Connection across the Mine Site to the Western Ridgeline, Identified as a Sub-Regional Corridor 5-89
Figure 25: Threatened Bird Species, Hooded Robin and Diamond Firetail, of the Marengo Offset Property 5-89
Figure 26: Vegetation on "Marengo" Property for Inclusion in BOS, Excluding Existing Lease Area 5-90
Figure 27: Water Habitat and Tumbledown Gum with Small Hollow, on the Mine Site North 5-90
Figure 28: Yellow Box Woodland and Derived Native Grasslands on the Mine Site South....5-91
Figure 29: Vegetation on the "Mine Site" Property for Inclusion in BOS, including the LOM Footprint Area, Existing BOS Area and Cleared Lands that would be Rehabilitated Post Mining....5-92
Figure 30: Derived Native Grasslands and Cleared Paddocks on "Eurunderee" 5-93
Figure 31: Vegetation on "Eurunderee" Property for Inclusion in LOM Project BOS, Including Existing BOS Area....5-94
Figure 32: Map of flora survey effort between 2004 and 2010....5-188

List of Tables

Table 1: Summary of DGR's Requirements 5-17
Table 2: Site location details 5-20
Table 3: Threatened and migratory species, known to occur or with the potential to occur on the Project Site 5-38
Table 4: Weather conditions during field survey recorded at Tamworth, NSW 5-40
Table 5: Condition class definitions for woodland vegetation, based on TSSC (2006) 5-40
Table 6: Summary of flora survey effort and compliance with Draft Threatened Biodiversity Survey and Assessment guidelines at Project Site 5-43
Table 7: Summary of field survey effort and compliance with NSW Threatened Biodiversity Survey and Assessment guidelines 5-44
Table 8: Relationships between various vegetation mapping projects in the study area 5-48
Table 9: Conservation status of mapped vegetation types at the Project Site 5-53
Table 10: Noxious weeds recorded at the Project Site 5-56
Table 11: Key fauna habitat features present across the study area 5-57
Table 12: Ecosystem Credits and estimated offset requirements using the Biobanking Assessment Methodology 5-77
Table 13a: Propsed offsets for the impacts of the LOM Project 5-80
Table 13b: Propsed offsets for the impacts of the LOM Project 5-80

Abbreviations

ABBREVIATION	DESCRIPTION
AHD	Australian Height Datum
BIA	Biodiversity Impact Assessment Report (as required under Part 3A, EP&A Act).
BAMCCOM	Biobanking Assessment Methodology and Credit Calculator Operational Manual
Biobanking Methodology	BioBanking Assessment Methodology and Credit Calculator Operational Manual
BOA	Biodiversity Offset Area
BOMP	Biodiversity Offset Management Plan
BOS	Biodiversity Offset Strategy
CES	Countrywide Environmental Services
CMA	Catchment Management Authority
Credit Calculator	BioBanking Credit Calculator
DECC	Former NSW Department of Environment and Climate Change (now part of DECCW)
DECCW	NSW Department of Environment, Climate Change and Water (formerly DECC)
DEWHA	Commonwealth Department of the Environment, Water, Heritage and the Arts (Formerly DEWR now DSEWPaC)
DEWR	Commonwealth Department of Environment and Water Resources (Now a part of DSEWPAC)
DGRs	Director General's Requirements
Director-General	The Director General of the NSW Department of Planning
DNG	Derived Native Grassland
DoP	NSW Department of Planning
DSEWPAC	Commonwealth Department of Sustainability, Environment, Water, Populations and Communities
EEC	Endangered Ecological Community
EIS	Environmental Impact Statement
ELA	Eco Logical Australia Pty Ltd
EP&A Act	NSW *Environmental Planning and Assessment Act, 1979*
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999*
GCNRC	Geoff Cunningham Natural Resource Consultants
GDE	Groundwater Dependant Ecosystem
HBT	Hollow Bearing Tree
LMP	Landscape Management Plan
LOM	Life of Mine
LOM Project	Werris Creek Coal Mine – Life of Mine Project
ML	Mining Lease
NES	National Environmental Significance (EPBC Act)
NW Act	NSW Noxious Weeds Act 1993
Operational Manual	BioBanking Assessment Methodology and Credit Calculator Operational Manual
PEA	Preliminary Environmental Assessment
Project	Werris Creek Coal Mine - Life of Mine Project
Proponent	Werris Creek Coal Pty Ltd
SEPP	State Environmental Planning Policy
TEC	Threatened Ecological Community (includes critically endangered, endangered and vulnerable ecological communities), as listed under the EPBC Act or TSC Act.
TSC Act	NSW *Threatened Species Conservation Act, 1995*
WCC	Werris Creek Coal Pty Ltd (the Proponent)

Executive Summary

Werris Creek Coal Pty Limited currently operates the Werris Creek Coal Mine, located approximately 4 kilometres (km) south of Werris Creek and 11 km north-northwest of Quirindi, within the North West Slopes and Plains of New South Wales. The Werris Creek Coal Mine "Life of Mine" (LOM) Project is a proposal to extend a currently approved open-cut mining operation to recover the remaining coal to the north of the current mining area.

The LOM Project will be assessed under Part 3A of the NSW *Environmental Planning and Assessment Act 1979*. The Minister for Planning is the approval authority for projects assessed under Part 3A. The Director General Requirements (DGRs) were issued by the Department of Planning (DoP), 29th June, 2010 (DoP 2010a).

A referral to the Commonwealth regarding 'Matters of National Environmental Significance' (NES matters), under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) was submitted in 30th June 2010. This LOM Project was deemed to be a 'controlled action', 12th August, 2008. The Commonwealth Department of Sustainability, Environment, Water, Populations and Communities (DSEWPAC) advised that NES matters could be addressed through an accredited environmental assessment (EA) under Part 3A. The DoP issued 'Supplementary DGRs', 1st September 2010 (DoP 2010b), which outlined the Matters of NES that were required to be considered in the EA.

This Part 3A Threatened Species Environmental Assessment assesses the biodiversity impacts of the proposed LOM Project in accordance with the DGRs, including impacts on native vegetation, threatened species and ecological communities, migratory species and groundwater dependant ecosystems.

Field work to inform the Biodiversity Impact Assessment was undertaken by Eco Logical Australia during April 2010 and July 2010. This survey period was complimented by numerous previous surveys of the Project Site undertaken between 2004 and 2010. Survey effort was consistent with the '*Draft Threatened Biodiversity Survey and Assessment Guidelines*' (DEC 2004). The assessment identified two threatened ecological communities (TECs) present at the Project Site, namely:

- White Box – Yellow Box – Blakely's Red Gum woodlands (and derived grasslands); and
- Brigalow (Acacia harpophylla dominant and co-dominant) woodlands.

These TECs are both listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), the former as 'critically endangered' and the latter as 'endangered'. They are also both listed as 'endangered' under the NSW *Threatened Species Conservation Act 1995* (TSC Act).

The supplementary DGR's issued to address NES Matters (DoP 2010b) required the impacts to the critically endangered ecological community 'Natural grasslands on basalt and fine-textured alluvial plains of Northern NSW and southern Queensland' to be assessed. This community does not occur within the Project Site.

There were eight threatened fauna species recorded during the survey period 2004 to 2010: Little Eagle (*Hieraaetus morphnoides)*; Hooded Robin (*Melanodryas cucullata*); Brown Treecreeper (*Climacteris picumnus*), Little Lorikeet (*Glossopsitta pusilla*), Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*); Yellow-bellied sheath-tail Bat (*Saccolaimus flaviventris*); Eastern False Pipistrelle (*Falsistrellus. tasmaniensis*); and Greater Broad-nosed Bat (*Scoteanax rueppellii*). These species are all listed as 'vulnerable' under the TSC Act. Impacts on these species have been assessed in accordance with the 'Draft Guidelines for Threatened Species Assessment' (DEC and DPI 2005).

There were no threatened or migratory species, listed under the EPBC Act, recorded at the Project Site during the survey period 2004 to 2010. The supplementary DGR's issued to address NES Matters (DoP 2010b) required the impacts of the LOM Project on four threatened species, which potentially occurred on the site, to be assessed: Regent Honeyeater (also a listed migratory species); Swift Parrot (*Lathamus discolor*); Finger Panic Grass (*Digitaria porrecta*); and *Prasophyllum* sp. Wybong. These threatened and migratory species were not recorded during the field surveys. The impacts of the LOM Project on these threatened and migratory species have been considered in accordance with '*EPBC Act Policy Statement 1.1 – Significant Impact Guidelines Matters of National Environmental Significance*' (CoA 2009).

No threatened flora, listed under the EPBC Act or the TSC Act, were recorded at the Project Site.

The LOM Project involves the clearance of approximately 195 hectares (ha) of native vegetation, comprising approximately 60 ha of woodland and 135 ha of derived native grasslands. In order to limit the impacts on threatened species and ecological communities, a number of measures are proposed. These include avoidance of impacts in the first instance, mitigation of impacts where possible, and the development of a Biodiversity Offset Strategy (LOM Project BOS) to offset impacts which are considered unavoidable.

Indicative Biobank Assessments were undertaken to determine the "quantum" of offsets required to meet an 'improve or maintain' outcome. These calculations indicated that an offset area of approximately 650 ha (based on the condition of vegetation within the proposed offset areas) would be required.

The LOM Project BOS proposes the creation of an 838.9 ha biodiversity corridor in addition to the existing Biodiversity Offset Area, incorporating approximately 567.7 ha of 'like for like' TEC, 211.9 ha of other woodlands and derived native grasslands and 59.3 ha of cleared lands. It provides a matrix of habitat attributes currently absent from the majority of the surrounding area as a result of current and past land uses such as grazing and cropping. The remainder of this corridor would be rehabilitated to native woodland with local provenance species. In addition to this there would also be 484.2 ha of woodland rehabilitation on the final landform, and when considered with the existing BOS for the Werris Creek Coal Mine, a total corridor of approximately, 1,655.2 ha would be created. The Biobank Assessments indicate that 7,902 credits are required for the 194.15 ha of impacts resulting from the proposed LOM Project. The proposed 838.9 ha Biodiversity Offset Area has been estimated to generate 10,212 credits of which 8,283 are for the White Box –Yellow Box – Blakely's Red Gum woodland community. Based on these Biobanking calculations the improve or maintain test will be exceeded with surplus credits offsetting impacts to the 0.35 ha of Brigalow impacted on a "like for like" basis.

Significantly, this corridor is in the area immediately surrounding the impact and provides an east-west link between two existing north-south 'sub-regional' corridors as identified in the Liverpool Plains Shire Councils Biodiversity Strategy (ELA 2010a), providing a migration link between the two corridors. Conservation outcomes would be secured through a covenant on land title.

The LOM Project has incorporated all feasible measures to avoid and mitigate the impacts on biodiversity. Where biodiversity impacts were unavoidable, a comprehensive Biodiversity Offset Strategy (the LOM Project BOS) has been developed to offset these impacts. With the suite of direct offsets provided by this package, it is considered that the LOM Project BOS would provide a significant conservation outcome that meets both the 'improve or maintain' and the 'no net loss' policies of the State and Commonwealth Governments. As a result of these amelioration measures, the LOM Project is not considered to have a significant impact on threatened or migratory species, or threatened ecological communities, listed under either the NSW TSC Act 1995 or the Commonwealth EPBC Act 1999.

This page has intentionally been left blank

1 Introduction

1.1 BACKGROUND

Werris Creek Coal Pty Ltd ("the Proponent") currently operates the Werris Creek Coal Mine, approximately 4 kilometres (km) south of Werris Creek and 11 km north-northwest of Quirindi, within the North West Slopes and Plains of New South Wales (**Figure 1**), under Development Consent DA 172-7-2004.

The Werris Creek Coal Mine "Life of Mine" (LOM) Project is a proposal to extend a currently approved open-cut mining operation to recover the remaining coal found to the north of the current mine. The principal objectives of the LOM Project are to:

- maximise resource recovery and efficiency of mining operations, through the extension of the approved open cut area in order to recover all available coal resources of the Werris Creek Coal Measures;
- maintain the stimulus to the local economies of Werris Creek, Quirindi and their surrounding districts through employment opportunities and the supply of services required for the operation of the coal mine;
- create a final landform that is safe, stable and is amenable to a combination of agricultural and native flora/fauna conservation activities;
- expand the existing Biodiversity Offset Strategy for the Werris Creek Coal Mine to compensate for additional disturbance to ecological communities resulting from the LOM Project;
- undertake all activities in an environmentally responsible manner, employing a level of control and safeguards that would ensure compliance with appropriate criteria/goals or reasonable community expectations at all times; and
- achieve the above objectives in a cost-effective manner and thereby ensure the ongoing viability of the Werris Creek Coal Mine.

The approved site of Werris Creek Coal Mine is defined by the existing Mining Lease (ML) 1563. The LOM Project would require an extension to the currently approved area and incorporate the following areas identified in **Figure 2**.

- An area bounded by ML 1563, Escott Road and Werris Creek Road (to incorporate the LOM Project open cut and overburden emplacement extension).
- An area to the west and southwest of the Rail Load-out Facility (to incorporate a proposed 'turn-around loop').

The LOM Project will be assessed under Part 3A of the NSW *Environmental Planning and Assessment Act 1979*, which provides the assessment and approvals process for major projects in NSW, including coal mining projects. The Minister for Planning is the approval authority for all projects assessed under Part 3A. The area including the existing and additional areas, which is the subject of the application under part 3A is referred to hereafter as the Project Site.

For the initial application under Part 3A, a Preliminary Environmental Assessment (PEA) was prepared and submitted to the NSW Department of Planning (DoP) in May 2010 (RWC 2010). The PEA included preliminary assessments of surface and groundwater; flora and fauna; soil and land capability; noise and vibration; indigenous and non-indigenous heritage; air quality and visual impacts.

Upon review of the PEA, the Director-General of the DoP issues environmental assessment requirements (generally referred to as the Director-Generals Requirements [or DGR's]). Relevant public authorities such as the NSW Department of Environment, Climate Change and Water (DECCW) and the local council were consulted in preparing the DGR's.

The DGR's also outline any consultation requirements and require that the Proponent prepare a 'Statement of Commitments', setting out the environmental management and mitigation measures to be undertaken on the site. A copy of the DGR's for the LOM Project are included at **Appendix A**.

The qualifications and experience of the survey team who undertook the field surveys and prepared this BIA is provided at **Appendix B**.

1.2 BIA COMPLIANCE WITH DIRECTOR – GENERALS REQUIREMENTS

Table 1 indicates where in this Biodiversity Impact Assessment (BIA) each of the DGR's have been addressed.

1.3 REPORT OBJECTIVES

The objectives of this BIA are to:

- undertake a flora and fauna assessment of the "Project Site" sufficient to assess all aspects of the proposed extension in accordance with State and Commonwealth Government agency requirements that address the Director Generals Requirement's (DGR's);
- report on the known and potential occurrence of any relevant threatened species and communities listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act) and/or the NSW *Threatened Species Conservation Act 1995* (TSC Act);
- assess the impacts to biodiversity values resulting from the LOM Project;
- provide advice relevant to avoiding, mitigating or offsetting any potential impacts; and
- develop a Biodiversity Offset Strategy (BOS)

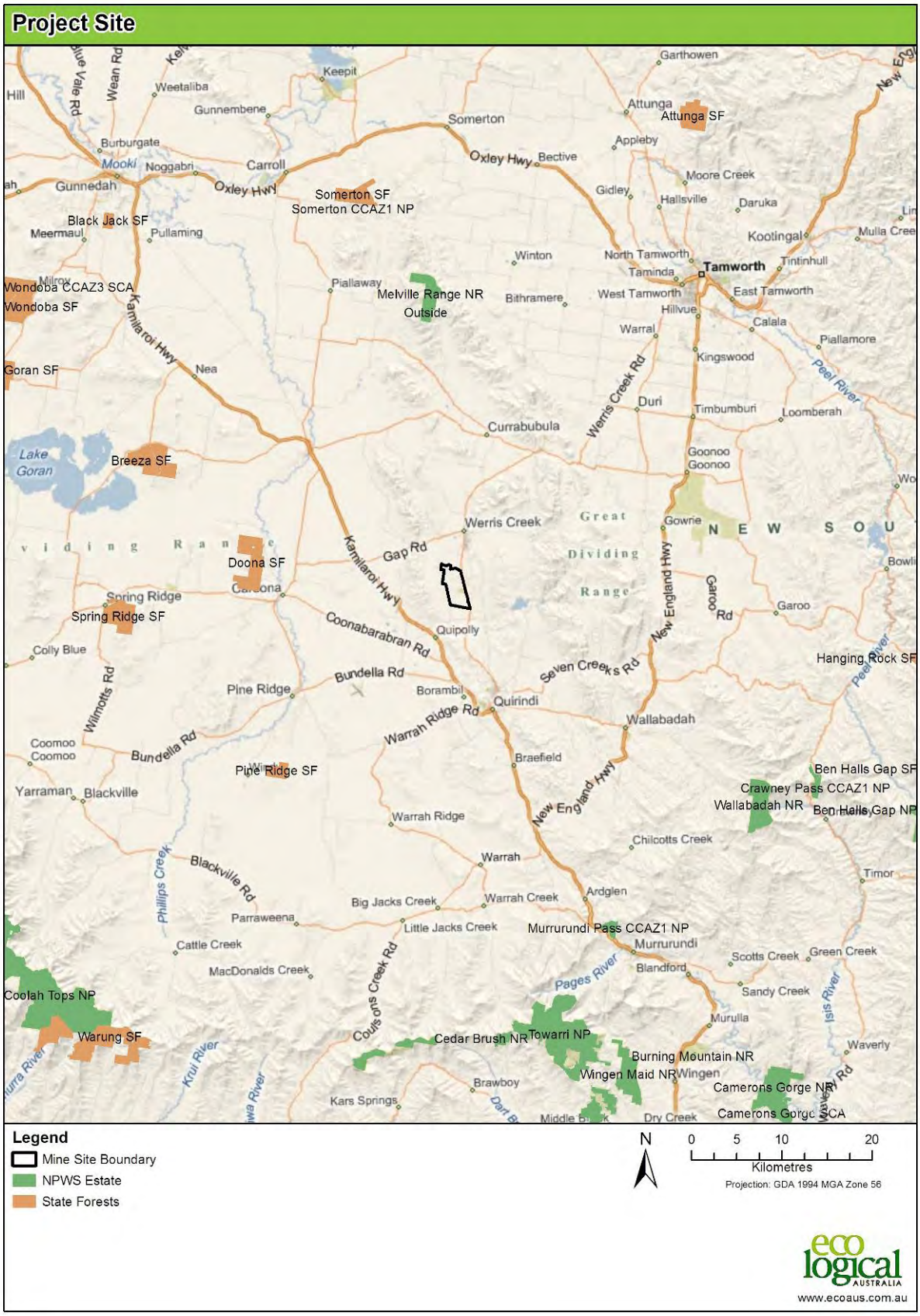


Figure 1: Regional Location of Werris Creek Coal Mine, the Project Site

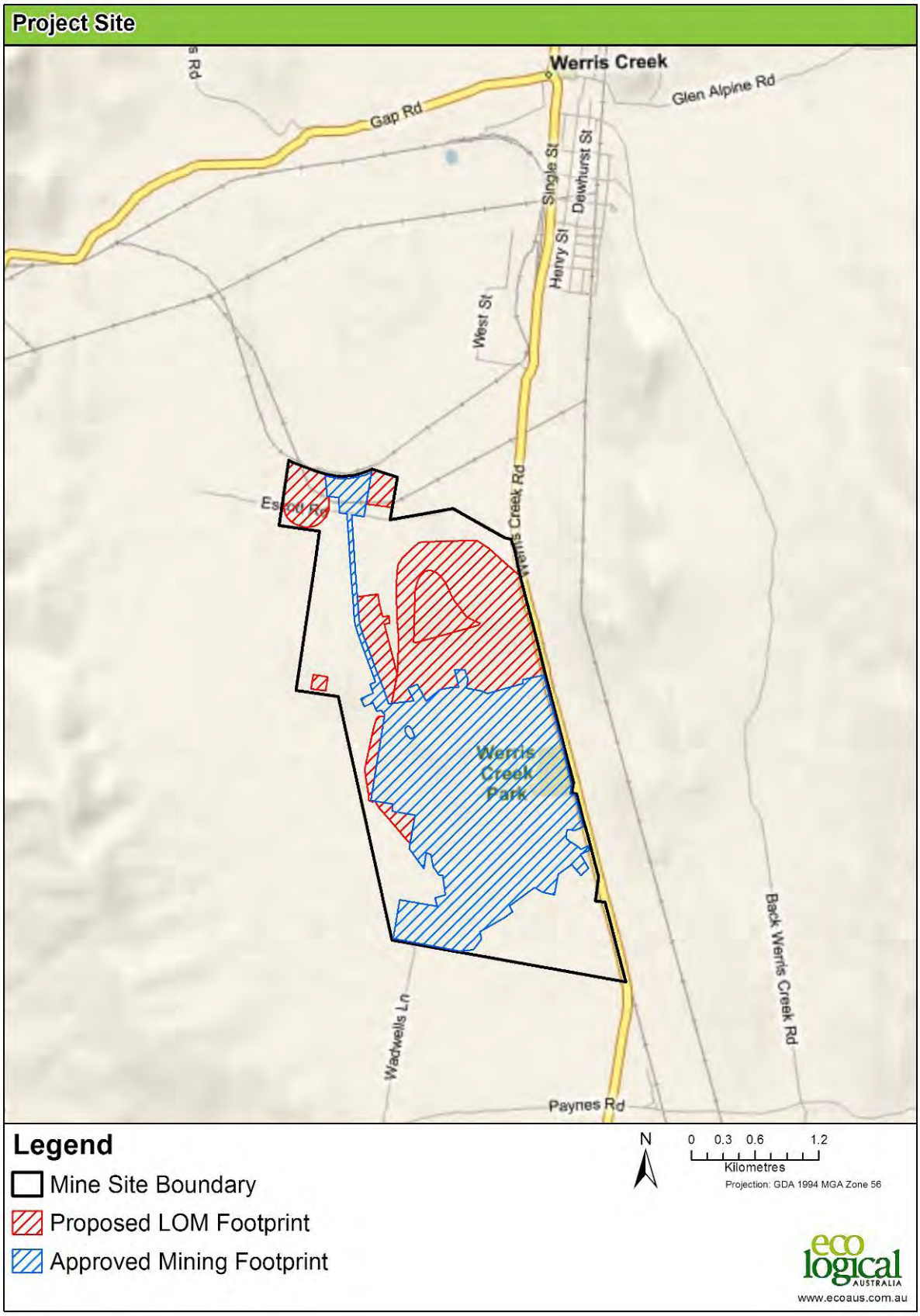


Figure 2: The Project Site and Disturbance Footprint

Table 1: Summary of DGR's Requirements

GOVERNMENT AGENCY	PARAPHRASED REQUIREMENT	RELEVANT EA SECTION(S)
Liverpool Plains Shire Council	**Biodiversity Conservation**	
	As part of the proponent's work in this area, Council would be pleased to see a reference to the objectives and findings of its adopted Shire-wide biodiversity conservation strategy.	**Section 8**
Environment Climate Change & Water	In summary the Department's key information requirements for the project are:	
	the impact on threatened species and native vegetation;	**Section 6 and 7**
Environment Climate Change & Water	**Impacts on Biodiversity and Specifically Threatened Species and their Habitat**	
	Generally, steps in the assessment in accordance with the Part 3A threatened species guidelines includes:	
	1. A field survey of the site should be conducted and documented in accordance with the gazetted draft *Guideline for Threatened Species Assessment* and the document "Threatened Biodiversity Assessment - Guidelines for Developments and Activities" (Working Draft) (DEC 2004)	**Section 5 (Tables 4 and 6);** **Appendix F**
	2. Likely impacts on threatened species and their habitat need to be assessed, evaluated and reported on. The assessment should specifically report on the considerations listed in Step 3 of the draft guideline.	**Section 6 and 7**
	3. Describe the actions that will be taken to avoid or mitigate impacts or compensate for unavoidable impacts of the project on threatened species and their habitat. This should include an assessment of the effectiveness and reliability of the measures and any residual impacts after these measures are implemented.	**Section 7 and 8**
	4. Describe the extent of loss of any native vegetation and a strategy to offset any losses to ensure maintenance of, or improved outcome for biodiversity.	**Section 6, 7 and 8**
	5. The EA needs to clearly state whether it meets each of the key thresholds set out in Step 5 of the guideline.	**Section 9**

Table 1 (Cont): Summary of DGR's Requirements

GOVERNMENT AGENCY	PARAPHRASED REQUIREMENT	RELEVANT EA SECTION(S)
	The EA must consider the corridor values or connective importance of any vegetation on the subject land. The Department prefers that vegetation on adjoining land that exhibits these corridor values should be retained and, where necessary, rehabilitated. The final rehabilitation objectives, with appropriate performance monitoring against rehabilitation objectives, should be clearly defined in the EA.	**Section 8**
Environment Climate Change & Water	**Impacts of the Project on Native Vegetation**	
	The EA needs to address the potential impact on native vegetation, specifically:	
	1. The hectares of native vegetation that will have to be cleared to accommodate mining for the extension project;	**Sections 6 and 7**
	2. The floristics of the botanical communities of native vegetation that will need to be cleared;	**Sections 6 and 7**
	3. The extent of native vegetation on the site which may be remnant vegetation, protection regrowth or non-protected regrowth as defined by the *Native Vegetation Act 2003*;	**N/A. This assessment is undertaken in accordance with the EP&A Act, not the NV Act; as such these definitions are not relevant to this assessment.**
	4. The requirement to develop suitable offset(s) to improve or maintain environmental outcomes for the lawful clearing of native vegetation, in relation to four environmental values: water quality, soils, salinity and biodiversity (including threatened species).	**This report addresses impacts to biodiversity (incl. threatened species)**
NSW Office of Water	The EA must identify the location of all drainage lines and watercourses on and adjacent to the site and include options for the management of these areas.	**Section 2**
	The assessment is required to identify any impacts on GDEs. GDEs are ecosystems which have processes wholly or partially determined by groundwater.	**Sections 5 and 6**

Table 1 (Cont): Summary of DGR's Requirements

GOVERNMENT AGENCY	PARAPHRASED REQUIREMENT	RELEVANT EA SECTION(S)
	The NSW Groundwater Dependent Ecosystem Policy provides guidance on the protection and management of GDEs. It sets out management objectives and principles to: - Ensure the most vulnerable and valuable ecosystems are protected. - Manage groundwater extraction within defined limits thereby providing flow sufficient to sustain ecological processes and maintain biodiversity. - Ensure sufficient groundwater of suitable quality is available to ecosystems when needed. - Ensure the precautionary principle is applied to protect GDEs, particularly the dynamics of flow and availability and the species reliant on these attributes.	**Sections 5 and 6**
Environment, Water, Heritage and the Arts	General information (including title, background, location)	**Section1**
	Description of the Controlled Action	**Section 3**
	Proposed safeguards and mitigation measures	**Section 7**
	Offsets	**Section 8**
	Other approvals and conditions	**Section 4**
	A description of relevant impacts of the controlled action	**Section 7; Appendix G**
	Economic and social matters	**Not addressed in this report**
	Environmental record of person proposing take the action	**Appendix J**
	Information sources	**References**
	Consultation	**Consultation with: DECCW, 17/08/2010 DSEWPAC, 19/07/2010**

2 Study Area

2.1 SITE LOCATION

The Project Site is located on the Werris Creek Rd approximately 2.6 km south of Werris Creek (at its closest point) and 11 km north-northwest of Quirindi, in the Liverpool Plain Local Government Area. This area is located within the North West Slopes and Plains of New South Wales.

Based on cadastre lot layout, the Project Site encompasses an area of 908 ha and it falls within the following Latitude and Longitude points (**Table 2**).

Table 2: Site Location Details

LOCATION POINT	LATITUDE			LONGITUDE		
	degrees	minutes	seconds	degrees	minutes	seconds
Southwest	31	24	52	150	37	46
Southeast	31	25	5	150	39	10
Northeast	31	22	51	150	38	32
Northwest	31	22	24	150	37	10

The Project Site lies within the Namoi River Basin in an area characterised by the transition from the elevated ranges associated with the Liverpool Ranges to the south, Great Dividing Range to the east, Nandewar Range to the north, and open plains to the west. Locally, the Project Site is located within a valley created by two north-south trending ridgelines extending from Werris Creek in the north to Quipolly Creek in the south. Elevations within this area are effectively bounded by the north-south oriented ridgelines and Werris and Quipolly Creeks and range from approximately 340 metres (m) AHD on the banks of Werris Creek to 670 m AHD on Grenfell Hill, 3.5 km west of the Project Site. The highest point within the Project Site boundary is Old Colliery Hill, at 440 m AHD, with the site falling away to the north and south to approximately 370 m AHD.

Roads of significance are Werris Creek Road bounding the eastern margin of the Project Site and Escott Road to the north of the mine pit and to the south of the rail load out facility. The Project Site and its immediate surrounds are illustrated in **Figure 2**.

2.2 LANDSCAPE HISTORY

The study area consists predominantly of White Box grassy woodlands, derived native grasslands, exotic pastures and cropping lands. Land use is generally small scale mixed farming, with larger more intensive agriculture increasing further to the west on the Liverpool Plains. This mixed farming involves a combination of cropping (generally wheat, oats or lucerne) and cattle grazing with or without varying levels of pasture improvement. These land uses have been practised across the Project Site for several decades and have resulted in the native vegetation of the Project Site being either cleared, or extensively modified so that the remnant native vegetation is generally in a degraded and simplified condition state. These land uses are ongoing on several of the surrounding properties owned by the Proponent, including "Eurunderee", "Railway View", "Marengo" and "Narrawolga", through lease agreements with the former owners or current occupiers.

Despite the history of agricultural land use, at the time of survey (April 2010), large areas of the vegetation meet the definition of threatened ecological communities (TEC) under NSW and Commonwealth legislation despite historical aerial photographs showing the history of cultivation, cropping, and at times, large areas of bare earth (**Figure 3**).

2.3 SOILS AND GEOLOGY

Mitchell Landscapes are a system of ecosystem classification mapped at 1:25 000 scale, based on a combination of soils, topography and vegetation (Mitchell 2002). The study area falls wholly within the Werris Creek Basalt Hills and Valleys Mitchell landscape, this landscape is described as undulating plain with low hills on gently folded lower Permian basalt, tuff and tuffaceous sandstone, general elevation 500 to 550 m, local relief 30 to 50 m. Brown and red brown gradational structured loam and clay loam merging with black sticky clay along streamlines. Profiles thicken down slope and are of moderate fertility (Mitchell 2002).

Soil landscapes in the study area comprise transferral and erosional landscapes mostly of basalt origin (McDonald et al. 1990). Three soil landscapes have been mapped within the area: Escott, Siphon and Narrawonga (GCNRC 2004a). Of these, the Escott and Siphon landscapes are considered to be transferral soil landscapes, i.e., deep deposits of mostly eroded parent materials washed from areas up-slope (McDonald et al. 1990). The Escott landscape is found to the west of the approved open cut area (GCNRC 2004a), and is described as footslopes of low Permian Sandstone hills (DLWC 2001). The Siphon landscape, found to the east of the approved open cut area (GCNRC 2004a), is described as basic volcanic alluvium and colluviums (DLWC 2001).

The Narrawolga soil landscape is considered an erosional landscape, sculpted primarily by erosive action of running water (McDonald *et al*. 1990). Soil depth is usually shallow and may be derived from water-washed parent materials or derived from in situ weathered bedrock (DLWC 2001). The Narrawolga landscape is found on the elevated land of the north-south oriented ridge within the Project Site (GCNRC 2004a), and is likely to be similar to the unsampled north-south rocky ridge to the west of the haul road.

Figure 3: Historic Aerial Imagery of the Project Site

2.4 VEGETATION COMMUNITIES

The vegetation at the Project Site has previously been mapped by Geoff Cunningham Natural Resource Consultants (2004b and 2009). GCNRC identified six vegetation communities on site, though reference to the associated vegetation maps does not include Community 5:

- Community 1 - Cleared - Cultivated / Pasture Lands
- Community 2 - Cleared Land - Uncultivated
- Community 3 - *Acacia harpophylla* (Brigalow) Community
- Community 4 - *Eucalyptus albens* (White Box) - *Eucalyptus melliodora* (Yellow Box) - *Eucalyptus blakelyi* (Blakely's Red Gum) Community
- Community 5 - *Eucalyptus albens* (White Box) - *Angophora floribunda* (Rough-barked Apple) Community (identified in report but not mapped on site)
- Community 6 - *Eucalyptus dealbata* (Tumbledown Gum) Community.

Regionally, a vegetation map for the Namoi CMA has been produced (ELA 2009a). This mapping product is underpinned by a Regional Vegetation Community (RVC) classification which is linked to the vegetation type classification in the Biometric Vegetation Types Database. This map identified the following three RVC's within the Project Site:

- White Box grassy woodlands of the Brigalow Belt South Bioregions and Nandewar;
- Derived grasslands, Brigalow Belt South and Nandewar; and
- Brigalow – Belah woodland on alluvial soil mainly Brigalow Belt South.

Most recently the vegetation on part of the Project Site has been remapped to align with the Biometric Vegetation types preferred by the DECCW (ELA 2010b), which can be easily correlated with threatened ecological communities listed under the EPBC and TSC Acts (**Section 6**). Biometric Vegetation Types are also the base units used in the Biobanking Tool, which has been used to guide offset requirements for impacts to native vegetation at the Project Site (**Section 8**). This mapping identified the following Biometric vegetation types:

- White Box grassy woodlands of the Nandewar and Brigalow Belt South Bioregions;
- Bluegrass – Spear Grass – Redleg Grass derived grasslands (derived from White Box grassy woodland) of the Nandewar Bioregion; and
- Brigalow – Belah woodlands on alluvial often gilgaied clay soil mainly in the Brigalow Belt South Bioregion.

Other vegetation onsite includes disturbed and exotic pasture; this land has been classified as 'Cleared land'. The correlation between these vegetation maps is outlined in **Table 8**, and discussed further in **Sections 5** and **6** of this report.

Other vegetation types found on surrounding properties include, 'White Box – White Cypress Pine – Silver-leaved Ironbark shrubby woodlands', 'Yellow Box – Blakely's Red Gum grassy woodlands', 'Rust Fig – Wild Quince – Native Olive dry rainforest', 'Rough-barked Apple riparian forb/grass open forest' and 'Plains Grass – Bluegrass grasslands'.

Native vegetation communities vary in condition across the study area and vary according to current and past grazing intensity and pastoral impacts. Further discussion of the mapped vegetation and condition classes is included in **Section 5**.

2.5 RIVERS, CREEKS AND WATERCOURSES

There are no mapped or naturally occurring creek lines or lakes within the boundaries of the Project Site. There are also a number of farm dams and sediment retention structures located on the Project Site.

The Project Site is positioned between two creeks, Quipolly Creek to the south and Werris Creek to the north. Werris Creek flows into the Mooki River and then into the Namoi River. Quipolly Creek, while restricted by the Quipolly Dam located upstream of Quipolly Creek, flows into Quirindi Creek, the Mooki River and then into the Namoi River.

Quipolly Creek is approximately 2.9 km south of the Project Site (elevation 360 m AHD) and 15 m lower (elevation 345 m AHD) than the southern-most point of the Project Site. To the north, Werris Creek is approximately 3.4 km and approximately 40 m lower than the northern-most point of the Project Site. These factors would inhibit floodwaters from moving out of Quipolly and Werris Creeks and inundating the Project Site.

2.6 GROUNDWATER DEPENDANT ECOSYSTEMS

Groundwater Dependant Ecosystems are ecosystems which have their species composition and their natural ecological processes determined by groundwater (ARMCANZ & ANZECC 1996, in DLWC 2004). There are different types of GDEs and Eamus et al. (2006a) identifies three primary classes of GDEs as follows.

- Aquifer and cave ecosystems, where stygofauna (groundwater-inhabiting organisms) reside within the groundwater resource. These ecosystems include karstic, fractured rock and alluvial aquifers. The hyporheic zones of rivers and floodplains are also considered in this category because these ecotones often support stygobites (obligate groundwater inhabitants);
- Ecosystems dependent upon the surface expression of groundwater. This includes base-flow rivers and streams, wetlands and some floodplains; and
- Ecosystems dependent on the subsurface presence of groundwater, often accessed by the roots of vegetation which penetrate into the capillary fringe (non-saturated margins) of the water table.

SKM (2010) identifies two catchments supporting GDE's within close proximity to the Project Site, these are Werris Creek and Quipolly Creek. For the purposes of the proposed activity, potentially two types of GDE may be impacted upon in these catchments: Ecosystems dependant on surface expression of groundwater and those dependant on the subsurface presence of groundwater, i.e. terrestrial vegetation. Potential impacts to GDE's are discussed in **Section 7**.

2.7 SURROUNDING RESERVES

There are no national parks or nature reserves within 30 km of the Project Site. The nearest reserve to the site is Doona State Forest at Caroona, approximately 25 km west of the Project Site. The closest national park is Towarri National Park, approximately 50 km south of the Project Site.

There are no significant water bodies or wetlands of national significance in close proximity to the Project Site.

2.8 CLIMATE

The annual rainfall as measured at Quirindi Post Office ranges from 337 mm/year to 1149 mm/year, with an average of 684 mm (BOM 2010). The region is predominantly a summer rainfall area, with rains often in short duration, and high intensity rain events or thunderstorms (Ringrose-Voase *et al.* 2003).

Air temperatures as measured at Quirindi Post Office, range from 13.2˚C to 37.3˚C, with an average of 24.6˚C (BOM 2010).

In Gunnedah, annual average pan evaporation (Epan) is 1884 mm. With a maximum monthly average of 263 mm in December and a minimum of 60 mm in June, Epan exceeds rainfall in all months. This pattern is true across most of the catchment (Ringrose-Voase et al. 2003).

Frost incidence is the other important climatic gradient. While temperatures vary as expected with elevation, there is a trend for more frequent frosts in the narrow alluvial valleys in the south of the catchment (e.g. near Pine Ridge) due to topographic effects compared to the broader alluvial plains in the north (Ringrose-Voase et al. 2003).

3 Description of the Project

Figure 4 presents the various components of the approved operations and the proposed LOM Project. The main attributes of these components are discussed in the following sections with further detail available in the Environmental Assessment (RWC, 2010).

Construction Activities

Whilst not strictly a construction phase, the LOM Project would require the relocation and upgrade of new infrastructure on the Project Site. The construction activities to be undertaken are identified on and include the following.

Modification Works

A second feed point to the Rail Load-out Facility would be installed. This would allow for the separation of the low ash and high ash coal product loading points (preventing contamination issues arising from the use of the one feed point).

The Product Coal Stockpile Area would be extended to the east to accommodate the storage of up to 250,000t of coal products.

The extension of the out-of-pit overburden emplacement to the west would require the retraction of several power poles and line that currently run between the branch line to the Zeolite Australia processing plant and the Project Site offices and coal processing area.

The extension of the out-of-pit overburden emplacement would also require the realignment of the current Mine Access Road.

Relocation Works

The westerly extension of the out-of-pit overburden emplacement would require the relocation of both the Site Administration and Facilities Area and Coal Processing Area.

In the case of the Site Administration and Facilities Area, the relocation would involve a replication of facilities (in some cases using the same transportable buildings) at the new location.

In the case of the Coal Processing Area, new crushing and screening facilities would be constructed which generally replicate the layout of the existing facilities. The stockpile area would be enlarged to provide for the storage of up to 200,000 t of ROM coal on a ROM Coal pad of approximately 2.5 ha.

The explosives magazine would be relocated to the western side of the internal haul road. The approved precursor storage facility would be constructed on the western side of the internal haul road.

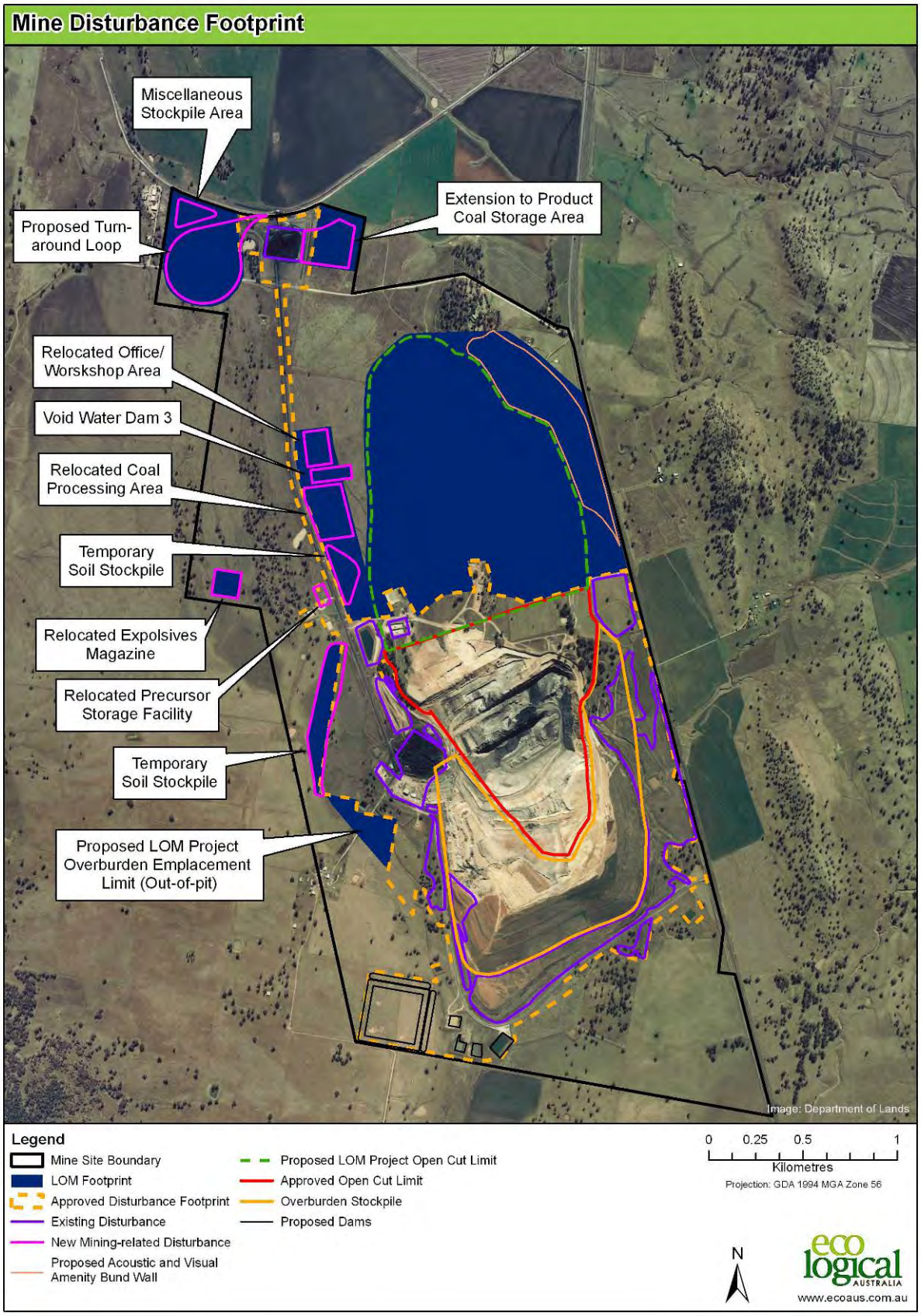


Figure 4: Existing and Proposed Disturbance Footprint at The Project Site, taken from RWC (2010)

New Construction Works

A new entrance to the Project Site would be constructed off Escott Road (near the intersection of the internal haulage road and Escott Road) ("the Escott Road Entrance"). A new sealed mine access road from the Escott Road Entrance to the Coal Processing Area and Administration and Facilities Area ("the Northern Mine Access Road") would also be constructed.

In order to accommodate the increased volume of traffic using Escott Road, the intersection of Escott Road and Werris Creek Road would be upgraded, as would Escott Road itself to the point of entry at the Escott Road Entrance.

A 'turn around' rail loop to the southwest of the existing Rail Load-out Facility would be constructed. Construction would be limited to approximately 1.6 km of rail in cleared grazing country/former cultivation area. The loop is required to speed up current train turnaround times and also to accommodate new generation rail wagons which do not have the ability to be unloaded from 2 sides (as is the case with current wagons) at Port Newcastle.

A conveyor could be constructed between the Coal Processing Area and Product Stockpiling Area. This could replace the internal road haulage (up to 16 truck loads per hour) currently operating between these two areas, however, is subject to a further economic feasibility study following commencement of the LOM Project.

Demolition Activities

The residences on the "Old Colliery" and "Preston Park" properties would be demolished in advance of the progression of the open cut.

Mining Method

Mining at the Werris Creek Coal Mine is undertaken using a conventional haulback system which involves up to five sequential activities, namely:

- vegetation removal;
- drainage installation;
- soil stripping;
- overburden removal and backfill of the open cut or placement within an overburden emplacement; and
- construction of a series of near horizontal benches by blasting from which the coal is removed.

Each of the five activities are generally being undertaken concurrently on one or more benches. The expanded mining area for the LOM Project is identified on and further detailed in the Environmental Assessment for the LOM Project (RWC 2010). **Figure 5** illustrates the mining method to be undertaken during the LOM Project.

Final landform construction and rehabilitation activities are also undertaken progressively after coal removal.

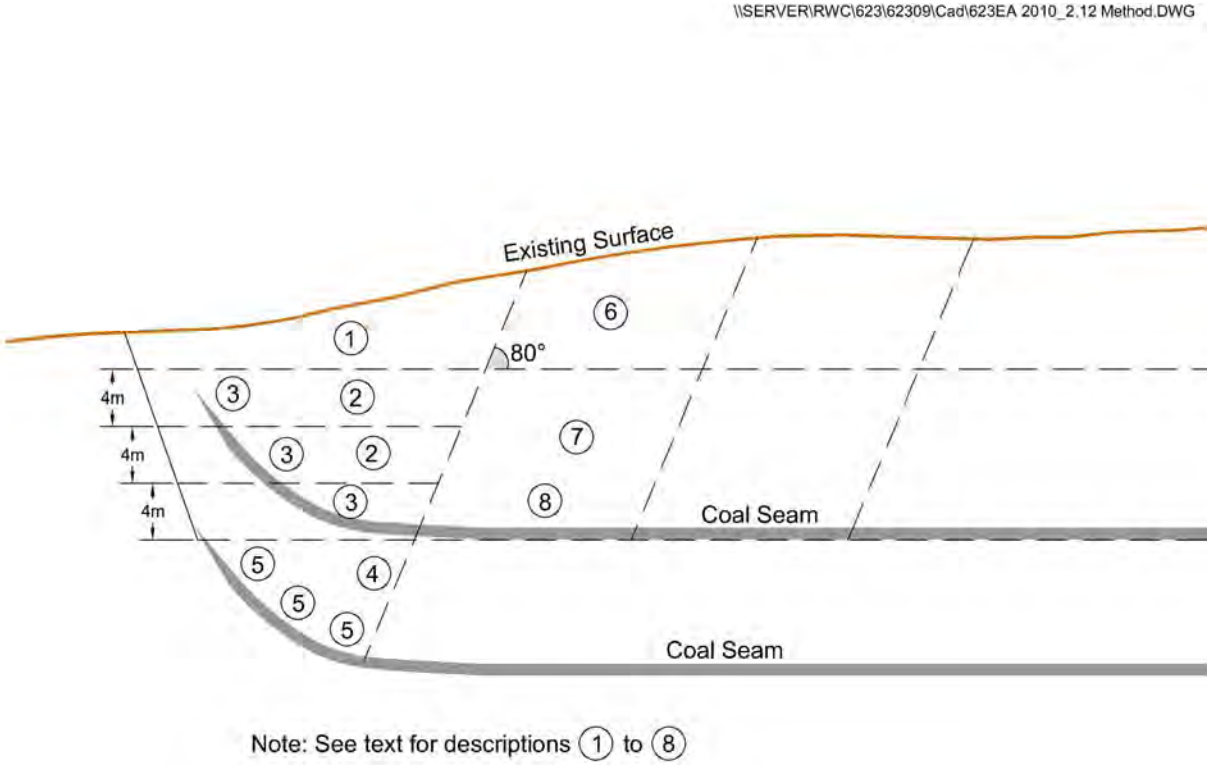


Figure 5: Illustrated Mining Method, taken from RWC (2010)

Rehabilitation and Biodiversity Offsets

Rehabilitation Objectives

The Proponent would maintain the progressive approach to the rehabilitation of areas of disturbance within the Project Site to ensure that, where applicable, completed mining or overburden emplacement areas are continued to be efficiently shaped and vegetated to provide a stable landform. The Proponent's rehabilitation objectives are considered in three specific categories, namely:

- integrating landscapes;
- achieving sustainable growth and development; and
- establishing the final land use.

The specific objectives associated with each category are as follows:

Integrated Landscapes

- To reduce the visibility of mine-related activities from adjacent properties, Werris Creek and the local road network.
- To blend the created landforms with the surrounding topography.
- To provide a low maintenance, geotechnically stable and safe landform with minimal erosion.

Sustainable Growth and Development

- To achieve a soil profile capable of sustaining the specified final land use.
- To establish native vegetation commensurate with the species diversity relevant to each ecological community.

Final Land Use

- To re-instate agricultural land commensurate with the agricultural land use on and around the Project Site.
- To re-instate native woodland commensurate with the nature conservation areas on or around the Project Site.
- To include habitat augmentation and corridors for fauna movement linking with adjacent woodland areas within the rehabilitation.

Final Land Use

The Proponent currently envisages two principal uses for the rehabilitated landform following successful vegetation establishment:

- Conservation areas for native flora and fauna, including the rehabilitation of native woodlands and the Brigalow community.
- Agricultural land suitable for grazing and cropping.

The on-site road network would be reviewed at the end of the mine life to establish which roads would be appropriately left for the ongoing land use(s) and which roads should be partially or fully removed.

4 Legislative Context

4.1 COMMONWEALTH LEGISLATION

Environment Protection and Biodiversity Conservation Act 1999

The primary objective of the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) is to 'provide for the protection of the environment, especially those aspects of the environment that are matters of National Environmental Significance.'

Environmental approvals under the EPBC Act are required for an 'action' that is likely to have a significant impact on the following.

- Matters of National Environmental Significance (known as 'NES matters') including:
  - World Heritage Areas;
  - National Heritage Places;
  - Ramsar wetlands of international importance;
  - Nationally listed threatened species and ecological communities;
  - Listed migratory species;
  - Nuclear actions; Commonwealth marine areas; and
  - Commonwealth heritage places.
- Actions taken on Commonwealth land that are likely to have a significant impact on the environment,
- Actions that are likely to have a significant impact on the environment of Commonwealth land, even if the action is taken outside Commonwealth land.
- Any action taken by a Commonwealth agency that is likely to have a significant impact on the environment.

An 'action' is considered to include a project, development, undertaking, activity or series of activities.

Of potential relevance to the LOM Project are matters of NES which include nationally listed threatened species and ecological communities and listed migratory species.

A Referral under this Act was prepared in July 2010 and submitted to DSEWPAC. The LOM Project was deemed to be a 'controlled action' with regards to threatened species and communities, and migratory species.

4.2 INTERNATIONAL AGREEMENTS

International Migratory Bird Agreements

- Japan - Australia Migratory Bird Agreement (JAMBA)
- China - Australia Migratory Bird Agreement (CAMBA)

The JAMBA and CAMBA agreements list terrestrial, water and shorebird species which migrate between Australia and the respective countries. In both cases, the majority of listed species are shorebirds.

Both agreements require the parties to protect migratory birds by:

- limiting the circumstances under which migratory birds are taken or traded;
- protecting and conserving important habitats;
- exchanging information; and
- building cooperative relationships.

The JAMBA agreement also includes provisions for cooperation on the conservation of threatened birds.

Australian government and non-government representatives meet every two years with Japanese and Chinese counterparts to review progress in implementing the agreements and to explore new initiatives to conserve migratory birds (DEWHA 2010a).

- Republic of Korea – Australia Migratory Bird Agreement (ROKAMBA)

In April 2002, Australia and the Republic of Korea agreed to develop a bilateral migratory bird agreement similar to the JAMBA and CAMBA.

The ROKAMBA formalises Australia's relationship with the Republic of Korea in respect to migratory bird conservation and provides a basis for collaboration on the protection of migratory shorebirds and their habitat (DEWHA 2010a).

Any actions that have the potential to impact upon these agreements are formally addressed under the EPBC Act.

4.3 NEW SOUTH WALES LEGISLATION

Environmental Planning and Assessment Act 1979

The NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) is the principal planning legislation for NSW. It provides a framework for land use control and assessment, determination and management of development. Part 3A of the EP&A Act facilitates major project and infrastructure delivery of development which is of significance to the State and encourages economic development, while strengthening environmental safeguards and community participation.

For the initial application under Part 3A, a Preliminary Environmental Assessment (PEA) was prepared and submitted to the NSW Department of Planning (DoP) in May 2010. The PEA included preliminary assessments of surface and groundwater; flora and fauna; soil and land capability; noise and vibration; indigenous and non-indigenous heritage; air quality and visual impacts.

Following a review of the PEA, and after consultation with other relevant government agencies, the Department of Planning issued Director-General's Requirements (DGRs) for the LOM Project, The DGRs require the following key thresholds to be assessed:

- whether or not the proposal, including actions to avoid or mitigate impacts or compensate to prevent unavoidable impacts will maintain and improve biodiversity values;

- whether or not the proposal is likely to reduce the long-term viability of a local population of the species, population or ecological community;
- whether or not the proposal is likely to accelerate the extinction of the species, population or ecological community or place it at risk of extinction; and
- whether or not the proposal will adversely affect critical habitat; and
- whether or not the proposal will impact upon Ground Water Dependant Ecosystems (GDE's).

Threatened Species Conservation Act 1995

The *Threatened Species Conservation Act 1995* (TSC Act) aims to protect and encourage the recovery of threatened species, populations and communities listed under the Act. The Act is integrated with the NSW EP&A Act and requires consideration of whether a major infrastructure or other project (Part 3A of the EP&A Act), a development (Part 4 of the EP&A Act) or an activity (Part 5 of the *EP&A Act*) is likely to significantly affect threatened species, populations and ecological communities or their habitat.

Fisheries Management Act 1994

The *Fisheries Management Act 1994* (FM Act) aims to conserve, develop and share the fishery resources of NSW for the benefit of present and future generations. The FM Act defines 'fish' as any marine, estuarine or freshwater fish or other aquatic animal life at any stage of their life history, exclude whales, mammals, reptiles, birds, amphibians or species specifically excluded. No threatened fish species, or endangered populations are known to occur within the study area.

In accordance with section 75U of the EP&A Act, applications for separate permits under section 201, 205 or 219 of the FM Act are not required as these matters are addressed and approved as part of the EP&A Part 3A process.

NSW Catchment Management Authorities Act 2003

Through a network of Catchment Management Authorities, this Act aims to devolve operational, investment and decision making natural resources functions to catchment levels, to provide for proper natural resource planning at a catchment level, to apply sound scientific knowledge and to involve communities in decision making regarding catchment management.

Under the Act, Catchment Management Authorities have been established and are required to prepare a Catchment Action Plan (CAP). The CAP aims to guide the CMA's investment in sustainable natural resource management and focuses on actions that the CMA can achieve within the scope of its role and capacity. The CAP contains targets for environmental improvement and is a plan for action that the CMA can directly undertake or directly influence. The CAP aims to ensure that future investment by the CMA is put towards key issues in the catchment and is based on the best available knowledge.

The Project Site is located within the Liverpool Plains bioregion (Thackway and Creswell 1995), in the Namoi River Catchment and is, therefore, within land managed under the Namoi Catchment Action Plan (NCAP) (NCMA 2007). The following target identified in the NCAP is relevant to the LOM Project:

- From 2006, there will be an improvement in the extent and condition of native plants and animals, and the environments in which they live, within each Interim Bio-Regional Assessment (IBRA) sub-region of the Namoi (NCMA 2007)

The LOM Project will assist in achieving this target through the implementation of a Biodiversity Offset Strategy across the Project Site and including surrounding properties that would create a corridor of native vegetation and habitat linking two sub-regional regional corridors.

Noxious Weeds Act 1993

The Noxious Weeds Act 1993 (NW Act) defines the roles of government, councils, private landholders and public authorities in the management of noxious weeds. The Act sets up categorisation and control actions for the various noxious weeds, according to their potential to cause harm to our local environment.

The objectives of the NW Act include:

- to identify noxious weeds in respect of which particular control measures need to be taken;
- to specify those control measures;
- to specify the duties of public and private landholders as to the control of those noxious weeds; and
- to provide a framework for the State-wide control of those noxious weeds by the Minister and local control authorities.

Under this Act, noxious weeds have been identified for Local Government Areas and assigned Control Categories (eg. 1, 2, 3, 4 and 5). Part 3 of the NW Act provides that occupiers of land (this includes owners of land) have responsibility for controlling noxious weeds on the land they occupy.

Native Vegetation Act 2003

The objects of this Act are:

- to provide for, encourage and promote the management of native vegetation on a regional basis in the social, economic and environmental interests of the State, and
- to prevent broad scale clearing unless it improves or maintains environmental outcomes, and
- to protect native vegetation of high conservation value having regard to its contribution to such matters as water quality, biodiversity, or the prevention of salinity or land degradation, and
- to improve the condition of existing native vegetation, particularly where it has high conservation value, and
- to encourage the revegetation of land, and the rehabilitation of land, with appropriate native vegetation, in accordance with the principles of ecologically sustainable development.

These outcomes are achieved through the application of the Environmental Outcomes Assessment Methodology, and the *Native Vegetation Regulation 2005*.

In accordance with Section 75U, EP&A Act, an authorisation under Section 12 of the *Native Vegetation Act 2003* to clear native vegetation or State protected land is not required for an approved project.

State Environmental Planning Policy 44 (Koala Habitat)

State Environmental Planning Policy 44 (Koala Habitat) (SEPP 44) aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas to ensure a permanent free-living population over their present range and reverse the current trend of koala population decline.

SEPP 44 applies to the Liverpool Plains Shire LGA (formerly, Quirindi Shire), however, SEPP 44 does not apply to Part 3A Projects. An assessment under SEPP 44 is therefore not required.

5 Methodologies

5.1 DATA AUDIT AND LITERATURE REVIEW

A significant amount of ecological survey and assessment has been undertaken at and surrounding the Werris Creek Coal mine site over the period of 2004 to 2010 (CES 2004, 2008, 2009; GCNRC 2004b, 2005; 2009; Ecotone, 2009; ELA, 2009b, 2010b,c). This has included:

- vegetation mapping;
- flora and fauna survey;
- analysis of ecological constraints, values and offset potential; and
- review of literature, data audit and consultation.

A significant amount of data has also been collected and collated for a number neighbouring properties owned by the Proponent (ELA, 2009c, d). This has included:

- vegetation mapping;
- flora survey; and
- assessment of land for the purpose of offsetting mine related disturbance.

A review of relevant data and background literature was undertaken as an initial stage of the LOM Project, prior to field surveys. Relevant datasets and information included:

- existing vegetation, soil and landscape mapping, as well as other available GIS data;
- Atlas of NSW Wildlife;
- EPBC Protected Matters Search Tool;
- previous flora and fauna survey reports including:
  - Countrywide Ecological Services (2004, 2008 and 2009);
  - Geoff Cunningham Natural Resource Consultants (2004, 2005 and 2009);
  - Ecotone (2009);
  - Eco Logical Australia (2009b,c;d; 2010b,c);
- Groundwater Dependant Ecosystem literature
  - DLWC (2004);
  - SKM (2010); and
  - NCMA (2007).

An assessment of the 'likelihood of occurrence' was made for threatened ecological communities, populations and species, and migratory species identified from a search of a 10 km radius from the centre of the Project Site (co-ordinates -S 31.40˚, E 150.6333˚). This assessment included database and other records (as outlined above), presence or absence of suitable habitat, features of the Project Site, results of the field survey and professional judgement.

A full summary of the results of this data audit along with a 'likelihood of occurrence' ranking using the following terminology can be found at **Appendix C**.

- "Known" = the species was or has been observed on the Project Site
- "Likely" = a medium to high probability that a species uses the Project Site

- "Potential" = suitable habitat for a species occurs on the Project Site, but there is insufficient information to categorise the species as likely to occur, or unlikely to occur
- "Unlikely" = a very low to low probability that a species uses the Project Site
- "No" = habitat on Project Site and in the vicinity is unsuitable for the species.

The results of this search identified four threatened ecological communities, nine threatened flora species, 23 threatened fauna and 11 migratory species. Of these it was determined that two threatened endangered ecological communities and eight threatened species were 'known' to occur on the Project Site, nine threatened species and three migratory species had the 'potential" to occur on the Project Site (**Table 3**).

5.2 FIELD ASSESSMENT OVERVIEW

The following sections outline the survey and assessment methodologies undertaken for this report, which were designed to meet the requirements of the NSW 'Draft Threatened Biodiversity and Assessment Guidelines' (DEC 2004) (as required by the 'Draft Guidelines for Threatened Species Assessment (DEC and DPI, July 2005) and the DGRs (DoP 2010). Reference was also made to the Commonwealth 'Survey Guidelines for Threatened Species' (DEWHA 2010a and b), for birds and microchiropteran bats (microbats) where applicable.

5.2.1 Preliminary Field Assessment

A preliminary site assessment was conducted by four Eco Logical Australia ecologists, Lucas McKinnon, Dr. Enhua Lee, Phil Gilmour and Gerry Swan, and Werris Creek Coal Mine's Environmental Officer, Andrew Wright, on the 19th April 2010. The purpose of the preliminary assessment was to identify access constraints and on ground location of the proposed LOM Project footprint. Observations on habitat were also undertaken to inform the placement of harp traps and Anabat recording devices for targeted microbat survey, hairtube placement for fauna survey and potential avifauna survey sites.

Detailed flora lists were not made during preliminary assessment, however, dominant species, structure, and composition of vegetation communities were noted to validate vegetation communities within the study area.

5.2.2 Field Survey Overview

Field survey was designed to target threatened flora and fauna regarded as having the potential to occur in the study area. Targeted threatened flora and fauna survey followed the NSW Department of Environment and Conservation (now the NSW Department of Environment, Climate Change and Water) guidelines for surveying threatened species (DEC 2004). Information on the methods and effort employed for surveying vegetation communities, flora, fauna and groundwater dependant ecosystems are outlined in detail in **Sections 5.3**, **5.4, 5.5** and **5.6**, but generally, the following methods were implemented:

- Flora: quadrat surveys, transects, traverses, and opportunistic observations;
- Diurnal birds: morning and evening censuses, habitat assessments, and opportunistic observations;
- Nocturnal birds: night time call playback, habitat assessments, and spotlighting;
- Microbat species: harp trapping, Anabat detection, and habitat assessments;
- Mammals (not including bats): spotlighting, hairtubes, call playback and habitat assessments; and
- Reptiles: rock rolling, tree bark removal, displacement of fallen timber and opportunistic observations.

Table 3: Threatened and Migratory Species, Known to Occur or With the Potential to Occur on the Project Site

SCIENTIFIC NAME	COMMON NAME	CONSERVATION STATUS		LIKELIHOOD OF OCCURRENCE
		TSC ACT	EPBC ACT	
ECOLOGICAL COMMUNITIES				
White Box – Yellow Box – Blakely's Red Gum Woodland (and derived native grassland)		E	CE	Known
Brigalow (*Acacia harpophylla* dominant and co-dominant) woodlands		E	E	Known
AVES				
Anthochaera phrygia	Regent Honeyeater	E	E and M	Potential
Ardea alba	Great Egret, White Egret	-	M	Potential
Ardea ibis	Cattle Egret	-	M	Potential
Climacteris picumnus victoriae	Brown Treecreeper (Eastern sub-species)	V	-	Known
Glossopsitta pusilla	Little Lorikeet	V	-	Known
Hieraaetus morphnoides	Little Eagle	V	-	Known
Lathamus discolor	Swift Parrot	E	E and M	Potential
Melanodryas cucullata ssp. *cucullata*	Hooded Robin	V	-	Known
Pyrrholaemus sagittatus	Speckled Warbler	V	-	Potential
Neophema pulchella	Turquoise Parrot	V	-	Potential
Stagonopleura guttata	Diamond Firetail	V	-	Potential
MAMMALIA				
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	Potential
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	-	Known
Miniopterus schreibersii oceanensis	Eastern Bent-wing Bat	V	-	Known
Nyctophilus timoriensis	Eastern Long-eared Bat	V	V	Potential
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	Potential
Saccolaimus flaviventris	Yellow-bellied Sheath-tail Bat	V	-	Known
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-	Known
REPTILIA				
Aprasia parapulchella	Pink-tailed Worm Lizard	V	V	Potential
Underwoodisaurus sphyrurus	Border Thick-tailed Gecko	V	V	Potential

Field surveys were conducted within the study area, although observations on habitat were also made for areas directly adjacent to the study area in order to determine the fauna and flora potentially occurring near the study area. Field survey was carried out for a total of 5 days/4 nights (19th to 23rd April 2010).

A summary of field survey effort, including previous survey within the Project Site is shown in **Figure 6**.

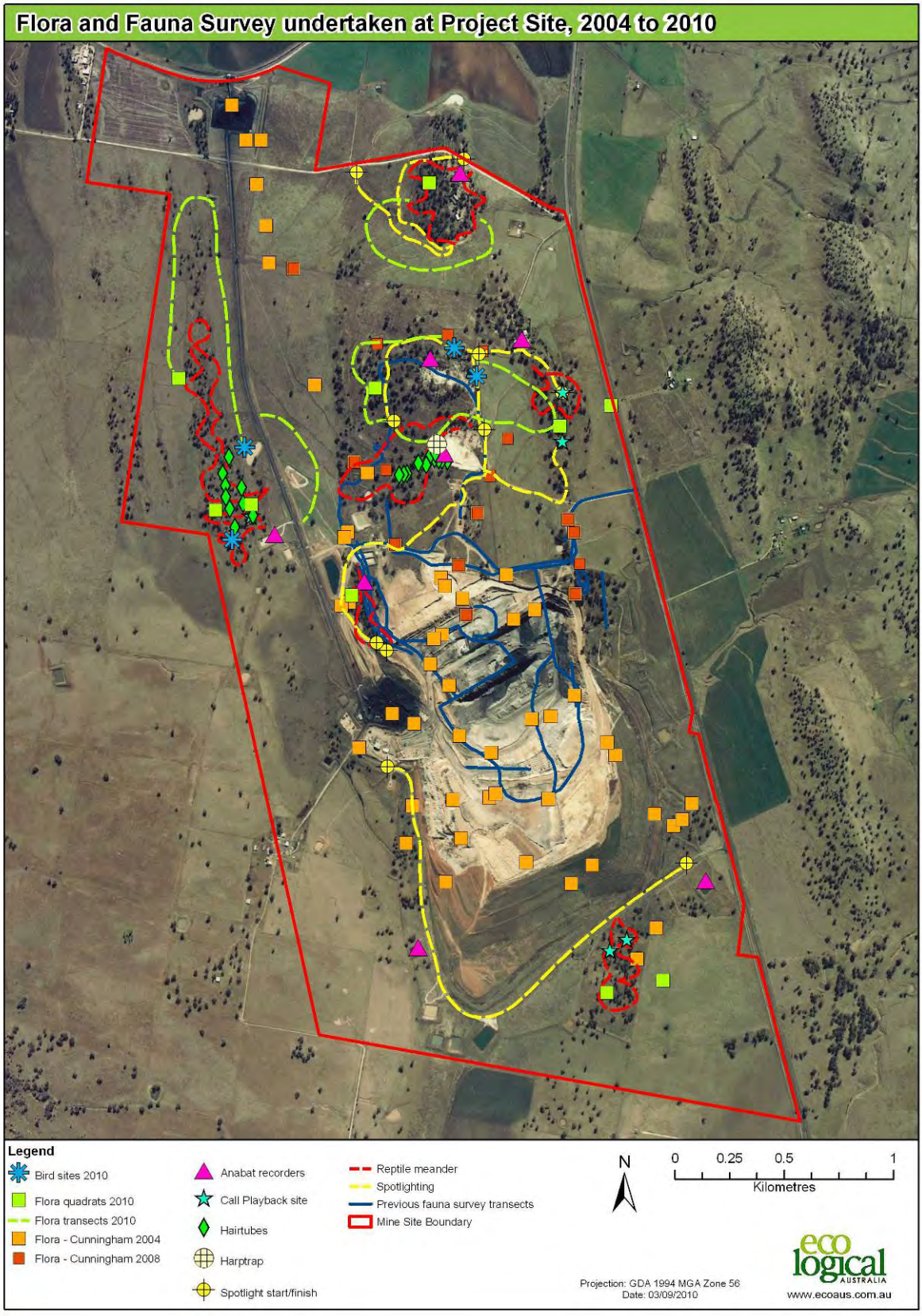


Figure 6: Flora and Fauna Survey Effort at the Project Site, between 2004 and 2010

5.2.3 Weather

Weather conditions during the survey were considered to be good. Bureau of Meteorology data from the nearest weather station at Tamworth (~40km north east) showed daytime temperatures ranged from 10.1°C to 28.6°C. No rainfall was recorded during the survey week and cloud cover was minimal for both day and night time surveys **Table 4**.

Table 4: Weather Conditions During Field Survey Recorded at Tamworth, NSW (~40km northeast of Project Site)

Date	Temps		Rain	9:00 AM			Wind		3:00 PM			Wind	
	Min	Max		Temp	RH	Cld	Dir	Spd	Temp	RH	Cld	Dir	Spd
	°C	°C	mm	°C	%	8th		km/h	°C	%	8th	km/h	
19-Apr	12.8	28.5	0	21.7	54	-	ESE	9	26.9	34	-	E	19
20-Apr	11.7	28.0	0	20.1	54	-	SE	19	27.4	28	-	E	15
21-Apr	12.7	28.4	0	21.0	54	-	ESE	9	27.6	24	-	SSE	9
22-Apr	11.2	28.6	0	20.3	59	-	SE	7	28.1	27	-	W	7
23-Apr	10.1	28.0	0	21.1	59	-	S	4	27.4	32	-	NNW	4

Source: http://www.bom.gov.au/climate/dwo/201004/html/IDCJDW2127.201004.shtml

5.3 VEGETATION COMMUNITIES

The vegetation classification system employed in this report follows the Biometric Vegetation Type Database (DECCW 2009). Listed threatened ecological communities (TECs) may consist of a single biometric vegetation type or be made up of various biometric vegetation types.

Woodland vegetation types are found in various condition states, often cleared of their overstorey species creating what are known as Derived Native Grasslands (DNG). In order to delineate between various condition states of woodland vegetation types, a condition class system following the Box-Gum Threatened Ecological Community Listing Advice (TSSC 2006) was employed (**Table 5**).

Table 5: Condition Class Definitions for Woodland Vegetation, based on TSSC (2006)

STRUCTURE	DEFINITION	CONDITION CLASS
Woodland	Both a native understorey (> 50% native species ground cover) and an overstorey of eucalypts exist in conjunction.	4
Derived Native Grassland	A native understorey (> 50% native species ground cover) exists, but the trees have been cleared	3
Woodland/Pasture	An overstorey of eucalypt trees exists (varying densities), but there is no substantial native understorey (< 50% native species ground cover).	2
Cleared land	Cleared land used for cropping or rural infrastructure (trees cleared, ground cover < 50% native species ground cover)	1

5.4 FLORA

Flora was surveyed by two people across the Project Site using quadrat and transect survey techniques. These surveys were supplemented by four random meander traverses throughout the survey period.

Quadrats included 0.04ha (20m x 20m) surveys to record presence of all vascular flora species, along with cover and abundance for each species using a modified Braun-Blanquet scale (measures of cover and abundance were taken to determine species dominating each stratum). Habitat features were determined over 0.1 ha survey (50m x 20m quadrats); measures included number of hollow bearing trees and length of fallen dead timber greater than 10 cm diameter. Within the 0.1 ha quadrats, projected foliage cover of each strata level and exotic flora was assessed along a 50m transect.

Vegetation quadrats followed the DECCW Interim Vegetation Standard (Siverstsen 2009) and transect habitat assessments followed the NSW Biobanking Methodology (DECC 2008).

Quadrats and transects were conducted in the following previously mapped vegetation units (GCNRC 2004b and 2009) (**Figure 7**):

- Community 1 - Cleared - Cultivated / Pasture Lands;
- Community 3 - *Acacia harpophylla* (Brigalow) Community;
- Community 4 - *Eucalyptus albens* (White Box) - *Eucalyptus melliodora* (Yellow Box) - *Eucalyptus blakelyi* (Blakely's Red Gum)] Community; and
- Community 6 - *Eucalyptus dealbata* (Tumbledown Gum) Community

Random meander traverses focussed on ‘pastureland’ communities to determine their correlation with Commonwealth EPBC Act condition thresholds and to identify any derived native grasslands that may conform with the NSW TSC Act endangered ecological community listings. These communities included:

- Community 1 - Cleared - Cultivated / Pasture Lands; and
- Community 2 - Cleared Land – Uncultivated.

The physical characteristics (such as aspect, slope and disturbance) of each location were noted and photos were taken of the quadrats along the 50 m transect line as well at points along the random meander traverses. Species were identified to the lowest taxonomic level possible.

The locations of all flora survey undertaken are shown in **Figure 6**.

Compliance with vegetation survey requirements in accordance with DEC (2004) are summarised in **Table 6**.

5.5 FAUNA

The locations of all fauna survey undertaken at the Project Site are shown in **Figure 6**. Compliance with fauna survey requirements in accordance with DEC (2004) are summarised in **Table 7**.

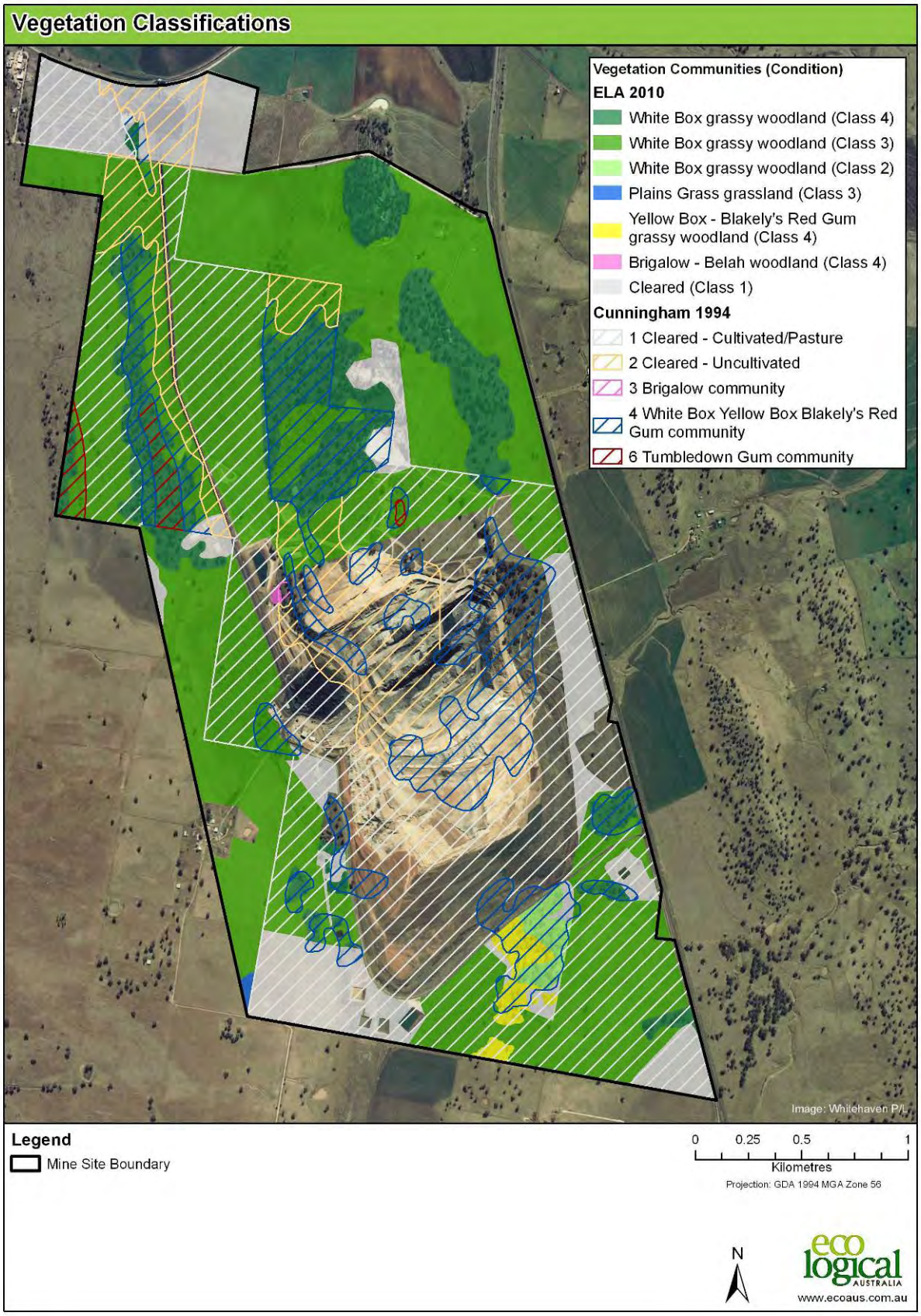


Figure 7: Overlay of Vegetation Mapping Undertaken at the Project Site by GCNRC (2004) and ELA (2010)

Table 6: Summary of Flora Survey Effort and Compliance with Draft Threatened Biodiversity Survey and Assessment (TSBA) Guidelines (DEC 2004) at Project Site

TARGET SPECIES OR TYPE	DEC (2004) TSBA GUIDELINES (APPROPRIATE SURVEY OPTIONS)	SURVEY EFFORT		SAMPLING COMPLIES WITH DEC GUIDELINES
		PREVIOUS SURVEY (GCNRC 2004; 2009)	CURRENT SURVEY (ELA 2010a)	
All flora	Transect: - 5x100m traverses per 251-500 ha stratification unit -10x100m traverses per 501-1000 ha stratification unit	Unspecified	4 random meander traverses between 500m and 2000m	Yes
All flora	Quadrat: - 5x0.04ha quadrats per 251-500 ha stratification unit - 10x0.04ha quadrats per 501-1000 ha stratification unit	62x0.04ha quadrats (2004); 18x0.04ha quadrats (2009)	10x0.04ha quadrats	Yes
Targeted threatened species searches	Random meander: - 30mins per quadrat	Unspecified	At least 30mins per quadrat	Yes

5.5.1 Avifauna

Diurnal Birds

A total of eight morning and six evening censuses were conducted for diurnal birds at four locations across the Project Site (**Figure 6**). Site 1 was located on a rocky ridgetop to the west of the haul road, overlooking grassland paddocks and a farm dam. Site 2 was located adjacent to a farm dam within a patch of native grassland with scattered mature White Box trees adjacent. Site 3 was located at a dam surrounded by regrowth and mature White Box trees toward the centre of the Project Site, at the rear of the Council quarry. Site 4 was situated in the vicinity of the Old Colliery property, which provided a diversity of native and exotic shrubs, mature Eucalypt and other trees species, house and shed structures, and overlooked extensive grassland and woodland.

Morning censuses were conducted on 20th to 23rd April between the hours, 0800hrs and 0930hrs, with evening census undertaken from the 20th to 22nd April, between the hours 1620hrs and 1730hrs. Morning and evening censuses were conducted by two observers for 20 minutes, focussing on an area of approximately 1ha surrounding the site location. During censuses, observers moved through vegetation communities supporting potential habitat for diurnal birds, and thus allowed for any cryptic species, such as Quails and Bush Stone Curlew, to be flushed. All species identified by either sight or call recognition during censuses were recorded. A total effort committed through census surveys was 280 person minutes.

In addition to morning and evening censuses, diurnal birds were surveyed continuously during daytime hours over the 5 day survey (19th to 23rd April 2010) while traversing suitable habitat within the study area.

Table 7: Summary of Field Survey Effort and Compliance with NSW Threatened Biodiversity Survey and Assessment Guidelines (DEC 2004)

GROUP	TARGET SPECIES OR TYPE	DECC (2004) THREATENED BIODIVERSITY SURVEY AND ASSESSMENT GUIDELINES (APPROPRIATE SURVEY OPTIONS)	SURVEY EFFORT		SAMPLING SATISFIES DEC (2004) GUIDELINES
			PREVIOUS SURVEY EFFORT AT PROJECT SITE (CES 2004)	SURVEY EFFORT (ELA 2010D)	
Avifauna - Diurnal	All species	Species time curve, survey may conclude when no additional birds are identified within a set time limit	4 transects, dawn and dusk over 4 days	14 x 20min censuses in 4 locations, over 4 days	Yes
		Water source 20 minute census at dawn or dusk for each watercourse	N/A	3 of 4 census locations in close proximity to standing water sources	
		Opportunistic sightings - time unspecified	Opportunistic sightings	Opportunistic sightings	
Avifauna - Nocturnal	Barking Owl - min. 5 visits/site	Call playback - Sites should be separated by 800 metres – 1km, and each site must have the playback session repeated as follows:	4 visits/site, 2 sites	4 visits/site; 3 sites	Yes
	Powerful Owl - min. 5 visits/site		4 visits/site, 2 sites	3 visits/site; 3 sites	Yes
	Sooty Owl - min. 6 visits/site		4 visits/site, 2 sites	2 visits/site ; 2 sites	Yes
	Masked Owl - min. 8 visits/site		4 visits/site, 2 sites	4 visits/site ; 3 sites	Yes
	Bush Stone-curlew	Day habitat search - search habitat for pellets and likely hollows.	Opportunistic sightings	Opportunistic sightings	N/A
	All nocturnal birds	Spotlighting - 10 minutes before and after call playback	360 person minutes, distance unspecified	176 person minutes, over approximately 8kms	Yes
Mammals (excluding microbats)	Arboreal and small mammals, gliders, possums	Arboreal hair tubes - 3 tubes in 10 habitat trees up to 100 ha of stratification unit, for at least 4 days and 4 nights Hair tubes - 10 large and 10 small tubes in pairs (min. 4 days and 4 nights per stratification unit)	1x stratification unit, 20 hair-tubes, duration of 14 days/nights	Two stratification units of 20 large hairtubes placed in habitat trees and 10 small hairtubes placed underneath these trees over 4 days and 4 nights.	Yes
	All mammals	Spotlighting - 1 hour walking at approximately 1km per hour on 2 separate nights per stratification unit up to 50 hectares, plus an additional effort for every additional 100 hectares.	360 person minutes, distance unspecified	176 person minutes, over approximately 8kms	Yes
	All mammals	Search for scats and signs – 30 minutes searching each relevant habitat, including trees for scratch marks per stratification unit up to 50 hectares, plus an additional effort for every additional 100 hectares.	Opportunistic	Approximately 1,020 person minutes	Yes
	Gliders, possums, koalas	Call playback - 2 sites per stratification unit up to 200 ha	2 sites, over 4 days	3 sites; 4 visits/site	Yes
	Small mammals	100 trap nights over 3-4 consecutive nights	100x Elliott traps (Type A); 4 successive nights (100x4 = 400 trap nights).	N/A	Yes
Mammals (microbats)	All species	Harp traps - Four trap nights over two consecutive nights per 100 hectares of stratification unit in October to March	2 trap-nights; 2 sites (2x2 = 4 trap nights)	2 trap nights, 1 site	Yes
		Anabats - Two Anabats utilised for the entire night (a minimum of four hours), starting at dusk for two nights per 100 hectares of stratification unit in October to March.	3hours, during spotlighting (vehicle mounted); no. of nights unspecified	4 sites, 2 nights/site (total 8 nights), 12hrs+/night.	Yes
Reptiles	All species	Habitat Search – 30-minute search on two separate days targeting specific habitat per stratification unit up to 200 hectares west of the ranges.	Hand searching of logs, bark and leaf litter over 4 days	Rock-rolling, tree bark removal, displacement of fallen timber and opportunistic sightings, for a total of 1,020 person minutes over 4 days	Yes
		Pitfall traps with drift nets – 24 trap nights over 4 consecutive nights per stratification unit up to 200 hectares west of the ranges.	4 pitfall trap lines of 2x 10L buckets and 2x tube traps along a 30cm high and 12m long drift fence	N/A	Yes
		Spotlighting/ nocturnal search – 30 minute search on 2 separate nights in specific habitat per stratification unit up to 200 hectares west of the ranges	120 person minutes (2 hour search, at dusk, one night)	176 person minutes, over approximately 8kms	Yes
Amphibians	Green and Golden Bell Frog, New England Bell Frog, Booroolong Frog	Combination of tadpole surveys, call surveys and day/night active searching.	4 pitfall trap lines of 2x 10L buckets and 2x tube traps along a 30cm high and 12m long drift fence	Opportunistic sightings	Yes

[a] **Further survey was undertaken at the site by CES (2008 and 2009) and Ecotone (2008), though sufficient detail of the methodologies were not provided in the associated reports to include in this table. Results of these surveys are included in Appendix D.**

Nocturnal Birds

Nocturnal bird call playback and spotlighting were undertaken for the Masked Owl and Barking Owl over 4 nights (19th to 22nd April), across three stratification units (i.e. sites >1km apart). Call playback and spotlighting was undertaken for Powerful Owl over three nights (19th to 21st) across three stratification units and Sooty Owl for two nights (19th to 20th April) across three stratification units.

Call playback was undertaken at three sites by two people over four survey evenings (**Figure** 6). One site was surveyed for the whole 4 nights (site west of haul road), with the other two sites surveyed for three consecutive nights. Calls were played using a loud hailer and digital recordings from (BOCA 2002), for 5 minutes, followed by 10 minutes of listening. The total effort spent on call playback was approximately 400 person minutes.

No stag watching was conducted as no owl wash was observed at the base of any large trees supporting tree hollows.

Spotlighting was conducted by two people from a vehicle travelling at approximately 5km/h along existing vehicle access tracks, vegetation remnants maintaining hollow bearing trees and in transit to call playback sites (**Figure 6**). Spotlighting was undertaken between the hours of 1800 and 2200 hours using a high powered (12V; 100W) hand held spotlight and vehicle high beam head lights. The total effort spent on spotlighting was approximately 176 minutes.

5.5.2 Mammals

Ground dwelling and arboreal mammals

Ground dwelling and arboreal mammals were surveyed using hair tubes, spotlighting, habitat assessments and opportunistic sightings throughout the 5 day / 4 night survey period.

Hair tubes were placed in two discrete transects in woodland locations. Along each transect hair-tubes were placed in large trees, 20 large hair-tubes were attached to trees limbs or trunks and 10 small hair-tubes were placed underneath these trees. Hair-tubes were baited with an oats/peanut butter/honey mixture, and double sided tape was attached to the opening of each tube.

Spotlighting and call playback were also undertaken, the survey design is outlined in **Section 5.5.1**. Digital fauna recordings were taken from Naturesound (Stewart, 2007).

Faunal habitat assessments were initially undertaken remotely using aerial photography, with waterbodies, woodland remnants, grasslands, rocky outcrops and manmade structures delineated in order to target survey accordingly. Additional habitat assessments were undertaken continuously during daytime hours over the 5 day survey (19th – 23rd April 2010), whilst traversing suitable habitat within the study area. Resources recorded include: shelter, basking, roosting, nesting and foraging sites for amphibians, birds, bats, arboreal mammals, ground-dwelling mammals and reptiles.

Any indirect evidence of fauna present were recorded including, feathers, fur, tracks, dens, nests, scratches, chew marks and owl wash.

Microchiropteran bat species

Survey for Microchiropteran (microbats) bat species involved the use of harp traps over two consecutive nights at one location and ultrasonic Anabat detectors over four nights in eight locations (**Figure 6**).

The open structure of the vegetation across the study area provided insufficient flyways for quality harptrapping, though two double harp traps were placed in close proximity to a moderately well vegetated dam for two consecutive nights (19th and 20th April) for potential opportunistic trapping. Trapping was abandoned on the third night as the vegetation structure was deemed to be ineffective in narrowing the bat flyway to effectively ensnare bats.

Microbats were also surveyed using Anabat detectors equipped with ZCAIM recording devices. Anabat detectors were placed in four locations for two consecutive nights and moved to four discrete locations for the remaining two nights. On each night of survey the Anabats were turned on between 1630 hours and 1800 hours and then turned off the following morning between 0730 hours and 0900 hours. Anabat calls were downloaded in the office and analysed by Alicia Lyon (Ecologist, Eco Logical Australia, Coffs Harbour).

Bat calls were analysed using the program AnalookW (Version 3.3q 03 October 2006, written by Chris Corben, www.hoarybat.com). Call identifications were made using regional based guides to the echolocation calls of microbats in New South Wales (Pennay *et al*. 2004); and south-east Queensland and north-east New South Wales (Reinhold et al. 2001) and the accompanying reference library of over 200 calls from north-eastern NSW (http://www.forest.nsw.gov.au/research/bats/default.asp).

Bat calls are analysed using species-specific parameters of the call profile such as call shape, characteristic frequency, initial slope and time between calls (Reinhold *et al*. 2001). To ensure reliable and accurate results the following protocols (adapted from Lloyd *et. al*. 2006) were followed:

- Recordings containing less than three pulses were not analysed (Law et al. 1999).
- Only search phase calls were analysed (McKenzie et al. 2002).
- Four categories of confidence in species identification were used (Mills et al. 1996):
  - definite – identity not in doubt;
  - probable – low probability of confusion with species of similar calls;
  - possible – medium to high probability of confusion with species with similar calls; and
  - unidentifiable – calls made by bats which cannot be identified to even a species group.
- Nyctophilus spp. are difficult to identify confidently from their calls and no attempt was made to identify this genus to species level (Pennay et al. 2004).

5.5.3 Reptiles

Reptiles were surveyed between 1000 hours and 1730 hours for the period 20th to 22nd April. Techniques included rock-rolling, tree bark removal, displacement of fallen timber and opportunistic sightings. Total reptiles search effort was approximately 1,020 person minutes.

5.5.4 Amphibians

Opportunistic observations of amphibians were throughout the 4 day survey period, 19th to 23rd April, 2010. These observations were complemented by call playback surveys and pitfall trapping undertaken in 2004 (CES 2004).

5.6 GROUNDWATER DEPENDANT ECOSYSTEM

Two GDE's were identified during the literature and database review as potentially occurring in the local area, these were (DLWC 2004):

- Terrestrial vegetation: that is supported by groundwater either permanently or seasonally; and
- Base flows in streams: ecosystems that are maintained by groundwater base flows in rivers and streams.

Prior to field survey, satellite imagery and vegetation maps of the Werris Creek and Quipolly Creek lines were assessed for terrestrial vegetation and base flows in streams that may be groundwater dependant. Health and condition of these GDEs were visually assessed during field survey along Quipolly Creek, 22nd April, 2010, by Phil Gilmour and Lucas McKinnon, and Werris Creek, 22nd July 2010, by Lucas McKinnon, Dan McKenzie and Andrew Wright (WCC).

This visual assessment was complemented by a review of the relevant groundwater drawdown predictions (RCA 2010).

5.7 SURVEY LIMITATIONS

5.7.1 Flora

Flora survey is always limited by seasonality, with best practise for survey generally being within the spring and summer months (except for when surveying for specific flora species that may be flowering at other times of year; DEC 2004). Survey work for this report occurred during mid-Autumn (April) and is thus outside of the optimal survey period. This limitation is considered to be minimal due to recent good rains prior to the survey period allowing for the persistence of flowering heads on much of the groundcover species, and by the cross seasonality of this survey when combined with previous surveys of the Project Site (GCNRC 2004 and 2009), providing flora survey in Autumn (April 2004) and Spring (November 2008).

5.7.2 Fauna

While it was intended to survey over the four night period for microbats using harp traps, as well as Anabats, the open structure of the vegetation across the site provided insufficient flyways to effectively isolate bats into the traps.

Best practise for fauna survey is generally within the spring and summer months (except for when surveying for specific fauna species that may be active at other times of year; DEC 2004). Survey work for this report occurred during mid-Autumn (April) and is thus outside of the optimal survey period. This limitation is not considered to be a significant factor in the integrity of this BIA due to the numerous previous survey works that have been undertaken at the Project Site between 2004 and 2010 (**Section 5**). The previous survey work includes all four seasons. It is also noted that high microbat activity was recorded during the current survey including species not previously recorded from within the Project Site (**Section 6**).

6 Survey Results

6.1 DATA AUDIT AND LITERATURE REVIEW

The data audit and literature review identified that vegetation across the study area has been classified by various authors (GCNRC 2004b; ELA 2009c.d; ELA 2010b), and as such has taken a number of directions and classification systems. A summary of the vegetation communities mapped across the Project Site by the various sources is provided in **Table 8**.

Table 8: Relationships Between Various Vegetation Mapping Projects in the Study Area

BIOMETRIC VEG TYPE	TEC REFERENCE	GCNRC COMMUNITY REFERENCE	NAMOI CMA RVC NAME
Cleared land	N/A	Community 1 Cleared - Cultivated / Pasture Lands	N/A
Bluegrass - Spear Grass - Redleg Grass derived grasslands of the Nandewar Bioregion	White Box- Yellow Box- Blakely's Red Gum Grassy Woodland – Derived Native Grasslands	Community 2 Cleared Land - Uncultivated	Derived grasslands, Brigalow Belt South and Nandewar
Plains Grass Grasslands on basaltic black earth soils , mainly on the Liverpool Plains in the Brigalow Belt South Bioregion	Native vegetation on Cracking Clay Soils of the Liverpool Plains	Community 2 Cleared Land - Uncultivated	Plains Grass – Bluegrass grasslands, Brigalow Belt South and Nandewar
Brigalow - Belah woodland on alluvial often gilgaied clay soil mainly in the Brigalow Belt South Bioregion (Benson 35)	Brigalow within the Brigalow Belt South, Nandewar and Darling Rivers Plains Bioregions.	Community 3 *Acacia harpophylla* (Brigalow)	Brigalow - Belah woodland on alluvial clay soil, mainly Brigalow Belt South
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	White Box- Yellow Box- Blakely's Red Gum Grassy Woodland	Community 4 *Eucalyptus albens* (White Box) *Eucalyptus melliodora* (Yellow Box) *Eucalyptus blakelyi* (Blakely's Red Gum)	White Box grassy woodland, Brigalow Belt South and Nandewar
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	White Box- Yellow Box- Blakely's Red Gum Grassy Woodland	Community 5 *Eucalyptus albens* (White Box) - *Angophora floribunda* (Rough-barked Apple)	White Box grassy woodland, Brigalow Belt South and Nandewar
White Cypress Pine -Silver-leaved Ironbark - Tumbledown Gum - shrubby open forest of the Nandewar and Brigalow Belt South Bioregions	N/A	Community 6 *Eucalyptus dealbata* (Tumbledown Gum)	White Box - Pine - Silver-leaved Ironbark Shrubby Open Forest, Brigalow Belt South and Nandewar

A number of threatened flora and fauna species have previously been recorded within the locality (i.e. 10 km radius). **Table 3** (**Section 5**) lists those species previously recorded within the locality (DECCW 2010a) or that are considered to have the potential to occur (DEWHA 2010b). The likelihood of these species occurring on site has been addressed in more detail in **Appendix C**.

6.2 VEGETATION COMMUNITIES

Three biometric vegetation types were recognised at the site (DECCW 2010b), though for the purposes of impact assessment they have been further delineated using Condition Classes, consistent with the EPBC Act Impact and Conservation Advice (TSSC 2006) (as discussed in **Section 2.4**). Vegetation mapping was confined to those areas north of the currently approved disturbance boundaries and within the Project Site boundary. These communities are described further below.

6.2.1 White Box Grassy woodland of the Nandewar and Brigalow Belt South Bioregions

The majority of tree covered vegetation at the Project Site is grassy woodland dominated by White Box (*Eucalyptus albens*) (**Figure 8**). The more exposed and erodible soils of the Narrawolga soil landscape maintains co-dominance of Tumbledown Gum (*Eucalyptus dealbata*), though these areas are not considered to be sufficiently distinct to warrant classification as a separate vegetation type.

A total of 187 flora species have been recorded in the Grassy Woodlands across the Project Site between 2004 and 2010, including 115 native and 72 exotic species.

Figure 8: Typical White Box Grassy Woodlands at the Project Site

The most abundant grass species of the understorey are *Aristida ramosa* (Purple Wiregrass), *Aristida leptopoda* (White Speargrass), *Chloris ventricosa* (Tall Chloris), *Austrostipa aristiglumis* (Plains Grass), *A. scabra* (Speargrass), A. *verticillat*a (Slender Bamboo Grass), *Bothriochloa macra* (Red-leg Grass) and *Dichanthium sericeum* (Queensland Bluegrass). Of the other understorey species present, six are considered "important species") (e.g. grazing-sensitive, regionally significant or uncommon species; TSSC 2006), these are: *Asperula conferta* (Common Woodruff), *Bulbine bulbosa* (Native Leek), *Calotis lappulacea* (Yellow Daisy-burr), *Glycine tabacina* (Glycine Pea), *Glycine tomentella* (Woolly Glycine) and *Sida corrugata* (Corrugated Sida).

This vegetation is considered to be part of the 'White Box-Yellow Box-Blakely's Red Gum (Box-Gum) woodland' threatened ecological community, listed under State and Commonwealth legislation. Hereafter referred to as Box-Gum Woodland.

6.2.2 Bluegrass – Spear Grass – Redleg Grass derived grasslands of the Nandewar Bioregion

The most common and widespread vegetation community at the Project Site is derived grassland dominated by native perennial grasses (**Figure 9**). The dominant grass species are Red-leg Grass, Queensland Bluegrass, White Speargrass, Plains Grass, *Chloris truncata* (Windmill Grass) and *Austrodanthonia bipartita* (Wallaby Grass).

Figure 9: Typical 'Bluegrass – Speargrass – Redleg Grass Derived Native Grassland', at the Project Site. This vegetation type is 'derived' from White Box Grassy Woodlands

A number of native herbs also occur in the grassland such as Boerhavia dominii, *Chamaesyce drummondii* (Caustic Weed), *Convolvulus erubescens* (Australian Bindweed), *Vittadinia cuneata*, *Wahlenbergia communis* (Tufted Bluebell) including the important species (TSSC 2006) Common Woodruff and *Cullen tenax* (Emu-foot). Occasional trees are also scattered throughout the grasslands but they are in too low in density to warrant mapping the areas as woodlands.

These derived grassland patches are described as a distinct community here, but would have previously been grassy woodland with a White Box dominant overstorey. For the purposes of the impact assessment, it is necessary to associate these grasslands with the legal definition of Box-Gum woodlands and Derived Native Grasslands (DNG). For this purpose they are further delineated into two Condition Classes:

- Condition Class 3a (high diversity): no native canopy cover, >11 native perennial understorey species (not including grasses) and at least 1 important species. This condition class equates to the EPBC Act and TSC Act definition of Box-Gum Woodland DNG.

- Condition Class 3b (low diversity): no native canopy cover, native grassy understorey with low diversity of herbs or other perennial understorey species. This condition class equates *only* to the TSC Act definition of Box-Gum Woodland DNG.

Hereafter these vegetation units are referred to White Box Grassy woodland Class 3a or Class 3b (or collectively as Class 3).

6.2.3 Brigalow – Belah woodland on alluvial often gilgaied clay soils mainly in the Brigalow Belt South Bioregion

This community is described as an open forest or woodland up to 25 m high with an upper stratum dominated by Brigalow (*Acacia harpophylla*), often with Belah (*Casuarina cristata*) on less gilgaied clays. It supports a sparse shrub and groundlayer, often with a lot of leaf litter (ELA 2010d).

This community occurs as a single remnant to the west of the current approved open cut area, maintaining a remnant of approximately 50 mature Brigalow trees (**Figure 10**). The community supports only Brigalow in the upper stratum, and only one small shrub was recorded in the understorey, *Maireana microphylla* (Bluebush). Previous vegetation survey (GCNRC 2004) also recorded the presence of the shrub *Maytenus cunninghamii* (Yellow-berry Bush). The majority of Brigalow trees present were mature, though regrowth was noted.

Figure 10: Remnant of Brigalow - Belah Woodland at Project Site

The groundcover is relatively sparse, with the species present more common to the adjacent Box-Gum Woodlands than to the Brigalow – Belah woodland. Only one species recorded was considered to be common to this vegetation type in Benson et al. (2006) and none were considered common in ELA (2010d). With the exception of Brigalow, all species found within the remnant were also recorded in the adjacent Box-Gum woodlands and grasslands.

Grasses consisted of Wallaby Grasses (*Austrodanthonia bipartita* and *A. racemosa*), Speargrass, Slender Bamboo Grass and *Cynodon dactylon* (Couch). Other natives present included*, Amaranthus* sp. (Amaranth), *Carex inversa*, *Chenopodium pumilio* (Small Crumbweed), *Cyperus gracilis* (Slender Flat-sedge), *Einadia trigonos* (Fishweed), *Oxalis perennans*, *Sida corrugata* (Corrugated Sida) and *Urtica incisa* (Stinging Nettle). A variety of exotic species were also found intact in the understorey including, *Bidens subalternans* (Greater Beggar's Ticks)*, *Cucumis myriocarpus* (Paddymelon)*, *Lepidium africanum* (Common Pepper-cress)*, *Malva parviflora* (Small-flowered Mallow)*, *Medicago sativa* (Lucerne)* and *Xanthium spinosum* (Bathurst Burr)*. *Eragrostis cilianensis** (Stinking Lovegrass) and *Schkuhria pinnata* var. *abrotanoides** (Dwarf Marigold) were also previously recorded (GCNRC 2004b).

A large amount of fallen coarse woody debris was recorded, 96 m / 0.1 ha plot, which is considered well above the benchmark for this vegetation type which is 15 m / 0.1 ha.

6.2.4 Cropped/cultivated paddocks (Cleared Land)

To the north of Escott Road, an area of the Project Site surrounding the product coal storage area and rail load-out facility has previously been cleared for cultivation and cropping and as such no longer represent a native vegetation community. An area of paddocks to the east of the approved open cut area appears to have also been subject to regular cultivation/cropping.

These areas have been modified from the natural state to the extent that native species are now uncommon and most of the cultivated areas were either cleared at the time of survey or dominated by planted introduced species such as Lucerne (*Medicago sativa*),

Although these paddocks are now either cleared or under cultivation, they would have previously been White Box Grassy Woodlands, as such have been mapped as ‘Box-Gum Woodland DNG, Condition Class 1’, i.e. <50% native groundcover with no native canopy.

6.2.5 Threatened Ecological Communities

Two threatened ecological communities (TECs) were identified at the Project Site. The patches of White Box grassy woodland and Bluegrass – Spear Grass – Redleg Grass derived grasslands discussed above are listed on the NSW *Threatened Species Conservation Act 1995* (TSC Act) as ‘Endangered’ under the name of “White Box Yellow Box Blakely’s Red Gum Woodland”, and in part are also as ‘Critically Endangered’ on the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) under the name of “White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland”.

The area identified as Brigalow – Belah woodland is listed as ‘Endangered’ under the TSC Act as, ‘Brigalow within the Brigalow Belt South, Nandewar and Darling Riverine Plains bioregions’, and also as Endangered under the EPBC Act as, ‘Brigalow (*Acacia harpophylla* dominant and co-dominant).

The EPBC Act listed critically endangered ecological community 'Natural Grasslands on basalt and fine-textured alluvial plains on Northern NSW and southern Queensland" was not recorded in the Project Site.

Table 9 outlines the mapped and vegetation units and their conservation status under State and Commonwealth legislation. A vegetation map is found at **Figure 11**. **Figure 12** provides the regional extent of White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland within a 10 km radius of the Project Site.

Table 9: Conservation Status of Mapped Vegetation Types at the Project Site

VEGETATION TYPE	CONDITION CLASS	DEFINITION	THREATENED ECOLOGICAL COMMUNITY?
White Box Grassy Woodland	4	Woodlands dominated by White Box, with native understorey	Yes EPBC Act and TSC Act
White Box Grassy Woodland – Derived Native Grasslands (DNG)	3a	Grasslands cleared White Box, with native understorey – high diversity	Yes EPBC Act and TSC Act
White Box Grassy Woodland – DNG	3b	Grasslands cleared White Box, with native understorey – low diversity	Yes TSC Act only
Cleared pastureland	2	Grasslands predominantly cleared of White Box, with exotic understorey	No
Cleared / Cultivated land	1	Cleared land used for cropping or rural infrastructure	No
Brigalow Woodlands	4	Woodland dominated by Brigalow tree species	Yes EPBC Act and TSC Act

6.3 FLORA

Native vegetation was present throughout much of the Project Site, with the majority subject to grazing of varying intensity and consequently found to be in varied condition classes. However, the range of historic aerial photographs in **Section 2** (**Figure 3**) illustrates that the condition of vegetation across the landscape is dynamic, with the 2010 assessment only providing a snap shot in time and not necessarily reflecting the year round condition.

Woodland areas of the Project Site support a large number of mature and hollow-bearing trees, although there was little evidence of recruitment of canopy species. Woody debris and fallen logs were also common throughout these woodland areas.

A total of 188 flora species were recorded during surveys undertaken in 2004, 2008 and 2010 (GCNRC, 2004b and 2009; ELA 2010b). Of these, 116 were native, 72 were exotic species with five of these considered noxious under the *Noxious Weeds Act 1993* (NW Act).

6.3.1 Noxious Weeds

Five noxious weeds were recorded within the Project Site during the 2004 and 2008 surveys, although none were recorded during the 2010 survey. A list of the noxious weeds recorded at the Project Site is included at **Table 10**, with a full inventory of native and exotic flora recorded at **Appendix E**.

Figure 11: Extant Vegetation Map of the Project Site

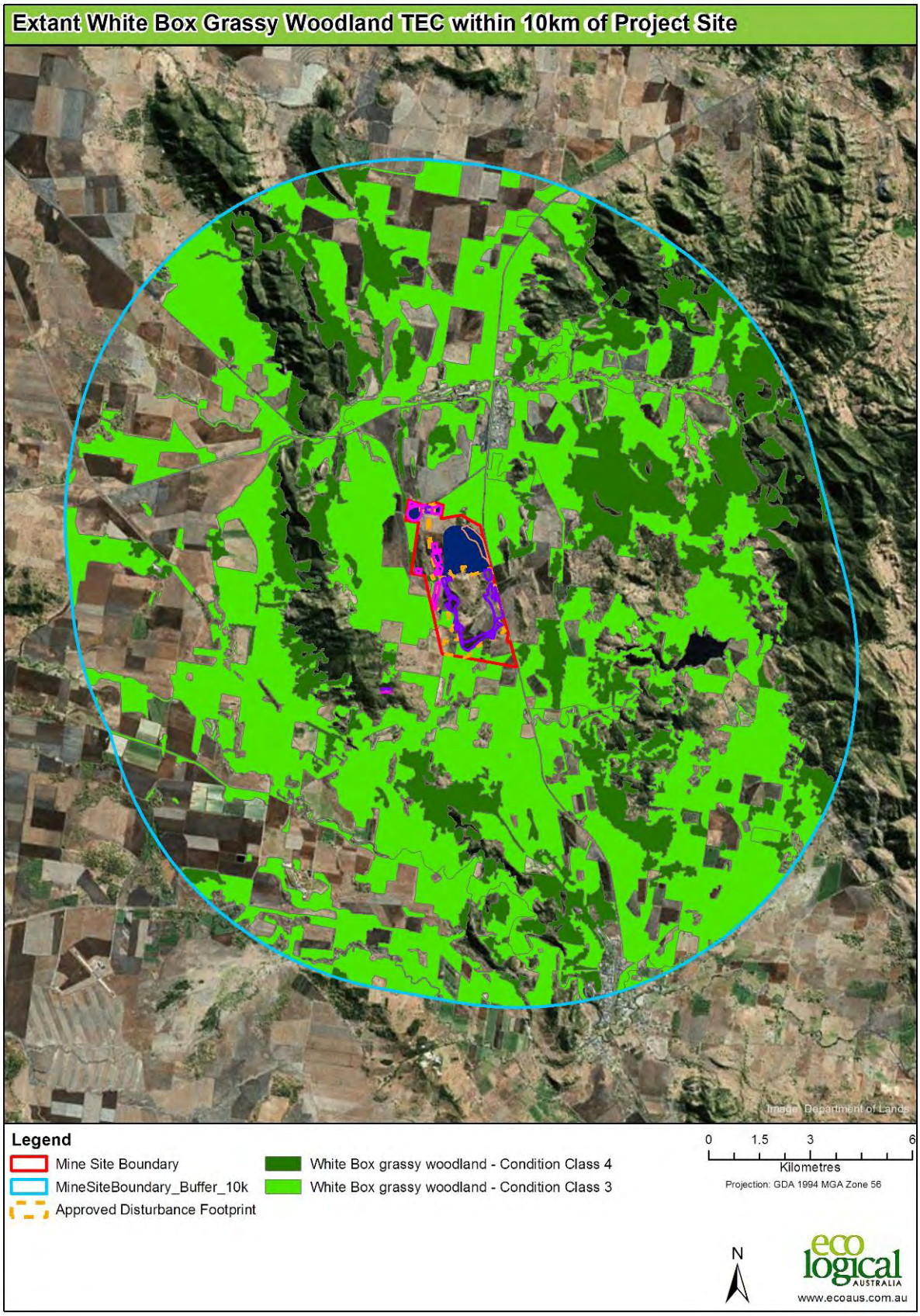


Figure 12: Regional Extant of the Threatened Ecological Community, 'White Box-Yellow Box-Blakely's Red Gum Woodlands and Derived Native Grasslands' Surrounding the Project Site

Table 10: Noxious Weeds Recorded at the Project Site

SCIENTIFIC NAME	COMMON NAME	YEAR RECORDED	CATEGORY OF WEED	ACTION REQUIRED
Cenchrus incertus	Spiny Burr Grass	2008	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority
Hypericum perforatum	St. John's Wort	2008		
Opuntia stricta	Prickly Pear	2004		
Xanthium pungens	Bathurst Burr	2004		
X. spinosum	Bathurst Burr	2004, 2008		

6.3.2 Threatened Flora

A number of threatened species are known to occur within the Liverpool Plains region and are considered to have the potential to occur at the Project Site (DECCW 2010; DEWHA 2010). An assessment of the likelihood of each species being present within the study area has been included in **Appendix C**, together with their conservation status under both state and Commonwealth legislation, habitat requirements and any vegetation communities across the study area that would provide potential habitat for these species.

No threatened flora species were recorded within the study area during the 2010 survey or the previous 2004 and 2009 surveys (GCNRC 2004b, 2009).

6.4 FAUNA

6.4.1 Fauna Habitat

One hundred and twenty fauna species were recorded across the Project Site between 2004 and 2010 (**Appendix D)**. Based on the vegetation types present within the study area, habitat for species such as ground-dwelling mammals and some arboreal mammals is limited. However, the landscape supports unique features such as grasslands, hollows, fallen dead timber, rocky areas, disused and in use anthropogenic structures (i.e. fences, houses, sheds, dams etc). Key habitat features are outlined in **Table 11** and discussed in more detail below.

Tree Hollows

Tree hollows are abundant throughout the mapped Class 4 White Box Grassy Woodlands of the Project Site. Given the amount of woodland found in the assessment area (~60ha), an accurate count of hollow bearing trees was not undertaken. However, during pre-clearing surveys undertaken at the Project Site in 2009 and 2010 (ELA 2009b and 2010c), an accurate count was undertaken in mature White Box grassy woodland, resulting in 87 hollows bearing trees (HBTs) over an area of approximately 6 ha of woodland, and 38 HBTs over an area of approximately 4 ha. Further counts of HBTs were undertaken during quadrat surveys over an area of 0.1 ha; with an average of 3 HBTs per 0.1 ha plot. This provides an average HBT density of between 9.5 and 30 HBT/ha. ELA (2010c) also identified the size of hollows in the HBTs, the proportions being: <5cm (32%), 5-15cm (30%), >15cm (17%), basal (6%) and spout (15%).

Table 11: Key Fauna Habitat Features Present Across the Study Area

HABITAT FEATURE	HABITAT TYPE	SPECIES
Hollow-bearing trees / stags	Woodlands Grasslands	Arboreal mammals, microchiropteran bats, hollow-dependent birds including owls, reptiles
Dead Tree Stags	Woodlands Revegetation area of overburden mound	Birds, particularly birds of prey
Rocky outcrops	Woodlands Quarry site Homesteads northern end of the Project Site	Reptiles
Dams	Grasslands	Amphibians, birds, reptiles, microchiropteran bats
Autumn / winter-flowering eucalypts	Woodlands	Foraging resources for birds, bats and mammals
Flowering myrtaceous trees and shrubs	Woodlands	Foraging resources for birds, bats and mammals
Coarse woody debris	Woodlands Revegetation area	Small mammals and reptiles
Leaf litter	Woodlands	Amphibians, reptiles, ground-dwelling mammals
Defoliating bark	Woodlands	Microchiropteran bats, reptiles
SEPP 44 Koala feed trees	White Box (Eucalyptus albens)	Koala
Anthropogenic structures	Across the Project Site	Vantage points and shelter for birds, bats, mammals and reptiles
Pastures	Grasslands	Foraging resources for birds, bats, reptiles, ground-dwelling mammals

Given that most of the remnant woodland areas maintained a high proportion of mature to senescent trees, the majority of the trees are expected to support hollows at similar proportions, therefore potential habitat for hollow-dependant species in woodland areas is abundant. It is noted, however, that during the pre-clearing survey of 2009, of the 87 HBTs identified, only 17 were found to be active and each of these were occupied by European Starlings. Further, of the 123 fauna species recorded at the Project Site from 2004 to 2010, only one large hollow dependant mammal or bird has been recorded, that being the Common Brushtail Possum.

Corridor Values / Movement Pathways

The Liverpool Plains Shire Biodiversity Strategy (ELA 2010a), identifies three types of corridors depending on their size and characteristics as follows.

- Regional Corridors: major vegetation pathways comprised of patches greater than 2 ha, not more than 3 km apart and over 70% woody vegetation. Buffer width 1 km.
- Subregional Corridors: vegetation pathways connecting regional corridors, riparian corridors and known locations of threatened species. Distance between stepping stones kept to less than 300 m in most areas. Buffer width 200 m.
- Subregional Riparian Corridors: rivers and creek lines across the LGA connecting to regional or subregional corridors and remnant native vegetation. Often with degraded riparian vegetation.

The Project Site is located between two prominent north-south Subregional Corridors and two east-west Subregional Riparian Corridors. Currently the linkage between these corridors is hindered by limited connectivity between woodland remnants due to current agricultural land uses preferentially maintaining grassland vegetation for grazing over woodland vegetation.

The approved Biodiversity Offset Strategy (BOS) (ELA 2010e) and Mine Rehabilitation Management Plan (RMP) (AECOM 2010) prepared in accordance with the existing Werris Creek Coal Mine approval, and the proposed BOS and RMP for the LOM Project (**Section 8**) would significantly increase the connectivity of this landscape. The existing BOS currently commits 362.5ha of land to a conservation corridor, with 310 ha of this land comprised of Box-Gum Woodlands and DNG and a further 52.5ha commitment to rehabilitation (revegetation).

The currently treeless DNG creates a lack of movement pathways for arboreal fauna, with limited islands in the landscape for fauna to take refuge.

6.4.2 Avifauna

Diurnal birds

The study area supports potential foraging, nesting and roosting habitat for a large variety of bird species. A total of 61 bird species from 29 Families have been recorded over the period of 2004 to 2010 within the study area. The species recorded are mostly considered common, with the exception of three threatened species. Further detail is provided below, with a full inventory found at **Appendix D**.

Species commonly recorded at the Project Site included the Australian Magpie (*Gymnorhina tibicen*), Richards Pipit (*Anthus novaeseelandiae*), Australian Raven (*Corvus coronoides*), Crimson Rosella (*Platycercus elegans*), Red Wattlebird (*Anthochaera carunculata*), Eastern Rosella (*Platycercus adscitus eximius*), Striated Pardalote (*Pardalotus striatus*), Red-Rumped Parrot (*Psephotus haematonotus*) and Magpie-lark (*Grallina cyanoleuca*).

Birds of prey were common throughout the study area. Five species have been recorded over the period 2004 to 2010, including two from the 'Eagle' family, Black-shouldered Kite (*Elanus axillaris*), and Little Eagle (*Hieraaetus morphnoides*), along with three from the 'Falcon' family, Nankeen Kestrel (*Falco cenchroides*), Brown Falcon (*Falco berigora*) and the Peregrine Falcon (*Falco peregrinus*). A sighting was also made Australian Hobby (*Falco longipennis*), although a positive identification was not achieved at the time.

Habitat for waterbirds was present in a number of farm dams across the study area, with four species of duck recorded, including, Australian Wood Duck (*Chenonetta jubata*), Grey Teal (*Anas gracilis*), Pacific Black Duck (*Anas superciliosa*), and Plumed Whistling Duck (*Dendrocygna eytoni*). Other waterbirds included White-faced Heron (*Egretta novaehollandiae*) and the Australasian Grebe (*Tachybaptus novaehollandiae*).

Nocturnal birds

Nocturnal bird species recorded during survey include the Southern Boobook (*Ninox novaeseelandiae*), Barn Owl (*Tyto alba*) and Tawny Frogmouth (*Podargus strigoides*).

Threatened Species

Given the large proportion of tree hollows found in the woodland areas of the Project Site (estimated from 9.5 to 30 hollows/ha), there is potential for a large number of threatened hollow dependant species to occur within the study area, along with threatened woodland birds. Only four have been recorded during the period of survey between 2004 and 2010. These are the Little Eagle, Brown Treecreeper (*Climacteris picumnus*), Little Lorikeet (*Glossopsitta pusilla*) and the Hooded Robin (*Melanodryas cucullata*) all of which are classified as vulnerable species under the TSC Act but not listed under the EPBC Act.

The survey of 2010 also recorded the Little Eagle and Brown Treecreeper. These species were recorded at the north end of the Project Site, in the woodland surrounding the homestead at the “Cintra” property.

Other threatened bird species for which the study area is likely to provide potential habitat include:

- Barking Owl (Ninox connivens)

This species was recorded within the study area during the surveys.

6.4.3 Mammals

Ground dwelling and arboreal mammals

Habitat across most of the study area for ground-dwelling mammals is limited as there is no shrub layer and limited fallen timber to provide refuge and shelter sites. However, in those areas where woodland patches are present and grazing is less intense, coarse woody debris such as fallen timber and logs provide nesting and shelter resources for ground-dwelling mammals. The high quantity of tree hollows present on the Project Site would also provide good nesting habitat for arboreal mammals.

Twelve species of mammal from eight Families have been recorded within the study area. Of the mammals recorded, five were native species including: Eastern Grey Kangaroo (*Macropus giganteus*); Wallaroo (*Macropus robustus*); Red-necked Wallaby (*Macropus rufogriseus*); Short-beaked Echidna (*Tachyglossus aculeatus*); and Common Brushtail Possum (*Trichosurus vulpecula*). Seven introduced mammals were also recorded within the study area including the Black Rat (*Rattus rattus*), House Mouse (*Mus musculus*), European Red Fox (*Vulpes vulpes*), European Rabbit (*Oryctolagus cuniculus*), Domestic Cow (*Bos taurus*), Domestic Dog (*Canis lupus familiaris*) and Feral Cat (*Felis catus*).

The Koala (*Phascolarctos cinereus*) is the only other arboreal mammal considered to have the potential to utilise the study area. White Box is listed as a Koala feed tree under SEPP 44 and is present across the Project Site. The Koala has previously been recorded to the west of the Project Site, on the "Eurunderee" property, however, none were sighted within the Project Site during the surveys. Call playback was undertaken for Koala at 3 sites over 4 successive nights of the 2010 survey (19th to 22nd April), and 2 sites over 4 successive nights during 2004 (CES 2004).

Microchiropteran Bats (microbats)

Habitat for microchiropteran bats (microbats) is present across the study area with 15 species recorded foraging, 13 of which were recorded during the 2010 survey. A total of 1,970 call sequences were recorded within the study area over 4 nights of the 2010 survey. Of these, 710 (36%) of the sequences could be identified confidently to species or genus level.

Bat activity within the study area was relatively high, with feeding buzzes often recorded; indicating bats were foraging over the study area. A large number of call sequences were of cruise phase calls and were too short to be reliably identified or of low quality. Bats generally emit cruise phase calls when commuting between sites rather than the search phase calls used for identification purposes whilst foraging. In many instances calls were recorded on dusk and just prior to sunrise indicating that bats were roosting nearby, and likely to be roosting in tree hollows within the study area. Isolated paddock trees are an important roosting, foraging and breeding resource for Greater Broad-nosed Bat and Eastern False Pipistrelle.

Threatened Bats

Of the 13 species recorded at the Project Site, four are considered vulnerable species under the TSC Act 1995. A full inventory of the bats present across the Project Site and a chronology of their identification date are included in **Appendix D**.

6.4.4 Reptiles

The rocky substrate across much of the study area provides suitable habitat for a variety of reptile species. In addition, the fallen debris in woodland areas and tree bark throughout the woodlands provides further habitat for reptiles.

Twenty five reptile species from seven Families were recorded across the Project Site during all survey periods. A full inventory of reptiles is included at **Appendix D**.

Threatened reptiles

No endangered reptiles are known from the general region and none have been recorded from the immediate area (Gerry Swan pers. comm.).

The area is within or at the edge of the range of four vulnerable reptile species. These are the Border Thick-tailed Gecko (*Underwoodisaurus sphyrurus*), the Pale-headed Snake (*Hoplocephalus bitorquatus*), the Pink-tailed Worm-lizard (*Aprasia parapulchella*), and Bell's Turtle (*Elseya belli*).

The Border Thick-tailed Gecko is known from the general region and has been recorded from Tamworth to the northeast of the Project Site. It is primarily associated with granite outcrops in or adjacent to trees. Suitable habitat exists on the rocky ridge with tree cover at the west of the site. It was not found within the study area, nor was it found during any previous surveys.

The Pale-headed Snake is known from scattered localities along the slopes and tablelands although none have been recorded from the immediate area. As it is primarily a frog eater it tends to favour tree lined watercourses. Given the lack of suitable habitat on the site it is unlikely to occur.

The Pink-tailed Worm-lizard has been found in the Gunnedah area which is a considerable range extension north from previously known localities. Rocky outcrops on the site were rigorously searched but no individuals or tell-tale sloughs were found. Given the search effort that has been applied to the site over the past 6 years, the species is not considered to occur.

Bell's Turtle is only known from the Namoi, McDonald and Gwydir Rivers, and is confined to the headwaters of these rivers. The Project Site falls within the Namoi catchment but the turtle is unlikely to occur on the Project Site as there are no permanently flowing creeks.

6.4.5 Amphibians

Habitat for amphibians was present within the study area in the form of farm dams, trees and leaf litter in close proximity of these water sources.

Specific survey was not conducted for amphibians during the 2010 survey, as no threatened species were considered likely to occur at the Project Site with no records found within 10 km during the literature review and database search. An opportunistic identification was made, however, of the Common Eastern Froglet (*Crinia signifera*).

Previous survey between 2004 and 2009 have identified eight species of frog using the Project Site, three from the 'Tree frog' Family (Hylidae), and five from the 'Ground frog' Family (Myobatrachidae). A full inventory of frog species and a chronology of their identification date are included in **Appendix D**.

Threatened Amphibians

One endangered amphibian has been recorded in the region. This is the Booroolong Frog (*Litoria booroolongensis*). The Booroolong Frog is a stream dwelling frog along the ranges from NSW to Victoria, generally above 200 m. The absence of permanent running streams would preclude it from the Project Site.

6.4.6 Migratory Fauna

Potential habitat is present for five migratory species within the Project Site. These are the:

- Regent Honeyeater (*Xanthomyza phrygia*);
- Swift Parrot (Lathamus discolor);
- Great egret (*Ardea modesta*);
- Cattle Egret (*Ardea ibis*); and
- Rainbow Bee-eater (*Merops ornatus*).

None of these species were recorded during survey between 2004 and 2010.

6.5 GROUNDWATER DEPENDANT ECOSYSTEMS

Vegetation communities which have a relationship with groundwater to the extent that species composition and natural ecological processes are determined by the presence of this groundwater are considered GDEs (DLWC 2004). The different types of GDE, as defined by Eamus et al. (2006), were previously described in **Section 2.6**.

Of these, two are relevant to the current proposal, including ecosystems associated with both the surface expression of groundwater (springs and soaks, hanging swamps base-flow rivers and streams) and vegetation dependent upon the subsurface presence of groundwater (DLWC 2004; NSW Scientific Committee 2007). Within the lands surrounding the Project Site, the main identifiable GDEs are the riparian vegetation and any associated stream based ecosystems of Werris and Quipolly Creeks (**Figure 13** and **Figure 14**).

The consequences of excessive groundwater abstraction on GDEs have been observed throughout Australia (Eamus and Froend 2006). Impacts to GDEs as a result of excessive groundwater extraction can be long lasting and include the disruption of ecological processes, reduction in biodiversity, stress and dieback (Eamus and Froend 2006). These impacts can arise from altering any of a number of aspects of the groundwater regime (Eamus *et al*. 2006), including:

- the depth of the water table;
- groundwater flow rates;
- the hydraulic head within an aquifer;
- the quality of the groundwater;
- location of discharge; and
- any temporal aspects of the groundwater regime including timing, frequency and duration.

The impact of groundwater extraction upon GDEs depends upon the extent of changes to the groundwater regime (including those aspects listed above) and the dependency of the ecosystem upon the groundwater. On the basis of the above information it is considered that there are GDEs to the south and north of the Project Site and that extraction of groundwater has the potential to cause adverse effects to these ecosystems.

Aquifer systems

The geology and hydrogeology of the Namoi Catchment can be grouped into three aquifer systems. These include the extensive unconsolidated sediments associated with the larger floodplains in the catchment as well as the alluvium associated with the smaller tributaries in the catchment; the porous rock aquifers, and the fractured rock aquifers (Office of Water, 2009, in SKM 2010).

Werris Creek and Quipolly Creek alluvial aquifers are shallow unconfined aquifers affected by climate variation and surface water flows. There is limited groundwater development and limited water level information for these aquifers. However due to the shallow nature of these alluvial systems and their connection with surface water resources the water table is likely to be less than 30 m (SKM 2010).

Groundwater Drawdown

An evaluation of the reduction of groundwater flow to the alluvium of Quipolly Creek and Werris Creek was undertaken by RCA (2010). This assessment included assigning creeks a ‘stream’ function within a model and the reduction to this system was calculated directly. This modelling indicated that there would be no predicted impact to either of these creek systems as a result of the LOM Project, and as such, there will be no associated impact on GDEs.

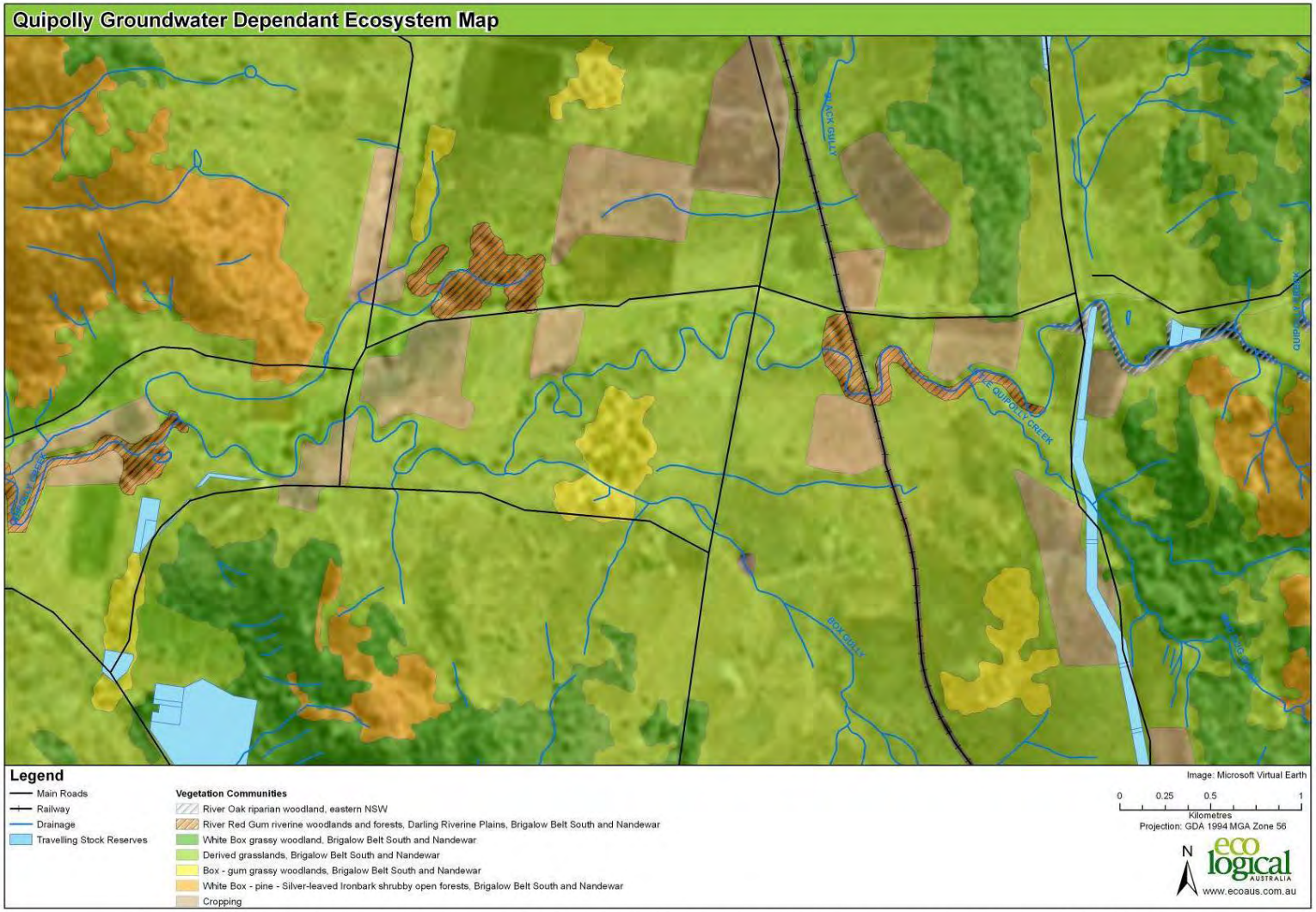


Figure 13: Vegetation Map of the Quipolly Creek Catchment, Showing Potential Groundwater Dependant Ecosystems

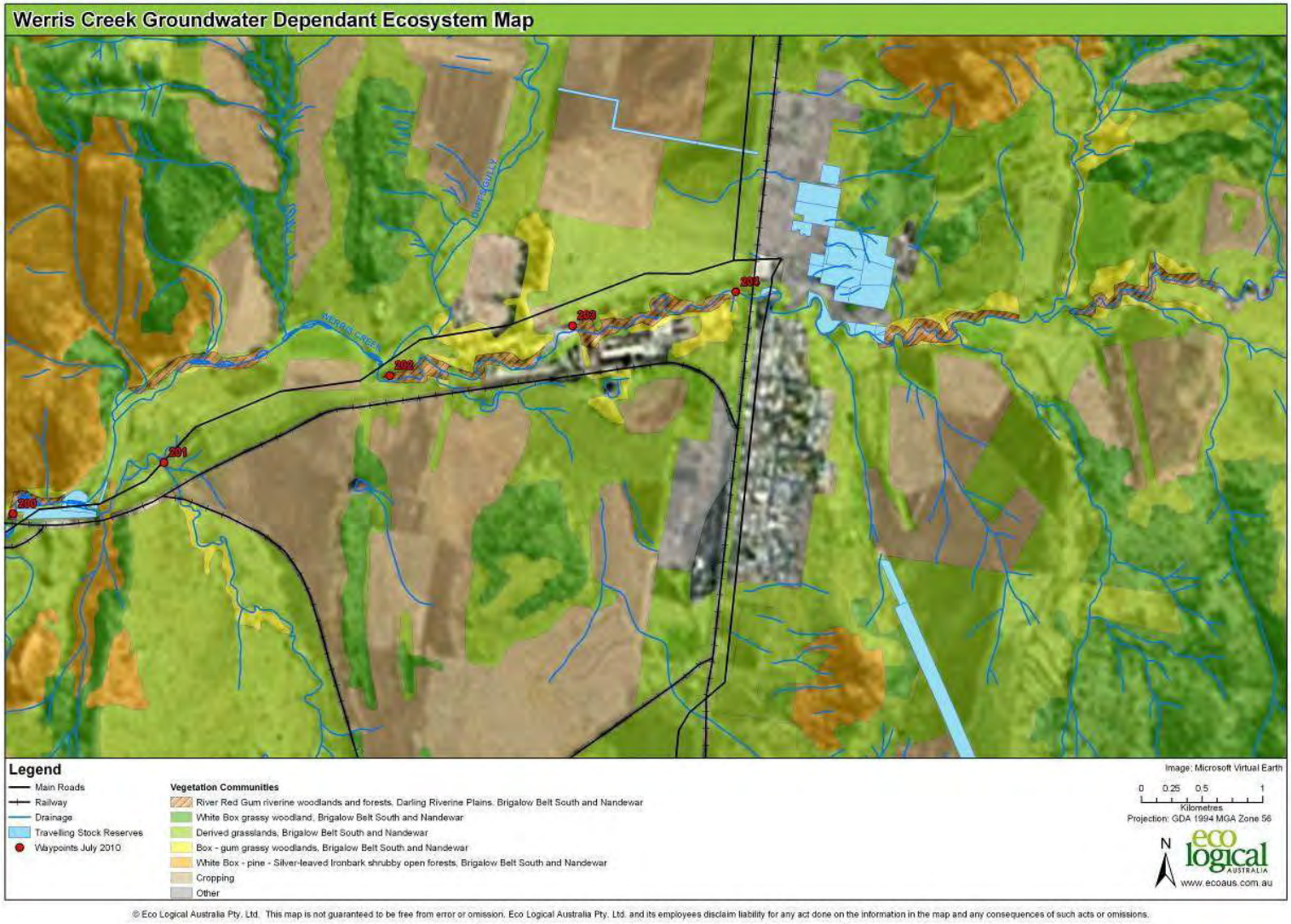


Figure 14: Vegetation Map of the Werris Creek Catchment, Showing Potential Groundwater Dependant Ecosystems

7 Impact Assessment

7.1 INTRODUCTION

This section of the report outlines the anticipated impacts from the LOM Project on the ecological values of the Project Site. It is structured in order of process as initially impacts have been avoided and minimised wherever possible. A number of mitigation measures were then formulated to further minimise the impacts from the LOM Project. The residual direct, indirect and cumulative impacts are then outlined. This approach is consistent with the requirements of the DGR's (i.e. the BIA should describe actions taken to avoid or mitigate impacts and then compensate for unavoidable impacts). For any impacts that cannot be avoided or mitigated, a comprehensive offset strategy has been proposed which is included in **Section 8**.

7.2 AVOIDANCE AND MINIMISATION MEASURES

The LOM Project involves the extraction of a sub-surface coal seam through open cut extraction techniques and as such the immediate impact of the open cut development is unavoidable if the coal resource is to be recovered. It is possible, however, to limit the impact of the associated infrastructure and overburden associated with the extraction of the coal. Notably, the majority of overburden is to be placed within the completed section of the open cut, limiting the additional area of land required for the creation of out-of-pit overburden emplacements. As the LOM Project is an extension to an existing operation, the majority of the components proposed have been located, as far as practicable, adjacent to the approved open cut to consolidate impacts and minimise habitat isolation, fragmentation and edge effects.

Outside of the impact footprint of the LOM Project open cut and overburden emplacement, the placement of the ancillary infrastructure for the LOM Project has been located preferentially in areas of lower conservation value, i.e. cleared land and exotic pastures. Where it has not been possible to utilise areas of cleared and cultivated lands, it has been proposed to place the required infrastructure in areas of native pasture or derived native grasslands, i.e. areas previously cleared of overstorey vegetation (Class 3). Whilst these native pastures still represent remnants of listed threatened ecological communities, they are in a highly modified state and the resulting impacts have been reduced through avoidance of further tree removal and a consequent reduction in habitat structure, complexity and integrity.

Where possible, current infrastructure such as the rail load-out road, rail load-out facility and water storages have been retained to avoid potential further impacts to the vegetation on the Project Site. Areas currently utilised for, or approved for the stockpiling of soil and cleared vegetation resources would continue to be used in preference to other undisturbed locations. Furthermore, once the overburden emplacement reaches its maximum height, the upper surface of the structure would be used for the stockpiling of soil and cleared vegetation (for future spreading over the created final landform).

It is notable that a northern extension of the overburden emplacement has been proposed which would follow the eastern and northern perimeter of the open cut. Whilst this does not abide by the impact avoidance principle discussed above, the placement of overburden in this fashion has been necessitated by the need to provide visual and acoustic screening of the mining operations to the town of Werris Creek to the north.

7.3 MITIGATION MEASURES

Vegetation clearing must be undertaken for mining to occur, however, the Proponent currently (and would continue to) mitigates the impacts of disturbance by adopting risk minimising practices for pre-start and clearing activities onsite (AECOM 2010). The following pre-start practices are used by the Proponent.

- Disturbance areas are kept to the minimum area required by having one year's worth of mining blocks surveyed and the boundary clearly pegged in the field. This ensures that disturbance is only done once per year and affords the flexibility to undertake the vegetation clearing during seasons that minimise the risk of impacting on hibernating microbats or breeding woodland birds.
- A Pre Start Clearing Inspection is completed by an ecologist of the proposed disturbance area to identify the presence of fauna (including threatened species such as the Koala and microbats).
- Pre Start Clearing Inspections also identify biological resources within the disturbance area including habitat resources (hollows, stag trees and coarse woody debris) and the availability of endemic seed.

The following active clearing practices are implemented.

- Environmental and noxious weeds are controlled within the disturbance area prior to clearing.
- Seed collection is undertaken.
- The identified habitat trees are inspected prior to felling.
- If no fauna is observed, a bulldozer is used to rip the root zone around the base of the tree.
- The dozer slowly pushes the tree to allow it to fall under its own weight, thereby minimising damage during felling.
- A trained wildlife handler is onsite to inspect the tree and to attend to any animals which may be injured or require assistance.
- The toppled trees are left on the ground overnight to allow any other unidentified animals to relocate.
- The trees are reinspected in the morning prior to being relocated to the rehabilitation areas for habitat augmentation.

Where possible, attempts are made to reduce the overall impact footprint through the following landscape management practices.

- Revegetation of the overburden emplacement and placement of previously felled trees over the final landform to provide habitat value for arboreal and ground hollow dependant fauna and perching sites. The placement of upright and on-ground dead timber provides a habitat resource for wildlife that is not currently available (or would be available) in the DNG areas and would take many decades to reproduce in these revegetation areas.
- Stripping soil in disturbance areas and immediately re-spreading over rehabilitation areas.
- Weed management particularly focused on noxious weeds which includes routine inspection and identification.
- Pest management activities as required.
- Bushfire management including maintenance of access tracks for fire breaks.

- Fencing of areas to minimise access for humans and cattle to avoid unauthorised or accidental disturbance.
- A seed collection strategy and program to harvest endemic seed from local vegetation to either directly sow or propagate for tube stock planting in either biodiversity offset or rehabilitation areas.
- Detailed monitoring and inspection programs that annually review progress against set criteria based on vegetation community benchmark data.

7.3.1 Rehabilitation / Revegetation

Current approvals require the rehabilitation of the final approved landform, with revegetation of native TEC woodland to the extent of 52.5 ha. The Proponent has already commenced work on this rehabilitation, taking an unconventional approach not usually employed or considered in post mining rehabilitation operations. These measures include, placement of dead standing timber (stags) and coarse woody debris on the reshaped overburden dump, along with rocky areas providing habitat for ground mammals and reptiles. The stags provide an important perching and roosting habitat for both birds of prey and passerine species when surveying for food, a habitat resource often lost in the landscape for up to 20 years until revegetation takes hold. **Figure 15** shows a Nankeen Kestrel perched atop the front stag. Local tussock grasses can also be seen colonising the area and tree seedlings appear in good health.

They also contain hollows and fissures, important for microbats and arboreal mammals, features absent for at least 100 years in cleared lands such as the surrounding derived native grassland.

Figure 15: Restanding Cleared Timber Placed as Stag Trees within the Current Rehabilitation Area

The success of this revegetation is already evident with the recolonisation of local native grasses and the healthy growth of seedlings that have been planted (**Figure 15**). These works attest to the strong desire of the Proponent to not only meet the commitments of current approvals, but to go above this and work towards creating a functional landscape post mining operations. The early success of these works would form a basis for the revegetation works that would be undertaken on the final landform that has been proposed for the LOM Project.

The disturbance footprint of the LOM Project is approximately 190 ha of existing vegetation, with around 60 ha of this being woodland and the remainder derived native grassland. As illustrated on (**Figure 16**), the majority of the disturbance footprint is proposed to be rehabilitated to a woodland structure using locally sourced seed of species common to the 'Box – Gum Grassy Woodland EEC', as well as the 'White Box – White Cypress Pine - Silver-leaved Ironbark Shrubby Open Forest'. Areas of water storage would be retained in the final landform, providing a fauna watering resource and habitat for water birds. Areas that are currently cleared within the footprint and on the surrounding offset properties would also be revegetated to meet the standard commenced in earlier revegetation works. With these proposed measures, along with the introduction of habitat features absent in the revegetation areas for between 20 and 100 years, including coarse woody debris, stags, hollows and rocky substrates, it is considered that the mine rehabilitation would form an important part of the offset package and the conservation corridor proposed.

The 0.35 ha Brigalow remnant that would be impacted is in a modified condition and has a low diversity of species common to this vegetation type (3 out of 15), although its landscape position is at the extreme southeast of its range, and thus provides a locally adapted genetic resource that may prove important for the recovery of this EEC. In order to maintain this resource, it is proposed that this remnant is supplanted locally into the revegetation area of the already approved post mining landform. It is currently proposed to rehabilitate an area of 3.5ha of Brigalow vegetation on this landform, and it is proposed that the Brigalow trees be mechanically harvested from the currently isolated position into this new area.

Unlike most Australian Acacia species, *Acacia harpophylla* (Brigalow) rarely flowers and does not have a hard-coated persistent seed, but it is capable of prolific vegetative reproduction (root suckering) following disturbances such as pulling (Johnson 1964 in Dwyer *et al.* 2009). Given this, it is considered that the Brigalow should sucker from root stock when supplanted, maintaining the local genetic stock and expanding the area currently occupied. This would also provide an avenue for the reintroduction of understorey species into the community from local provenance seeds, that are currently absent from the community.

Whilst the proposed revegetation of Brigalow vegetation would provide for a positive outcome for this EEC remnant that currently has an uncertain future genetically (due to its isolation) and in terms of diversity (as it maintains few species common to this vegetation type), the success of the revegetation is not certain and is proposed as an additional component of revegetation requirements under current approvals.

A detailed Landscape Management Plan (LMP) should be prepared that would identify those areas to be rehabilitated on the final landform. The currently proposed rehabilitation includes >500 ha of native woodland, 3.7 ha of Brigalow and 37 ha of Class III Agricultural Land.

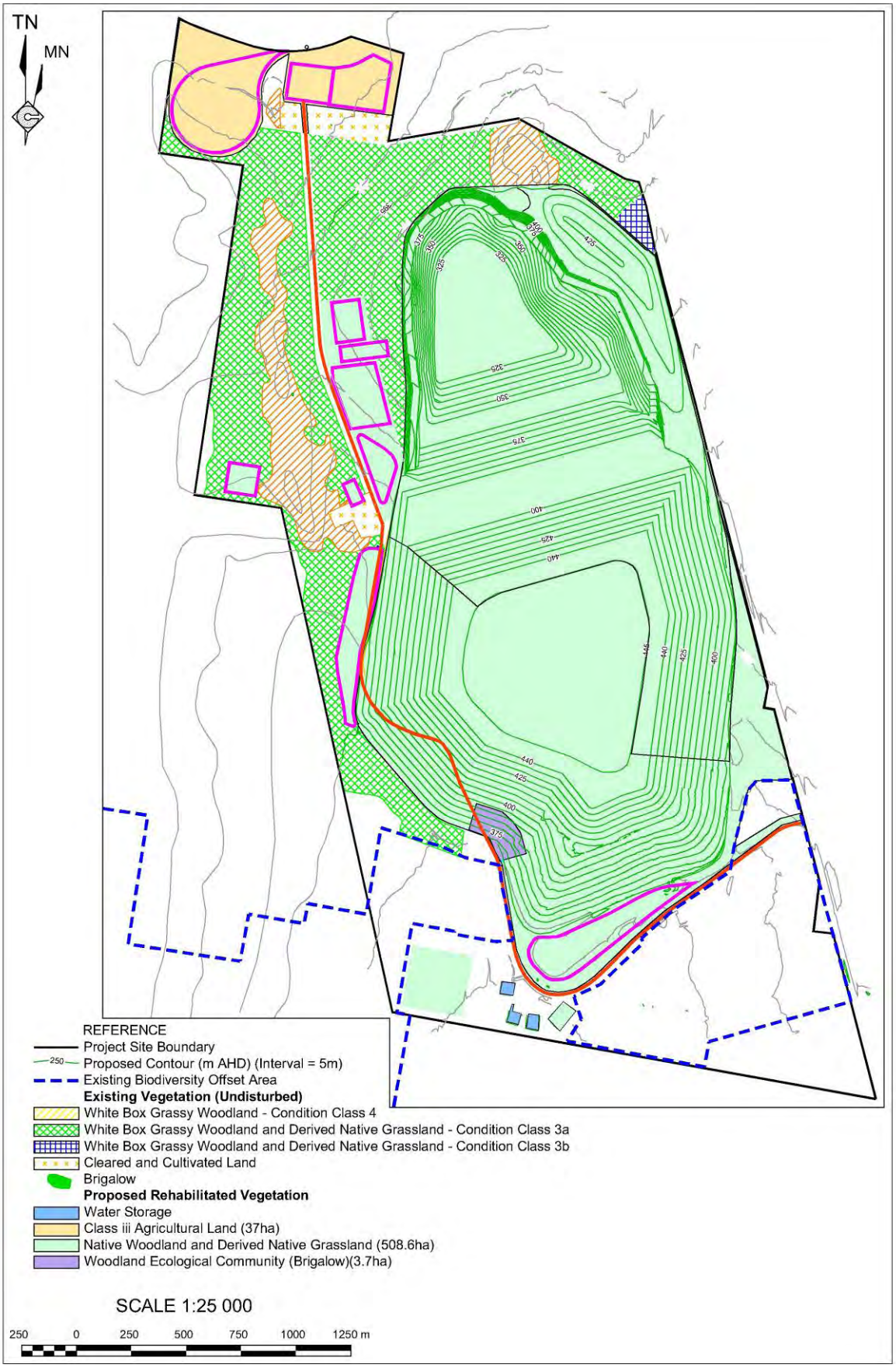


Figure 16: Conceptual Final Landform and Rehabilitation Plan

7.4 RESIDUAL IMPACTS

7.4.1 Direct Impacts

Clearing of vegetation

The LOM Project would result in the removal of approximately 194 ha of native vegetation, comprising approximately 59 ha of woodland vegetation (Class 4) and 135 ha of derived native grasslands (Class 3a and 3b). Of the DNG vegetation, 74 ha is listed as threatened under both the NSW TSC Act 1995 and the Commonwealth EPBC Act 1999 and a further 61 ha is listed under the TSC Act only (see **Section 6**). This clearing would result in:

- a direct reduction in the extent of these communities in the local area;
- a loss of fauna habitat;
- potential incidental mortality of threatened bats during clearing;
- temporary fragmentation of remnant woodland and grassland vegetation; and
- a temporary reduction in the ecological function of this vegetation type in the immediate area.

7.4.2 Indirect Impacts

Edge Effects

Potential edge effects that may be introduced by the LOM Project include weed invasion and fragmentation of existing woodland remnants. These impacts would be considered minimal due to current weed management practices undertaken by the Proponent and the highly cleared nature of the surrounding landscape (e.g. cropping and grazing lands).

Noise

The noise associated with the operation of the LOM Project is discussed in detail in the Environmental Assessment (RWC 2010). It is possible that the noise associated with mining operations will indirectly impact upon fauna species by limiting communication between individuals and the general ambience of the natural environment. This may cause the migration of some highly mobile species from the Project Site to alternative habitat in the local area during the period of mining operations.

Survey work undertaken in 2010 recorded 82 fauna species using the Project Site, including 2 threatened bird species and 4 threatened bat species, of a total of 124 recorded during the survey period 2004 to 2010. Given the diversity of species still found at the Project Site alongside current mining operations, this potential indirect impact is considered to be minimal with respect to fauna.

Watertable Drawdown

There is a potential for a drawdown of the watertable due to the water extraction required for the LOM Project. A significant drawdown could potentially impact upon Groundwater Dependant Ecosystems in the vicinity of Werris Creek and Quipolly Creek. The drawdown expected from the mine operations has been modelled by RCA (2010), and is predicted through modelling to be minimal. Impacts to GDE's were previously considered in **Section 6**.

7.4.3 Cumulative Impacts

Current mining approvals have allowed the clearance of 43 ha native woodland (CES 2009). The loss of a further 194 ha of native vegetation as a result of the LOM Project would add to the cumulative loss of vegetation from the local area. Given the extent of Box Gum woodland mapped within the local area (~25,000 ha within a 10 km radius of the Project Site), this cumulative impact on the biodiversity values of the region is not considered to be significant. These losses are proposed to be offset through a comprehensive Biodiversity Offset Strategy (BOS) which would ultimately increase the areas of woodland above current levels and provide for increased connectivity including enhanced regional corridors **(Section 8**).

7.5 ASSESSMENT OF IMPACTS TO THREATENED SPECIES AND ECOLOGICAL COMMUNITIES

Individual assessments of the potential effects of the LOM Project for each threatened species and ecological community recorded at the Project Site have been completed in accordance with *Appendix 3* of the Draft Guidelines for Threatened Species Assessment (DEC & DPI 2005) and are included as **Appendix F**.

Impact Assessments for all Matters of NES indicated in the controlled action determination have also been completed and are included at **Appendix G**.

These assessments have concluded that with the implementation of the Biodiversity Offsets Strategy, as outlined in **Section 8**, there would be no significant impacts to threatened species or ecological communities.

7.6 OFFSETS

Retention of land for conservation to ensure no loss of connectivity

As discussed previously, other than the BOA for the current mining operation (362.5 ha), land on properties adjoining the Project Site are currently managed for agricultural activities which will maintain the surrounding vegetation in a highly modified and simplified state. However, despite the history of agricultural use of the surrounding properties, they still maintain a proportion of similar vegetation including White Box Grassy woodlands and derived native grasslands, which in the existing BOA has already shown high resilience with the woodland canopy actively regenerating (**Figure 17**).

A detailed proposal for the future management of the Project Site should be presented in an updated Landscape Management Plan and BOS (as outlined in **Section 8**). The LOM Project BOS proposes the addition of a further 840 ha of land adjacent to the Project Site to conservation covenant and management, including an additional >500 ha of woodland rehabilitation.

Figure 17: Recolonisation of Derived Native Grasslands by Eucalypts in the Current Biodiversity Offset Area, due to the removal of Cattle Grazing

8 Biodiversity Offset Strategy

8.1 INTRODUCTION

The DGR's for the LOM Project require the Proponent to avoid, minimise and ameliorate the impacts of the LOM Project to the maximum extent possible. Where there are impacts that cannot be avoided or ameliorated, the DGR's require that these residual impacts be offset through the development of '*an offset strategy to ensure the project maintains or improves the biodiversity values of the region in the medium to long term'*.

This section provides a detailed description of the proposed offset strategy which aims to address the DGR's. In summary the proposed LOM Project Biodiversity Offset Strategy (LOM Project BOS) provides for:

- rehabilitation of the Project Site;
- a package of covenanted offset properties where existing biodiversity values would be enhanced and areas of degraded land revegetated;
- in perpetuity biodiversity management of these properties; as well as
- a 20 year monitoring plan for the offset properties and revegetation areas.

The offset strategy builds on the existing BOS for the Werris Creek Coal Mine which already provides a 362.5 ha offset area (310 ha remnant vegetation and 52.5 ha of mine site rehabilitation), established as a requirement of the existing development consent for the Werris Creek Coal Mine. The existing BOS completes important linkages to identified regional conservation corridors.

An outline of the offset options available, an assessment of the potential area of offset required and the potential offset opportunities are provided. Other than the Biobanking Assessment Methodology, there is no standardised quantitative method of assessing whether a proposal meets the 'maintain and improve' standard specified in the DGR's. Accordingly, an indicative biobanking calculation has been undertaken to inform the calculation of suitable offset ratios in conjunction with the consideration of the social and economic benefits provided by the LOM Project.

A draft version of the LOM Project BOS was discussed with DECCW at a meeting in Dubbo, 17th August, 2010. This meeting was attended by Danny Young (Environmental Manager, Whitehaven Coal Limited), Andrew Wright (Werris Creek Coal Mine, Environmental Officer, Werris Creek Coal Pty Limited), Robert Humphries and Lucas McKinnon (Eco Logical Australia) and Alex Irwin (Senior Environmental Consultant, R.W. Corkery & Co. Pty Limited).

8.2 OFFSETTING OPTIONS

8.2.1 Offset Principles

Principles that must be considered when proposing an offset strategy are defined by the State (DECC 2008) and the Commonwealth (CoA 2007). The following principles are outlined in these documents.

NSW (DECC 2008)

- Impacts must be avoided first by using prevention and mitigation measures.
- All regulatory requirements must be met.
- Offsets must never reward ongoing poor performance.
- Offsets will complement other government programs.
- Offsets must be underpinned by sound ecological principles.
- Offsets should aim to result in a net improvement in biodiversity over time.
- Offsets must be enduring and they must offset the impact of the development for the period that the impact occurs.
- Offsets should be agreed prior to the impact occurring.
- Offsets must be quantifiable and the impacts and benefits must be reliably estimated.
- Offsets must be targeted.
- Offsets must be located appropriately.
- Offsets must be supplementary.
- Offsets and their actions must be enforceable through development consent conditions, licence conditions, conservation agreements or a contract.

Commonwealth (CoA 2007)

- Environmental offsets should be targeted to the matter protected by the EPBC Act that is being impacted.
- A flexible approach should be taken to the design and use of environmental offsets to achieve long-term and certain conservation outcomes which are cost effective for proponents.
- Environmental offsets should deliver a real conservation outcome.
- Environmental offsets should be developed as a package of actions - which may include both direct and indirect offsets.
- Environmental offsets should, as a minimum, be commensurate with the magnitude of the impacts of the development and ideally deliver outcomes that are 'like for like'.
- Environmental offsets should be located within the same general area as the development activity.
- Environmental offsets should be delivered in a timely manner and be long lasting.
- Environmental offsets should be enforceable, monitored and audited.

This policy identifies two kinds of biodiversity offset, 'direct offsets' including such measures as long-term protection of existing habitat, and 'indirect offsets' for such measures as implementing recovery plan actions or contributions to relevant research.

The proposed LOM Project BOS has been designed to meet the nominated principles and goals of both the NSW and Commonwealth jurisdictions.

8.2.2 Offset Options

The offset options available to meet these principles are shown in **Figure 18**, which identifies a range of "covenanting options" to provide security on title, to the contribution of funds for the management and enhancement of existing secure sites.

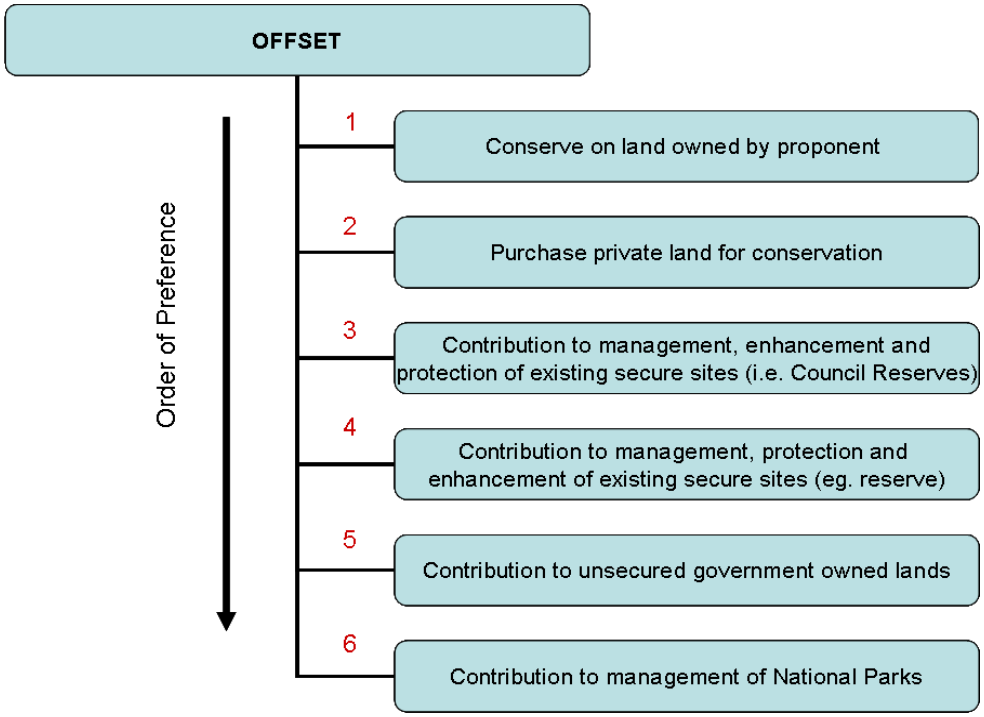


Figure 18: Offsetting Options.

As the Proponent is a significant landholder in the immediate area surrounding the Project Site, Offset Option 1 is the preferred and primary option for the LOM Project BOS proposal. Offset Option 1 requires the Proponent to place a 'conservation covenant' (such as under s88B of the *Conveyancing Act 1919*, a Voluntary Conservation Agreement, under the *National Parks and Wildlife Act 1974* or other appropriate covenant on the title of a proportion of the land to provide in perpetuity security.

A series of 'direct offsetting' options are proposed to offset the impacts on the 'Box – Gum Grassy Woodlands' and 'Derived Native Grasslands', including long term protection of existing habitat and revegetation of cleared and degraded lands. Vegetation meeting the definition of 'Brigalow – Belah woodlands' has not been mapped within the local area (i.e. 10km radius), and there are currently no known opportunities where impacts to this EEC can be 'directly offset' in the local area.

8.3 OFFSET AREA

8.3.1 Offset Calculations for Vegetation loss at Impact Site

Other than the Biobanking Assessment Methodology ("the Biobanking methodology"), there is no standard framework or requirement to provide an offset of a certain size, rather, the adequacy of the offset has traditionally been based on the biodiversity values to be impacted (type, area and condition), conservation status (endangered or not threatened community), the social and economic benefits of the proposal and the ability to secure offsets. However, DECCW prefers that an assessment of the offset requirements is calculated using the Biobanking methodology and the results are then used to "inform or guide" the negotiation of suitable offset packages for Part 3A Projects, taking into consideration the social and economic benefits of the project, even if the area required under the Biobanking methodology is not attained.

Accordingly, an assessment of the proposed LOM Project BOS has been undertaken to determine whether an 'improve or maintain' outcome can be met in accordance with the Biobanking Assessment Methodology (DECC 2009).

Whilst the field survey techniques undertaken for the BIA did not comply fully with the methodology required for a full Biobanking Assessment (in regard to the minimum number of condition plots), as the LOM Project is being assessed under Part 3A of the EP&A Act and not as a Biobanking Assessment, sufficient data was obtained at survey sites to enable robust estimates of the area of offset required under this methodology. The results of these calculations were then used to inform the area of offset required.

Approval is being sought for the LOM Project based on an assessment of the impacts and offset requirements based on the understanding of impacts at the time of approval.

8.3.2 Area of Vegetation Required at Offset Site (Biobanking Methodology)

The Biobanking Methodology (DECC 2008) was utilised to calculate the number of Ecosystem Credits required to offset the impacts of the LOM Project. These credits are used as a surrogate for habitat loss / or gain during the offsetting process. The amount of offset required for ecosystem credits is determined by both the condition of the impact site and the potential to improve the condition (biodiversity values) of the offset site. A summary of the credits required (using the Biobanking methodology) to offset the impact of the LOM Project is included in **Table 12**. As stated previously, the LOM Project has not been assessed as a Biobanking project and as such the credits included in **Table 12** provide guidance only in relation to the establishment of the LOM Project BOS.

Generally, an impact site in ‘moderate to good condition’ will require a larger offset than a site in ‘low condition’. In addition, due to the way the Biobanking methodology assesses improvement in vegetation condition, an offset site in ‘moderate’ condition will produce more credits than a site in ‘low condition’ or ‘benchmark condition’. This is due to the expected improvement at a site in ‘moderate’ condition being greater than that which is achievable at a ‘low condition’ or a ‘benchmark’ site. Therefore, the offset required will be smaller if a ‘moderate’ condition site is proposed as an offset, rather than a ‘low condition’ or a ‘benchmark’ site.

The vegetation at the Project Site is found in various conditions, and has been mapped accordingly. A copy of the summarised plot data, plot locations, species lists and credit reports for the impact site, mine rehabilitation and proposed offset sites are included at **Appendices H & I**.

When using the Biobanking methodology, the vegetation type that correlates with ‘Box – Gum Grassy Woodlands EEC’ in the Namoi Catchment Management Authority is, ‘White Box Grassy Woodlands of the Nandewar and Brigalow Belt South Bioregions’. The vegetation type that correlates with ‘Brigalow Woodland TEC’ is, ‘Brigalow – Belah Woodland of the Nandewar and Brigalow Best South Bioregions’.

Biobanking calculations have been undertaken to give an indication of the size of the offset required based on the level of improvement that could be expected under appropriate conservation management. The use of this figure provides a relatively accurate figure of the offset required for the LOM Project. For the area and condition of vegetation being impacted, **Table 12** indicates that an offset in the order of **650 hectares** would be required under the Biobanking methodology to meet the ‘improve or maintain’ requirements.

Table 12: Ecosystem Credits and Estimated Offset Requirements Using the Biobanking Assessment Methodology

VEGETATION TYPE NAME	CONDITION CLASS	CLEARED AREA (HA[1])	NO. OF CREDITS REQUIRED (Impact Site)	CREDITS REQUIRED / HA	AVERAGE NO. CREDITS GENERATED / HA (MOD-GOOD SITE)	OFFSET REQUIRED TO MEET IOM OUTCOME (HA)
White Box Grassy Woodland of the Nandewar and Brigalow Belt South Bioregions	4	58.5	3,826	65	11.06	345.9
White Box Grassy Woodland of the Nandewar and Brigalow Belt South Bioregions (Derived Native Grassland)[2]	3a	74.6	2,238	30	13.31	168.1
White Box Grassy Woodland of the Nandewar and Brigalow Belt South Bioregions (Derived Native Grassland)[3]	3b	60.7	1,821	30	13.31	136.8
Brigalow - Belah Woodlands on alluvial often gilgaied soil in the Nandewar and Brigalow Belt South Bioregions	4	0.35	16.8	48	10	1.68
Final Offset Requirements (TSC Act only)		**194.2**	**7,902**			**652.5**
Final Offset Requirements (EPBC Act only)		**133.2**	**6,080**			**515.7**

[1] The areas in this table do not match those in Appendix I, as the final impact areas were reduced during the assessment, as measures were implemented to 'avoid, reduce and offset'. However, the number of credits required per hectare of impact have been used to determine the final offset requirements.
2 Meets the TEC classification for both the EPBC Act and TSC Acts
3 Only meets the TEC classification for the TSC Act

8.3.3 Offset Calculations for loss of threatened fauna habitat at impact site

All of the threatened fauna species recorded at the impact site are classed as "ecosystem credits" in the Biobanking Methodology, that is, their offset requirements are calculated as part of the loss of vegetation. However, DECCW and DSEWPaC have requested that the loss of potential foraging habitat for the Regent Honeyeater be considered specifically.

The project will result in the loss of 58.5 ha of existing potential foraging habitat (Class 4) for the Regent Honeyeater. The proposed offset package includes the immediate permanent protection and long term management of 120 ha of intact (with canopy) White Box Grassy Woodlands of the Nandewar and Brigalow Belt South Bioregions and a further 447.7 ha of White Box Grassy Woodlands of the Nandewar and Brigalow Belt South Bioregions DNG. The DNG has been assessed as having moderate to high resilience and is already showing active canopy regeneration in the existing offset area. Under the proposed management of the LOM BOA (see section 8.5), this will protect a total of 567.7 ha of suitable foraging habitat in the medium to long term.

8.3.4 EPBC Act Offset Requirements

The principles for 'direct offsets' under the EPBC Act are generally consistent with the principles for offsets in NSW. Similarly, the DSEWPAC has no standard offset ratios for projects that impact on Matters of National Environmental Significance, instead using similar criteria to determine whether a proposed offset is adequate, i.e. area and condition of what is being impacted, conservation status and (at the determination stage) the social and economic benefits of the project. The DSEWPAC has, however, recently advised the NSW Government that it endorses the use of the Biobanking Methodology to consistently and transparently assess the size of offset required.

8.4 PROPOSED LOM PROJECT BIODIVERSITY AREA

The proposed LOM Project BOS has been developed in recognition of the indicative Biobanking calculations from the subject vegetation types, to compensate for the residual impacts of the LOM Project that cannot be ameliorated through avoidance and mitigation measures (**Section 7**).

The LOM Project BOS has been designed and selected to meet both Commonwealth and State offset principles (**Appendix J**) provides a summary of how the offset strategy meets these principles). The package includes a range of direct (land protection and management) measures to offset the impacts of the LOM Project.

The offset package incorporates 'like for like' EEC vegetation including Box-Gum Grassy Woodland and Derived Native Grasslands, other woodland vegetation in good condition providing extensive habitat features not available in the derived native grassland areas, and is in addition to the existing BOA of 362.5 ha.

The importance of any methods to 'offset' environmental impacts can be measured against the functionality and capacity to achieve outcomes for conservation that are not less than were available prior to the impact. One of the most important ways the LOM Project BOS would achieve this is through the creation of a final conservation corridor of over 1,655.2 ha, that is contiguous in the landscape and creates a migration link between two existing sub-regional corridors. These corridors run north-south on either side of the Project Site, and whilst they do maintain some linkage through two sub-regional riparian corridors (**Figure 21**), the vegetation along these corridors is often disjunct due to current land use including grazing pasture, cropping and golf courses. The width of these riparian corridors is often less than a few metres and they are often infested with exotic species including willows and lantana (**Figure 19**).

Figure 19: Golf Course and Weed Infestation along Werris Creek, a Sub-Regional Biodiversity Corridor

The conservation corridor provided by the proposed LOM Project BOS would provide a vegetated corridor up to 3 km wide at inception, and with increasing time and good management it would provide a consistent native woody passage between the sub-regional corridors.

A summary of the properties, their vegetation types, area and condition class that are included in the proposed LOM Project BOS, for management and enhancement to offset impacts to NSW listed EECs, are summarised in **Table 13a** and shown in **Figure 20**. **Table 13b** identifies the quantum of offsets to be included in the LOM Project BOS to address Matters of NES that will be impacted upon by the proposal, along with others expressedly identified by DSEWPaC for consideration.

The total area of conserved offset vegetation proposed is 779.6 ha across four properties/areas that are already owned by the Proponent. The offset area includes 567.7 ha of extant Box – Gum Grassy Woodland EEC and 211.9 ha of other, non EEC vegetation). In addition to this there would be 454.2 ha of additional rehabilitation works undertaken on the final landform (**Section 7**) and 59.3 ha on the offset properties (revegetation of currently cleared lands). When included with the current commitment of 362.5 ha already protected under the existing Werris Creek Coal Mine BOA, the total conservation corridor is approximately 1,655.6 ha.

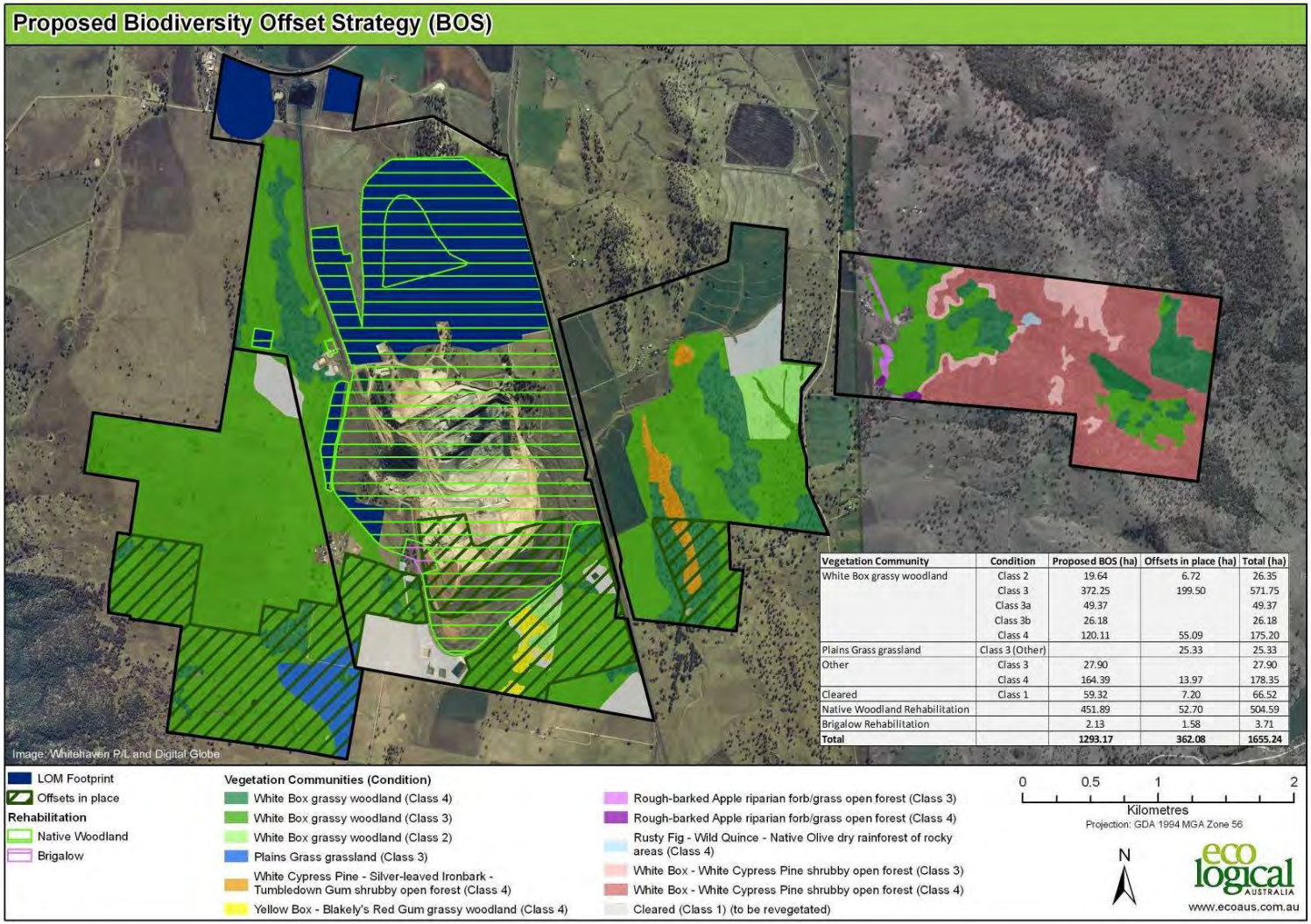
Table 13a: Proposed offsets for the impacts of the LOM Project

NSW						
PROPERTY	**WHITE BOX GRASSY WOODLAND**	**DERIVED NATIVE GRASSLAND**	**TOTAL TEC**	**OTHER VEGETATION (Cleared land)**	**TOTAL EXTANT VEGETATION**	**TOTAL OFFSET LANDS**
	Condition Class 4	**Condition Class 3**				
Railway View	44.2	101.3	145.5	29.6 (14.3)	175.1	189.4
Marengo	44.8	57	101.8	182.3	284.1	284.1
Mine (Project) Site	31	87.4	118.4	0 (35.2)	118.4	153.6
Eurunderee	0	202	202	0 (9.8)	202	211.8
Offset Totals	**120**	**447.7**	**567.7**	**211.9 (59.3)**	**779.6**	**838.9**
Impact Totals	**58.5**	**135.3**	**193.8**	**0 (N/A)**	**193.8**	
Offset Ratios	***2.1***	***3.3***	***2.9***		***4.0***	

Table 13b: Proposed offsets for the impacts of the LOM Project

Commonwealth							
Matters of National Environmental Significance (EPBC Act)	**Impact total**	**Offset Totals**					
		White Box Grassy Woodland		**Total TEC**	**Other Offset Vegetation (Cleared lands)**	**Total Offset Vegetation Extant**	**Total Offset Lands**
		Class 4	**Class 3a**				
Ecological Communities							
White Box – Yellow Box – Blakely's Red Gum Grassy Woodlands (White Box Grassy Woodland)	Class 4 = 58.5 Class 3a = 74.6	120.0	447.7	567.7	211.9 (59.3)	779.6	838.9
Brigalow	Class 4 = 0.35[4]						
Natural Grasslands on basalt and fine-textured alluvial plains of Northern NSW	0	N/A	N/A	N/A	N/A	N/A	N/A
Threatened Species							
Regent Honeyeater	Class 4 (White Box) = 58.5	120	447.7	567.7	211.9	331.9	838.9

4 A 'like for like' offset for this vegetation type was not available in the local area (i.e. within 10kms), so offsets are provided for as part of the total offset package.



Vegetation Community	Condition	Proposed BOS (ha)	Offsets in place (ha)	Total (ha)
White Box grassy woodland	Class 2	19.64	6.72	26.35
	Class 3	372.25	199.50	571.75
	Class 3a	49.37		49.37
	Class 3b	26.18		26.18
	Class 4	120.11	55.09	175.20
Plains Grass grassland	Class 3 (Other)		25.33	25.33
Other	Class 3	27.90		27.90
	Class 4	164.39	13.97	178.35
Cleared	Class 1	59.32	7.20	66.52
Native Woodland Rehabilitation		451.89	52.70	504.59
Brigalow Rehabilitation		2.13	1.58	3.71
Total		**1293.17**	**362.08**	**1655.24**

Figure 20: Location of Proposed Offset Properties and Revegetation Areas.

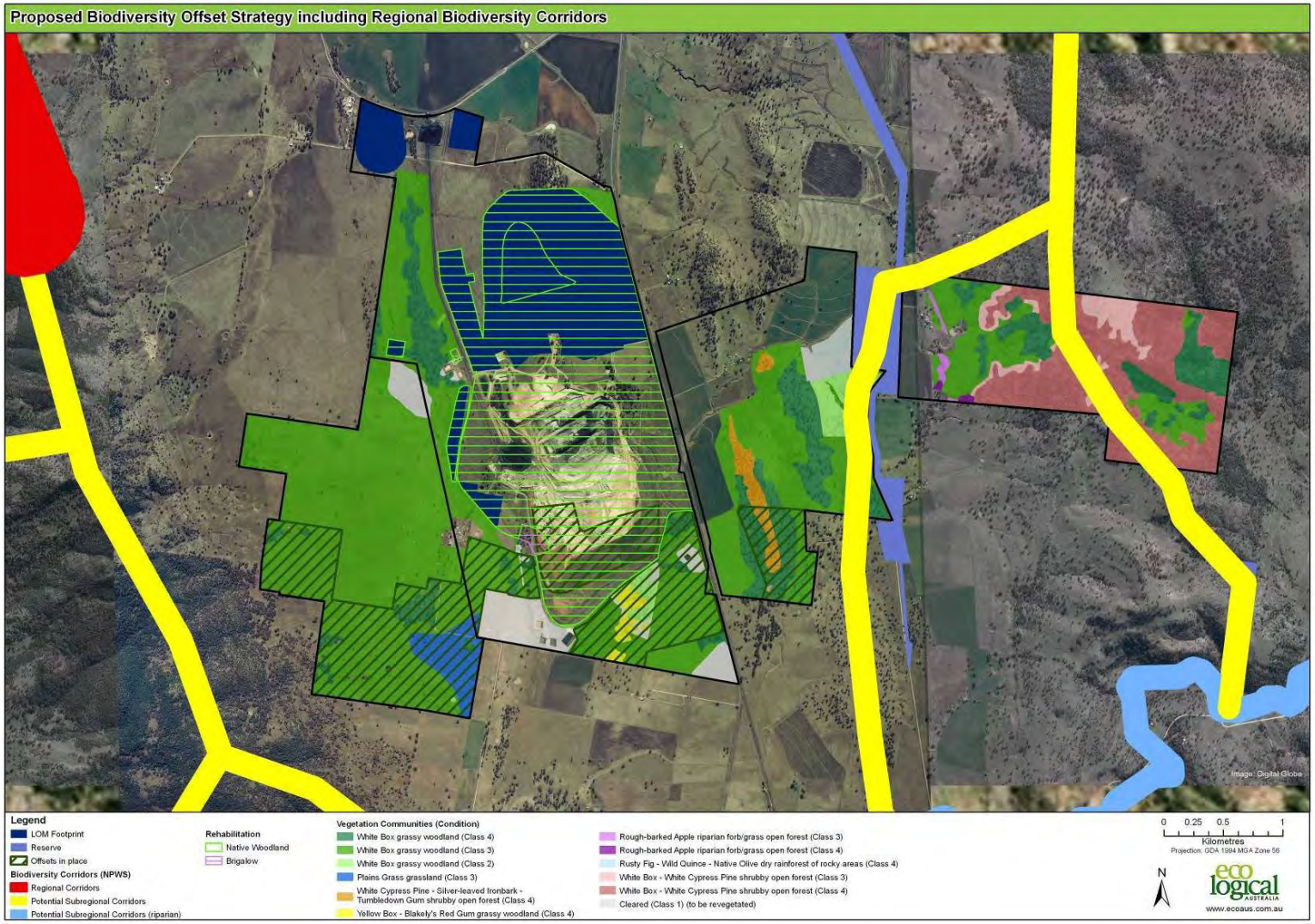


Figure 21: Regional Location of offset properties, Regional and Subregional Biodiversity Corridors.

The Biobank Assessments indicate that 7,902 credits are required for the 194.15 ha of impacts resulting from the proposed LOM Project. The proposed 838.9 ha Biodiversity Offset Area has been estimated to generate 10,212 credits of which 8,283 are for the White Box – Yellow Box – Blakely's Red Gum woodland community (**Table 14**). Based on these Biobanking calculations the "improve or maintain" test will be exceeded with surplus credits offsetting impacts to the 0.35 ha of Brigalow impacted on a "like for like" basis.

8.5 LONG TERM SECURITY AND MANAGEMENT OF PROPOSED LOM OFFSET AREAS

The objectives of the LOM BOA are to retain, enhance and reinstate endangered woodland vegetation adjacent to the Project Site, to provide suitable habitat for regionally significant threatened species, including the Regent Honeyeater, and provide and enhance landscape linkages to promote the movement of fauna in the local landscape.

The LOM BOA will be protected and managed in perpetuity via a conservation covenant placed on title (either a s.88B covenant under the *Conveyancing Act* 1919, a Voluntary Conservation Agreement under the *National Parks and Wildlife Act* 1974 or other appropriate covenant on title).

The Biodiversity Offset Management Plan for the existing and approved Biodiversity Offset Area will be expanded to include and address the proposed LOM offset areas.

The expanded BOA Management Plan will include a detailed description of the procedures to be applied within the offset area including erosion and sediment control, soil and water management, bushfire management, exclusion of domestic stock, weed management, retention of regrowth and native vegetation, retaining all dead timber and fallen logs, carrying out of infill planting with locally indigenous species where required, feral animal control, limiting human access and an annual review and reporting requirement.

The Biodiversity Offset Area Management Plan and its implementation will be independently reviewed every 5 years.

8.6 FLORA AND FAUNA MONITORING

A monitoring program to assess the improvement/enhancement of biodiversity values and condition of the BOA is proposed for a 20 year period. The monitoring program would be based on the collection of a detailed baseline flora and fauna inventory and continuation of the current monitoring program undertaken as part of the existing BOS. The full details of the monitoring project would be developed following approval of the proposed LOM Project BOS, and detailed in the revised BOA Management Plan.

8.7 PROPOSED OFFSET PROPERTIES

The proposed LOM Project BOS includes five properties currently owned by the Proponent (**Figure 20**). The fact that the offset properties are already owned by Werris Creek Coal Pty Ltd ensures that the offset can be secured. The properties have been selected for their proximity to the proposed impact site, the 'like for like' nature of the majority of the vegetation, the habitat attributes available and their landscape position between two sub-regional corridors providing a well vegetated east-west migration link in the landscape not currently available in the local area (**Figure 21**).

Table 14: Comparison of Credits Required for LOM Project and Credits Generated by LOM Project BOS

	Impact Site				Offset Site		
VEGETATION TYPE NAME	**Condition Class**	**Area (ha)**	**No. Credits Required (Impact Site)**	**Average Credits Requirement (/ha)**	**Area (ha)**	**Credits Generated**	**Average No. Credits generated (/ha)**
Brigalow - Belah Woodlands on alluvial often gilgaied soil in the Nandewar and Brigalow Belt South Bioregions	4	0.35	17	49	0.00	0	0.00
White Box Grassy Woodland of the Nandewar and Brigalow Belt South Bioregions	4	58.5	3,826	65	120.00	1,328	11.07
White Box Grassy Woodland of the Nandewar and Brigalow Belt South Bioregions	3a	74.6	2,238	30	447.70	5,961	13.31
White Box Grassy Woodland of the Nandewar and Brigalow Belt South Bioregions	3b	60.7	1,821	30			
White Box Grassy Woodland of the Nandewar and Brigalow Belt South Bioregions	2	0			19.64	252	12.83
White Box Grassy Woodland of the Nandewar and Brigalow Belt South Bioregions	1	0			59.30	742	12.51
White Box- White Cypress Pine - Silver-leaved ironbark shrubby open forest of the Nandewar Bioregion	4	0			152.10	1,605	10.55
White Box- White Cypress Pine - Silver-leaved ironbark shrubby open forest of the Nandewar Bioregion	3	0			24.85	262	10.54
Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion	4	0			1.28	14	10.94
Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion	3	0			13.05	37	2.84
Rusty Fig - Wild Quince- Native Olive dry rainforest of rocky areas of the Nandewar Bioregion	4	0			1.00	11	11.00
Total (Area/Credits)		**194.15**	**7,902**		**839**	**10,212**	**12.17**
Matching Credits					**646.64**	**8,283**	**12.81**

The following sub-sections provide a detailed description of each of these properties, the vegetation contained and contribution to the proposed LOM Project BOS.

8.7.1 Railway View

- Total Condition Class 4 – Box-Gum Grassy Woodland: 44.2 ha
- Total Condition Class 3 – Box-Gum Grassy Woodland DNG: 121.0 ha
- Total non-EEC vegetation: 29.6 ha
- Total vegetation: 194.8 ha
- (Additional vegetation already under offset covenant: 37.5 ha)

The "Railway View" property is currently under an existing lease / agistment arrangement and is wholly owned by the Proponent. A proportion of this property is under cultivation (oats), and the remainder is covered by both Box-Gum Grassy Woodland and DNG (**Figure 22**).

Figure 22: Box-Gum Grassy Woodland, including Derived Native Grassland on "Railway View" Property

The vegetation selected on this property has been chosen to complement an area of existing vegetation under conservation covenant towards the southern boundary, which includes 'Box-Gum Grassy Woodland', 'White Box – White Cypress Pine – Silver-leaved Ironbark Shrubby Open Forest' and 'Box-Gum Grassy Woodland – Derived Native Grasslands'. This covenanted area totals 37.5 ha, which includes 21.0 ha of Box-Gum Grassy Woodland EEC, 11.0 ha DNG EEC and 5.5 ha of other vegetation. The selected area of vegetation provides a link between the current and other proposed conservation lands to the west on the southern portion of the Project Site (Mine Site south), through to a travelling stock route and reserve to the east which is situated between "Railway View" and "Marengo" properties (Marengo is also proposed as an offset property in this package) (**Figure 23**).

8.7.2 Marengo Property

- Total Condition Class 4 – Box-Gum Grassy Woodland: 44.8 ha
- Total Condition Class 3 – Box-Gum Grassy Woodland DNG: 57.0 ha
- Total TEC: 101.8 ha
- Total non-TEC Vegetation: 182.3 ha
- Total vegetation available for offset: 284.1 ha

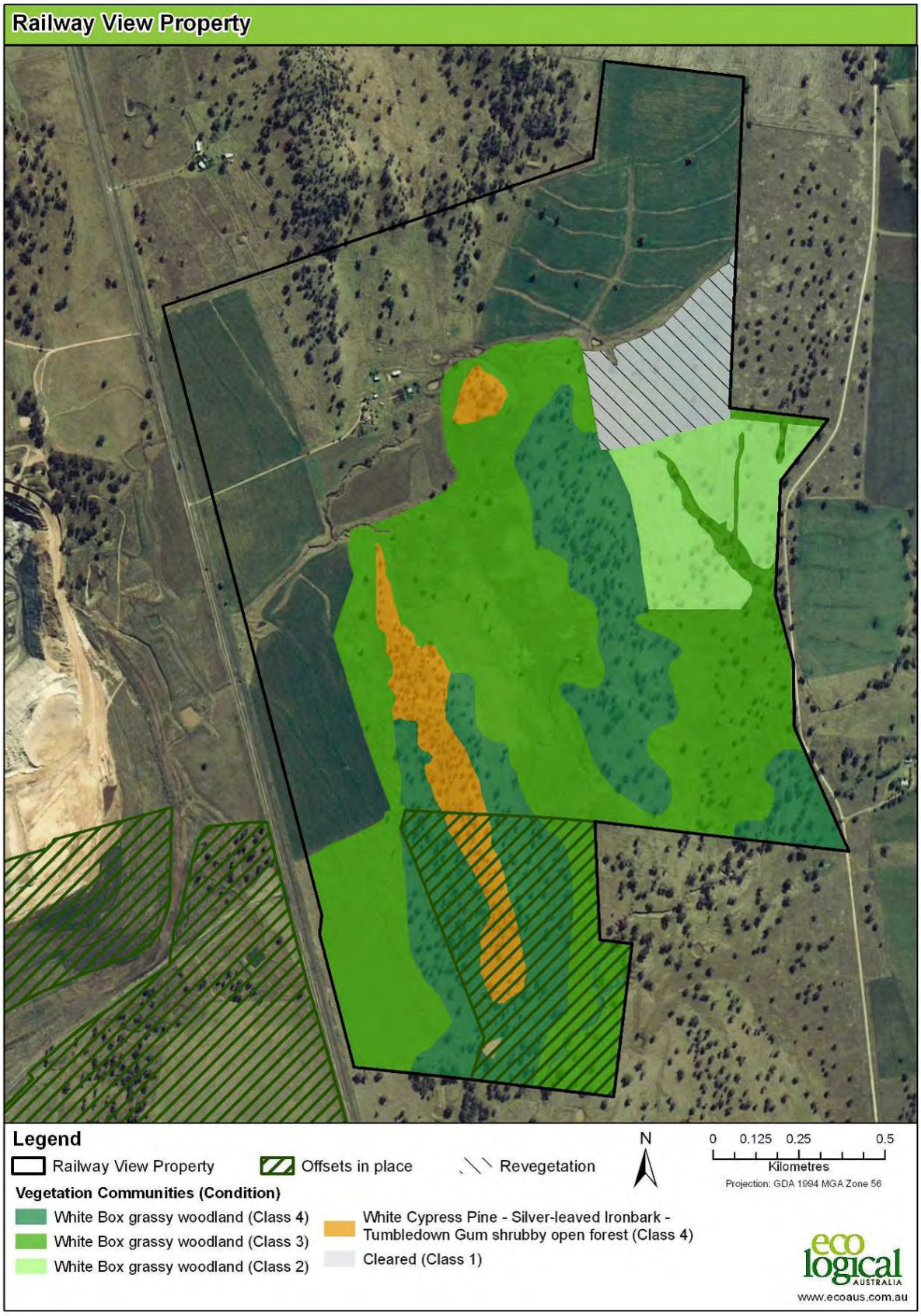


Figure 23: Existing Vegetation and Offset at the Railway View property, East of the Project Site

Vegetation mapping has been undertaken on this property, with five vegetation types identified, along with cleared lands in the west surrounding the homestead (ELA 2010) (**Figure** 26). The diversity of vegetation available on this property provides an opportunity to secure an array of habitat resources that are currently unsecured in the area and not readily available at the Project Site.

The "Marengo" property maintains approximately 44.8 ha of Box-Gum Grassy Woodland and 57 ha of Box-Gum Grassy Woodland DNG available for offset, though the majority of the vegetation on this property is White Box Shrubby Open Forest (Vegetation Type: White Box – White Cypress Pine – Silver-leaved Ironbark Shrubby Woodland). This vegetation type provides abundant habitat features including rocky substrates, stags with hollows, coarse woody debris, shrubby structural elements and tree species (Ironbark, White Box) across all age classes including some mature trees with small hollows (see **Figure 24**). The inclusion of this vegetation along with 'like for like' EEC vegetation, provides an increase in the size and continuity of the vegetated corridor between the two sub-regional corridors. It also provides an intermediate resource for hollows in the lieu time between the derived native grassland developing mature White Box and forming hollows. Securing this cohort of trees is important as a transitionary habitat.

There is also a small rainforest remnant found on the "Marengo" property, 'Rusty Fig – Wild Quince – Native Olive dry rainforest'. Although this community is not highly cleared and well reserved in the region, it provides important habitat for fauna including the Endangered Population, Australian Brush-turkey population in the Nandewar and Brigalow Belt South bioregions, along with other threatened species including Barking Owl, Black-striped Wallaby, Brown Treecreeper, Brush-tailed Rock-wallaby, Masked Owl, Speckled Warbler and Spotted-tailed Quoll. Notably, two threatened woodland birds, the Hooded Robin and Diamond Firetail, were observed on this property in July 2010 (see **Figure 25**).

8.7.3 Mine Site

- Total Box-Gum TEC Condition Class 4: 29 ha
- Total Box-Gum TEC Condition Class 3: 82.1 ha
- Total TEC: 111.1 ha

At the northern end of the Project Site, approximately 29 ha of woodland vegetation are to be retained along with 82.1 ha of derived native grassland. The areas of woodland maintain old growth White Box and Tumbledown Gum with hollows, and also provide a coarse woody debris resource for ground mammals and reptiles (see **Figure 27** and **Figure 29**). A reduction in the stocking rate in the woodland area to the west of the haul road has allowed for regrowth to occur and the diversity of ground forbs to re-establish. This part of the Project Site also maintains a rocky outcropping providing further habitat for ground dwelling fauna and reptiles. Currently two dams are in place on this section of the site which provides habitat for water birds including Australasian Grebe, Whistling Plumed Duck and White-faced Heron.

The majority of the vegetation on this part of the Project Site is derived native grassland, though with the removal of grazing pressure secured under covenant the area has the potential for recolonisation with local provenance tree and groundcover species. Recolonisation with plants of local provenance provides an important resource base of species genetically adapted to local conditions. It increases the success of revegetation projects (on adjacent lands) and decreases the risk of disrupting the local flora gene pool. A large proportion of this property would also be subject to rehabilitation upon closure of the mine and removal of the current infrastructure.

Figure 24: Habitat Features available on “Marengo” Property (Stags, Coarse Woody Debris and Rocky Substrates. The fourth image, looking west from “Marengo”, Shows the Connection across the Mine Site to the Western Ridgeline, Identified as a Sub-Regional Corridor (LPSC 2009)

Figure 25: Threatened Bird Species, Hooded Robin and Diamond Firetail, of the Marengo Offset Property

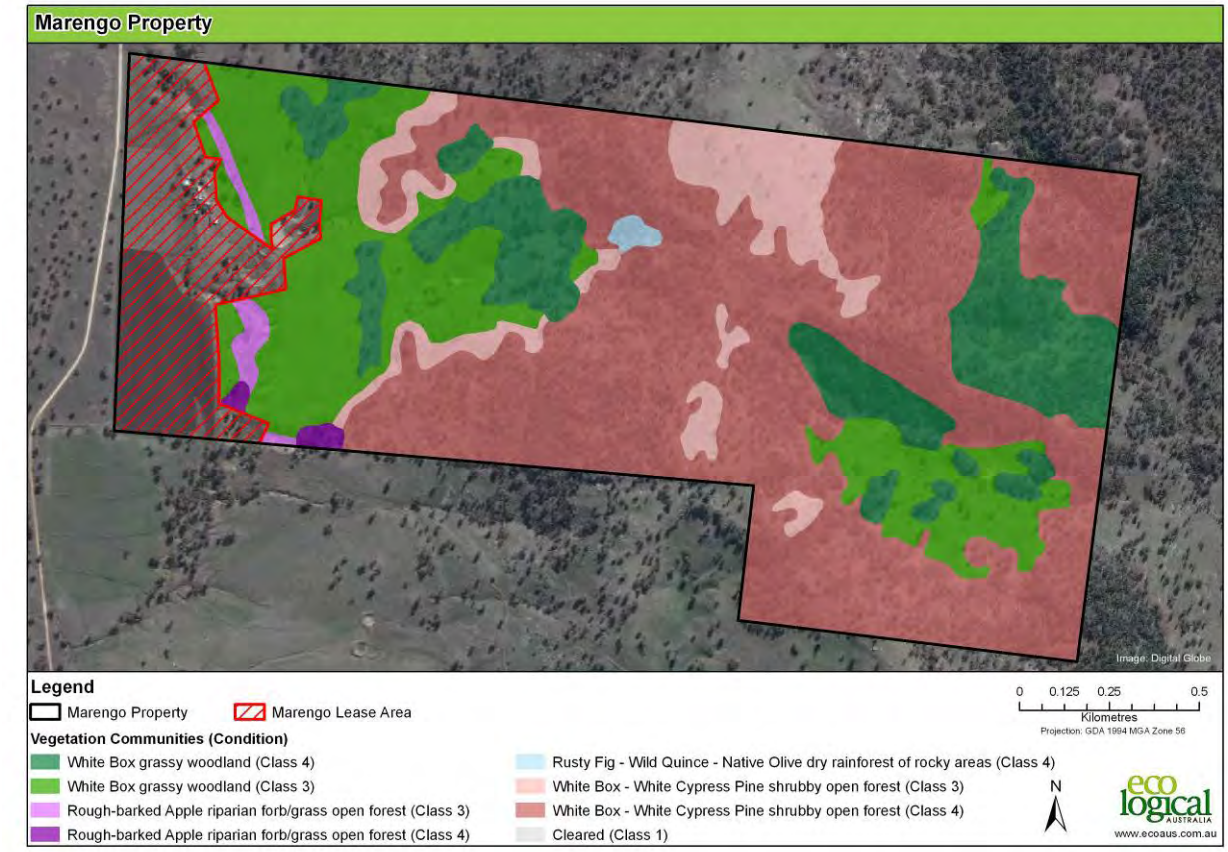


Figure 26: Vegetation on "Marengo" Property for Inclusion in BOS, Excluding Existing Lease Area

Figure 27: Water Habitat and Tumbledown Gum with Small Hollow, on the Mine Site North

The southern portion is also predominantly DNG, with the majority of the woodland vegetation included in the existing Werris Creek Coal Mine BOS (ELA 20010d). The remaining derived native grassland is available to increase the width of the corridor and allow for colonisation of Yellow Box from the adjacent woodland (**Figure 28** and **Figure 29**).

Figure 28: Yellow Box Woodland and Derived Native Grasslands on the Mine Site South

Rehabilitation of a proportion of this land would also be undertaken, using local provenance seed of species common to the Box-Gum Grassy Woodland TEC. The areas that would be the subject of rehabilitation are depicted as cleared lands in.

8.7.4 Eurunderee

- Total Box-Gum TEC Condition Class 4 0 ha
- Total Box-Gum TEC Condition Class 3 202.0 ha
- Total Vegetation available: 202.0 ha

A significant proportion of this property is currently under conservation covenant as part of the existing BOS, including woodlands and derived native grassland. This land provides the entry point into the proposed conservation corridor at its western edge. The already covenanted land provides a direct link to the sub-regional biodiversity corridor that runs along the western ridgeline (**Figure 21**), with grazing already removed from this land creating an opportunity for recolonisation of local understorey species and regrowth of White Box and other tree species.

Northern sections of the property (between Mine Site (north) and the current offset area on Eurunderee) are Box-Gum Grassy Woodland EEC derived native grasslands, though it is currently heavily grazed and not likely to conform to EPBC thresholds. Removal of stock or a reduction in stocking before the spring would provide best results for this vegetation to recolonise with native forbs and herbs. A large proportion of the site has been cultivated and is currently almost bare ground, with some scattered regrowth tussock grasses. These areas would need concentrated management to re-establish natural vegetation of any integrity.

8.8 BIODIVERSITY OFFSET STRATEGY

The proposed Biodiversity Offset Strategy (BOS) outlines a package of offsets, rehabilitation and other measures that are designed to achieve a net ecological gain and meet the policy positions (Offset principles) of both the State and Commonwealth governments. Most importantly, this LOM Project BOS would secure vegetation considered to be Critically Endangered nationally, and Endangered at the state level into conservation in perpetuity, and provide a conservation corridor designed to complement existing conservation lands that would also connect two existing sub-regional corridors.

Figure 29: Vegetation on the "Mine Site" Property for Inclusion in BOS, including the LOM Footprint Area, Existing BOS Area and Cleared Lands that would be Rehabilitated Post Mining

Figure 30: Derived Native Grasslands and Cleared Paddocks on “Eurunderee”

The vegetation that would form the direct offset portion of the package has already been secured under title by the Proponent, and significantly, is located in the immediate area adjacent to the LOM Project disturbance footprint. This vegetation would substantially increase the size of a corridor already conserved by the Proponent in the existing Werris Creek Coal Mine BOS; creating a vegetated linkage (including TEC) of 1,655.2 ha (~1200 ha of which would be under conservation covenant).

The rehabilitation of the final mine landform would add to this offset vegetation by creating more Box-Gum Grassy Woodland than currently exists in and around the Project Site, in areas that have not been able to regenerate due to past and existing land uses.

With the suite of direct offsets provided by this package, it is considered that the LOM Project BOS would provide a significant conservation outcome that meets both the ‘improve or maintain’ and the ‘no net loss’ policies of the State and Commonwealth Governments respectively.

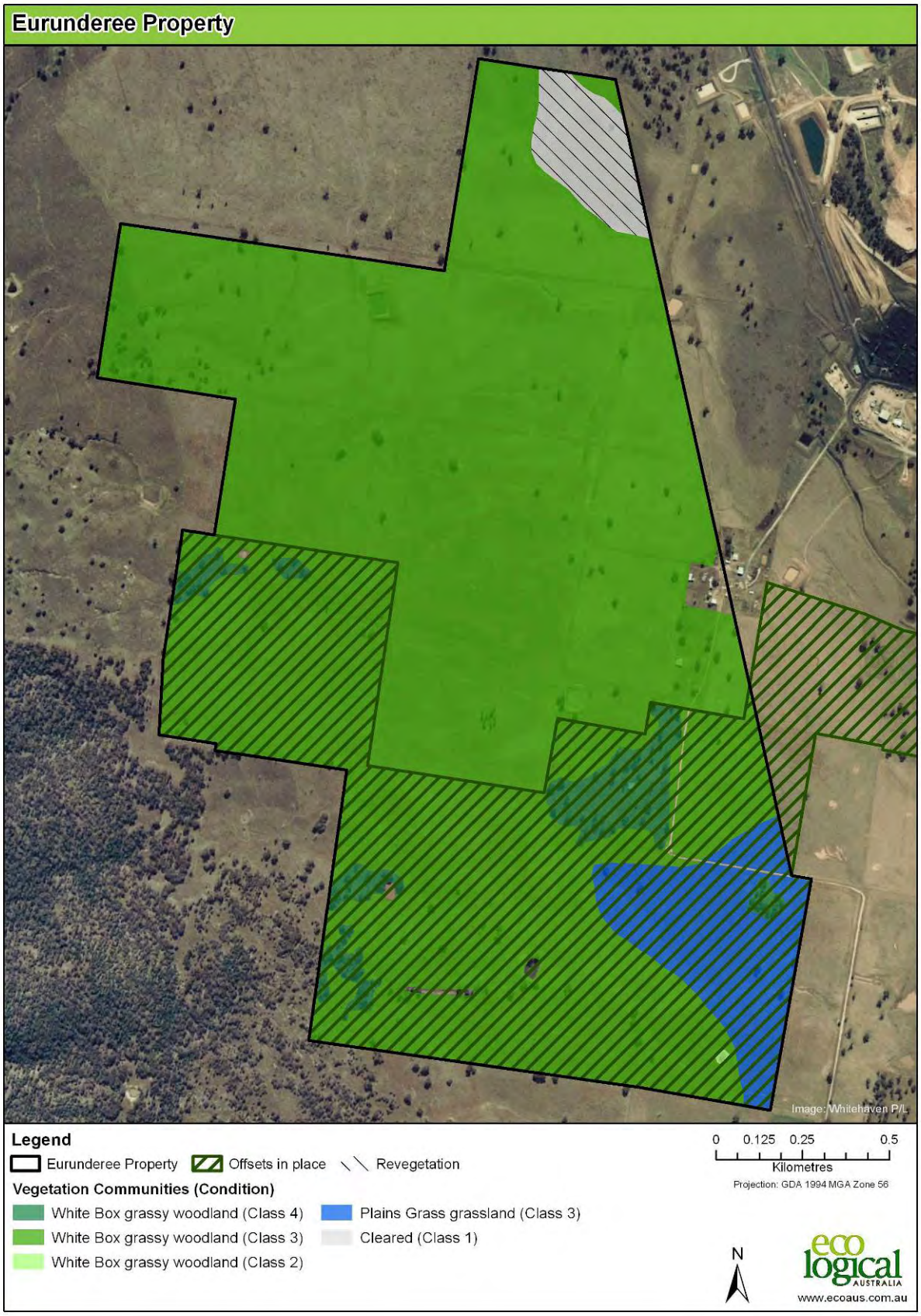


Figure 31: Vegetation on "Eurunderee" Property for Inclusion in LOM Project BOS, Including Existing BOS Area

9 Conclusions

The LOM Project would involve the removal of approximately 194 ha of woodland and derived native grassland vegetation. This includes 58.5 ha of White Box Grassy Woodland and 74.6 ha of derived native grassland listed as threatened under the NSW TSC Act 1995 and the Commonwealth EPBC Act 1999. A further 60.7 ha of the derived native grassland is listed as threatened under the NSW TSC Act 1995. An area of 0.35 ha of Brigalow woodland would also be removed, a threatened ecological community under both the TSC Act 1995 and the EPBC Act 1999.

Eight threatened species were recorded within the Project Site during the survey period 2004 to 2010, including four threatened birds: Little Eagle (*Hieraaetus morphnoides)*; Little Lorikeet (Glossopsitta pusilla), Hooded Robin (*Melanodryas cucullata*); and Brown Treecreeper (*Climacteris picumnus*), and four threatened microbats: Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*); Yellow-bellied sheath-tail Bat (*Saccolaimus flaviventris*); Eastern False Pipistrelle (*Falsistrellus. tasmaniensis*); and Greater Broad-nosed Bat (*Scoteanax rueppellii*). These species are all listed as 'vulnerable' under the TSC Act.

No threatened or migratory species listed under the EPBC Act recorded at the Project Site during the survey period 2004 to 2010. The supplementary DGR's issued to address Matters of National Environmental Significance (NES) (DoP 2010b) required the impacts on four threatened species, to be assessed: Regent Honeyeater (also a listed migratory species); Swift Parrot (Lathamus discolor); Finger Panic Grass (*Digitaria porrecta*) and *Prasophyllum* sp. Wybong. These threatened and migratory species were not recorded during the field surveys.

Impacts on these threatened species, threatened ecological communities and migratory species have been assessed in accordance with the NSW 'Draft Guidelines for Threatened Species Assessment' (DEC and DPI 2005) and the 'EPBC Act Policy Statement 1.1 – Significant Impact Guidelines Matters of National Environmental Significance' (CoA 2009). A statement addressing Section 5 of the Draft Guidelines is provided below.

Whether or not the proposal, including actions to avoid or mitigate impacts or compensate to prevent unavoidable impacts, will maintain or improve biodiversity values.

This report makes a number of key recommendations to achieve the 'maintain or improve' or 'no net loss' outcomes. These include: the avoidance of impacts (e.g. infrastructure placement; incremental clearing of vegetation; pre-clearing surveys; and undertaking clearing outside of the winter hibernation period for micro-bats); mitigation of impacts (through continual rehabilitation of the final landform and other cleared areas to a functional landscape; revegetation and placement of habitat features including dead standing and fallen timber as well as rocky substrates); and the offsetting of residual impacts through a comprehensive 840 ha Biodiversity Offset Strategy (Section 8).

Whether or not the proposal is likely to reduce the long-term viability, accelerate the extinction or place at risk of extinction, a local population of the species, population or ecological community.

The LOM Project is not likely to reduce the long-term viability, accelerate the extinction or place at risk of extinction, a local population of the species, population or ecological community for the following reasons.

- The species recorded at the Project Site consisted of common and vulnerable species only, i.e. no critically endangered or endangered species were recorded.
- Of the seven vulnerable species recorded, three were birds that are considered to have sufficient resources available to them in the area to adequately adapt to the proposed impacts, and with the implementation of the LOM Project BOS would result in a net gain in resources available to these species throughout the conservation corridor that would be created.
- Other vulnerable species recorded within the Project Site included one cave dwelling bat for which no roosting habitat is present on the Project Site, and three hollow dependant bats that would suffer a periodic loss of habitat. Actions to be undertaken to minimise any impacts to these bat species include pre-clearance surveys and pre-winter clearing of hollow bearing trees.
- Due to the highly mobile nature of these bat species, there is ample habitat available to them in the local area.
- The LOM Project BOS provides a 'net gain outcome' in terms of the extent of threatened ecological communities. This conservation outcome is secured through a covenant on the land title.

Whether or not the proposal will adversely affect critical habitat.

There is no critical habitat declared for any threatened ecological communities or species at or in the vicinity of the Project Site.

Statement of Commitments

As discussed above, the impacts of the LOM Project would be ameliorated through avoidance and mitigation measures, complimented by the LOM Project BOS in order to achieve a 'no net loss' outcome. The Proponent is committed to the following actions in order to ensure this outcome.

- Preparation of a comprehensive Rehabilitation Management Plan.
- Preparation of a Management Plan for the nominated Biodiversity Offset Strategy (Section 8);
- Annual reporting of the LOM Project BOS flora and fauna monitoring program (Section 8);
- Pre-clearing surveys undertaken outside of winter months to avoid potential mortality of hibernating microbats in tree hollows (Section 7).
- Securing the LOM Project BOS under covenant on land title (Section 8).

As discussed throughout this report, the LOM Project has incorporated all feasible measures to avoid and mitigate the impacts on biodiversity. Where biodiversity impacts were unavoidable, a comprehensive Biodiversity Offsets Strategy has been developed to offset these impacts. With the suite of direct offsets provided by this package, it is considered that the biodiversity offsets strategy would provide a significant conservation outcome that meets both the 'improve or maintain' and the 'no net loss' policies of the State and Commonwealth Governments. As a result of these amelioration measures, the LOM Project is not considered to have a significant impact on threatened or migratory species, or threatened ecological communities, listed under either the NSW TSC Act 1995 or the Commonwealth EPBC Act 1999.

Glossary

TERM	DEFINITION
accredited assessor	A person who has been accredited in accordance with s. 142B(1)(c) of the TSC Act to use the methodology and credit calculator.
benchmarks	(vegetation benchmarks) Quantitative measures of the range of variability in vegetation condition where there is relatively little evidence of modification by humans since European (post-1750) settlement. Benchmarks are defined for specified variables for vegetation communities. Vegetation with relatively little evidence of modification generally has minimal timber harvesting (few stumps, coppicing, cut logs), minimal firewood collection, minimal exotic weed cover, minimal grazing and trampling by introduced or overabundant native herbivores, minimal soil disturbance, minimal canopy dieback and no evidence of recent fire or flood. It is not subject to high-frequency burning and has evidence of recruitment of native species. Benchmarks are available by vegetation class (*sensu* Keith 2004) at http://www.environment.nsw.gov.au/projects/BiometricTool.htm and can also be obtained from reference sites or published sources
biodiversity credits	Ecosystem or species credits required to offset the loss of biodiversity values on development sites or created on biobank sites from management actions that improve biodiversity values.
biodiversity values	Include composition, structure and function of ecosystems, and include (but are not limited to) threatened species, populations and ecological communities and their habitats, as defined by the TSC Act, and exclude fish or marine vegetation, unless that fish or marine vegetation has been the subject of an order under s. 5A of the TSC Act.
Box-Gum Grassy Woodland TEC	Collective term used to refer to the threatened ecological community, 'White Box – Yellow Box – Blakely's Red Gum Woodland and Derived Native Grassland', as per the definitions under the EPBC and TSC Acts.
Condition Class 4	Both a native understorey (> 50% native species ground cover) and an overstorey of eucalypts exist in conjunction.
Condition Class 3	A native understorey (> 50% native species ground cover) exists, but the trees have been cleared
Condition Class 2	An overstorey of eucalypt trees exists (varying densities), but there is no substantial native understorey (< 50% native species ground cover).
Condition Class 1	Cleared land used for cropping or rural infrastructure (trees cleared, ground cover < 50% native species ground cover)
cleared land	Where the native over-storey has been cleared, there is no native mid-storey (or the native mid-storey has been cleared), and less than 50% of the ground cover vegetation is indigenous species or greater than 90% of the ground cover (dead or alive) is cleared.
CMA area.	The area of operation of a catchment management authority, as described in Schedule 2 of the *Catchment Management Authorities Act 2003*
CMA sub-region	Sub-regions of catchment management authority areas as set out in the Environmental Outcomes Assessment Methodology, *Native Vegetation Regulation 2005*.
condition class	A measure of species diversity and integrity pertaining to the 'benchmark' state of that community, further defined in Section XX.
Credit Calculator	A computer program that applies the methodology and calculates the number and classes of credits required at a development site or created at a biobank site.
critically endangered ecological community	As defined in s. 4(1) of the TSXC Act and any additional critically endangered ecological communities listed under Part 13 of the EPBC Act.

derived native grassland	A vegetation type cleared of overstorey species that now maintains a grassland structure, 'derived' from the former structural definition, e.g. woodland, forest etc.
ecosystem credits	The class of biodiversity credits created or required for the impact on general biodiversity values and some threatened species, i.e. for biodiversity values except threatened species or populations that require species credits. Species that require ecosystem credits are listed in the Threatened Species Profile Database (TSPD).
endangered ecological community	As defined in s. 4(1) of the TSC Act and any additional endangered ecological communities listed under Part 13 of the EPBC Act. Endangered and critically endangered ecological communities are collectively referred to as EECs.
habitat	An area or areas occupied, or periodically or occasionally occupied, by a species, population or ecological community, including any biotic or abiotic component.
Local area	Defined as a 10 km radius from the Project Site or Study Area
Locality	See local area
Mine site	See Project Site
moderate to good condition vegetation	Native vegetation that is not in low condition.
Project Site	Defined by the existing Mining Lease (ML) 1563 and additional areas: • bounded by ML 1563, Escott Road and Werris Creek Road (to incorporate the LOM Project open cut and overburden emplacement extension); and • an area to the west and southwest of the Rail Load-out Facility (to incorporate a proposed 'turn-around loop').
Rehabilitation	Land that is to be reconstructed from the ground up, i.e., revegetation of the final landform.
Revegetation	Cleared land (as per above definition) that is to be replanted with local provenance grasses/trees.
Study Area	Defined as the Project Site
The Proponent	Werris Creek Coal Pty Ltd
Threatened species	Critically endangered, endangered or vulnerable threatened species and populations as defined in s. 4(1) of the TSC Act; or any additional threatened species listed under Part 13 of the EPBC Act as critically endangered, endangered or vulnerable.
Vegetation type	The finest level of classification of native vegetation used in the methodology. Vegetation types are assigned to vegetation classes, which in turn are assigned to vegetation formations. There are approximately 1,600 vegetation types within NSW.

References

AECOM (2010) Draft Landscape Management Plan – Werris Creek Coal Mine. Prepared for Whitehaven Coal by AECOM Pty Ltd (www.aecom.com).

ARMCANZ and ANZECC (1996) Allocation and use of groundwater. A National Framework for Improved Groundwater Management in Australia. Occasional Paper no. 2.

Benson, J.S., Allen, C.B., Togher, C. and Lemmon, J. (2006) New South Wales Vegetation Classification and Assessment: Part 1 Plant communities of the NSW Western Plains. *Cunninghamia* **9** (3): 383-450.

BOCA (2002) A field guide to Australian Birdsong – Rainbow Lorikeet to Grass Owl. Compiled and edited by Howard Plowright for the Bird Observers Club of Australia, Victoria.

BOM (2010) Bureau of Meteorology website: Accessed, between April and Sept, 2010: www.bom.gov.au

CES (2004). Fauna Assessment, proposed Werris Creek Mine. Report prepared for Werris Creek Coal Mine Pty Ltd by Countrywide Ecological Services, Hornsby NSW.

CES (2008 and 2009). Fauna Monitoring Werris Creek Feb-March 09. Report prepared for Werris Creek Coal Pty Ltd by Countrywide Ecological Services, Hornsby NSW.

CoA (2009). Significant Impact Guidelines 1.1 – Matters of National Environmental Significance. Department of Environment, Water, Heritage and the Arts, Commonwealth of Australia, Canberra.

CoA (2007)

Debus, S. (1995). Surveys of large forest owls in northern New South Wales: methodology, calling behaviour and owl responses. *Corella* **19**, pp. 38-50.

DEC (2004) Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities – Working Draft. NSW Department of Environment and Conservation

DEC and DPI (2005) Draft Guidelines for Threatened Species Assessment under Part 3A, *Environmental Planning and Assessment Act 1979*. NSW Department of Environment and Conservation and the NSW Department of Primary Industries.

DECC (2008) BioBanking Assessment Methodology and Credit Calculator Operational Manual. NSW Department of Environment and Climate Change, Sydney.

DECCW (2009) Biometric Vegetation Types Database. Accessed, April 2010: http://www.environment.nsw.gov.au/projects/BiometricTool.htm

DECCW (2010a) Atlas of NSW Wildlife. Accessed June 2010:
http://wildlifeatlas.nationalparks.nsw.gov.au/wildlifeatlas/watlas.jsp

DECCW (2010b) Vegetation Benchmarks Database. Accessed, June 2010:
http://www.environment.nsw.gov.au/biobanking/vegbenchmarkdatabase.htm

DEWHA (2010a) Japan – Australia Migratory Bird Agreement / China – Australia Migratory Bird Agreement, accessible at:
http://www.environment.gov.au/biodiversity/migratory/index.html

DEWHA (2010b) Protected Matters Search Tool. Accessed June 2010:
http://www.environment.gov.au/erin/ert/epbc/index.html

DEWHA (2010c) Survey Guidelines for Threatened Bats. Guidelines for detecting bats listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999*. Commonwealth Department of Environment, Water, Heritage and the Arts, Canberra.

DEWHA (2010d) Survey Guidelines for Threatened Birds. Guidelines for detecting birds listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999*. Commonwealth Department of Environment, Water, Heritage and the Arts, Canberra.

DLWC (2001) Soil Landscape Summaries of the Tamworth 1:100 000 Sheet. Edited by R. G. Banks, Gunnedah Research Centre, NSW Department of Land and Water Conservation, Gunnedah.

DLWC (2003) Namoi Catchment – A blueprint for the future. NSW Department of Land and Water Conservation.

DLWC (2004) Groundwater Dependant Ecosystem Policy. A component Policy of the NSW State Groundwater Policy Framework Document. NSW Dept. of Land and Water Conservation.

DoP (2010a) Werris Creek Life of Mine Project (MP 10_0059) Director-General's Requirements for Environmental Assessment under Part 3A of the *Environmental Planning and Assessment Act 1979*. NSW Department of Planning, Sydney.

DoP (2010b) Werris Creek Life of Mine Project (MP 10_0059). Supplementary Director-General's Requirements for Environmental Assessment under Part 3A of the *Environmental Planning and Assessment Act 1979*. NSW Department of Planning, Sydney.

Eamus, D. and Froend, R. (2006). Groundwater-dependent ecosystems: the where, what and why of GDEs. *Australian Journal of Botany*, **54** pp 91-96.

Eamus, D., Froend, R., Loomes, R., Hose, G. and Murray, B. (2006). A functional methodology for determining the groundwater regime needed to maintain the health of groundwater-dependent vegetation. *Australian Journal of Botany*, **54**, pp 97-114.

Eco Logical Australia (2009a) A vegetation map for the Namoi Catchment Management Authority. Report prepared for the Namoi CMA (Project No. 125-004), by Eco Logical Australia, Coffs Harbour.

Eco Logical Australia (2009b) Werris Creek Coalmine – Pre-clearing survey. A report prepared for Whitehaven Pty Ltd, by Eco Logical Australia, Newcastle.

Eco Logical Australia (2009c) Vegetation of the Railway View Property, Werris Creek, NSW. A report prepared for Whitehaven Pty Ltd, by Eco Logical Australia, Armidale.

Eco Logical Australia (2009d) Vegetation of the Marengo Property, Werris Creek, NSW. A report prepared for Whitehaven Pty Ltd, by Eco Logical Australia, Armidale.

ELA (2009e) Biobank Credit Assessment Report Whitehaven Coal Regional Biobank Site. Report prepared for Whitehaven Coal Pty Ltd by Eco Logical Australia Pty Ltd, Sutherland NSW.

Eco Logical Australia (2009f) A pre-European vegetation map for the Namoi Catchment Management Authority. Report prepared for the Namoi CMA (Project No. 125-009), by Eco Logical Australia, Coffs Harbour.

Eco Logical Australia (2010a) Biodiversity Strategy, Liverpool Plains Local Government Area. A project undertaken for the Liverpool Plains Shire Council, by Eco Logical Australia, Coffs Harbour.

Eco Logical Australia (2010b) Werris Creek Coal Mine Life of Mine Project – Biodiversity Impact Assessment. Report for Werris Creek Coal Pty Ltd, Eco Logical Australia, Sutherland NSW.

Eco Logical Australia (2010c) Werris Creek Coal Mine – Pre-clearing fauna surveys. A report prepared for Whitehaven Coal Ltd by Eco Logical Australia, Newcastle, NSW.

Eco Logical Australia (2010d) Regional Vegetation Community profiles of the Namoi Valley. A project undertaken for the Namoi Catchment Management Authority.

Eco Logical Australia (2010e) Draft Biodiversity Offsets Management Plan for Werris Creek Coal Mine. Prepared for Werris Creek Coal Pty Ltd by Eco Logical Australia, Sutherland NSW. (Draft currently being assessed by NSW Dept. Of Planning).

Eco Logical Australia (2010f) Referral of Proposed Action to the Minister of Environment Under the Environment *Protection and Biodiversity Conservation Act 1999.* Report prepared for Werris Creek Coal Pty Limited by Eco Logical Australia, Sutherland.

Ecotone (2009). Fauna Impact Assessment of the Proposed Modification to the Werris Creek Coal Mine. Report prepared for Werris Creek Coal Pty Ltd by Ecotone Ecological Consultants, Waratah NSW.

GCNRC (2004a), Soils Assessment for the Proposed Werris Creek Coal Mine. Prepared on behalf of Werris Creek Coal Pty Limited - Part 4 of the Specialist Consultant Studies Compendium Geoff Cunningham Natural Resource Consultants Pty Ltd.

GCNRC (2004b), Flora Assessment for the Proposed Werris Creek Coal Mine. Prepared on behalf of Werris Creek Coal Pty Limited - Part 4 of the Specialist Consultant Studies Compendium. Geoff Cunningham Natural Resource Consultants Pty Ltd

GCNRC (2005). Flora and Fauna Management Plan for the Werris Creek Coal Mine. Report prepared for Werris Creek Coal Mine Pty Ltd by Geoff Cunningham Natural Resource Consultants, Killara NSW.

GCNRC (2009), Flora Assessment for the Proposed Modification to the Werris Creek Coal Mine. Prepared on behalf of Werris Creek Coal Pty Limited - Part 4 of the Specialist Consultant Studies Compendium. Geoff Cunningham Natural Resource Consultants Pty Ltd.

GSS Environmental (in press), Site Water Management Plan for the Proposed Werris Creek Coal Mine. Prepared on behalf of Werris Creek Coal Pty Limited.

Hatton, T. and Evans, R. (1998). Dependence of Ecosystems on Groundwater and its Significance to Australia. LWRRDC Occasional Paper No. 12/98. LWRRDC, Canberra.

Hoser, R. T. (1989). Australian Reptiles & Frogs. Pierson, Mosman.

Isbell, R.F. 1962 Soils and Vegetation of the Brigalow Lands, Eastern Australia. Soils and Land Use Series No. 43, Division of Soils, CSIRO.

Johnson, R.W., 1964. Ecology and Control of Brigalow in Queensland. Queensland Department of Primary Industries, Brisbane.

Koehn, J.D., Brierley, G.J., Cant B.L. and Lucas, A.M. 2001. River Restoration Framework. Land and Water Australia Occasional Paper 01/01.

Landcom (2004) Managing Urban Stormwater: Soils and Construction, Volume 1 4th Edition. Department of Housing, NSW, Sydney.

Law, B. S., Anderson, J., and Chidel, M. (1999). Bat communities in a fragmented forest landscape on the south-west slopes of New South Wales, Australia. Biological Conservation 88, 333-345.

Lloyd, A.M., Law, B.S., and Goldingay, R. (2006) Bat activity on riparian zones and upper slopes in Australian timber production forests and the effectiveness of riparian buffers. Biological Conservation 129, 207-220.

McDonald, R.C., Isbell, R.F., Speight, J.G., Walker, J. & Hopkins, M.S. (1990) (2nd edn), Australian Soil and Land Survey Field Handbook, Inkata Press, Melbourne & Sydney.

McKenzie, N. L., Stuart, A. N., and Bullen, R. D. (2002). Foraging ecology and organisation of a desert bat fauna. Australian Journal of Zoology 50, 529-548.

Mills, D. J., Norton, T. W., Parnaby, H. E., Cunningham, R. B., and Nix, H. A. (1996). Designing surveys for microchiropteran bats in complex forest landscapes - a pilot study from south-east Australia. Special issue: Conservation of biological diversity in temperate and boreal forest ecosystems 85, 149-161.

Mitchell PB. (2002) NSW ecosystems study: background and methodology. Unpublished report to the NSW National Parks and Wildlife Service, Hurstville.

NCMA (2007) Namoi Catchment Action Plan (CAP). Namoi Catchment Management Authority, Tamworth.

NPWS (1995) Endangered Fauna of Western New South Wales, NSW National Parks and Wildlife Service, Hurstville.

NSWSC (1996 – 2010) Final determinations to list threatened species, populations and ecological communities, NSW Scientific Committee. Available at: http://www.environment.nsw.gov.au/determinations/

Office of Water (2009). Namoi Catchment – 2008 Depth to Water Table Map Report. Prepared by Office of Water, Department of Environment, Climate Change and Water, NSW.

Parnaby, H. (1992). An interim guide to identification of insectivorous bats of south-eastern Australia. Technical Reports of the Australian Museum Number 8.

Pennay, M., Law, B., and Rhinhold, L. (2004). Bat calls of New South Wales: Region based guide to echolocation calls of Microchiropteran bats. NSW Department of Environment and Conservation, Hurstville.

PWS (1996) Coepolly No.2 Dambreak Study. NSW Department of Public Works and Services.

RCA (2010) DRAFT Groundwater Impact Assessment of the Proposed Werris Creek Coal Mine Life of Mine Project. A report prepared by Robert Carr and Associates for Werris Creek Coal Pty Ltd.

Reader Digest (1986) The Complete Book of Australian Birds. 345 pages. Readers Digest, Surrey Hills NSW.

Reinhold, L., Law, B., Ford, G., and Pennay, M. (2001). Key to the bat calls of south-east Queensland and north-east New South Wales. Queensland, DNR.

Ringrose-Voase, A.J., Young, R.R., Paydar, Z., Huth, N.I., Bernardi, A.L., Cresswell, H.P., Keating, B.A., Scott, J.F., Stauffacher, M., Banks, R.G., Holland, J.F., Johnston, R.M., Green, T.W., Gregory, L.J., Daniells, I., Farquharson, R., Drinkwater, R.J., Heidenreich, S. and Donaldson, S. 2003. Deep Drainage under Different Land Uses in the Liverpool Plains Catchment. Report 3, Agricultural Resource Management Report Series. NSW Agriculture.

RWC (2010) Environmental Assessment for the Proposed Werris Creek Coal Mine Life of Mine Project. Prepared for Werris Creek Coal Pty Ltd by R. W. Corkery and Co. Pty Ltd, Orange.

Sivertsen, D. (2009) Native Vegetation Interim Type Standard, Department of Environment, Climate Change and Water NSW, Sydney.

SKM (2010) Mapping Groundwater Dependant Ecosystems in the Namoi Catchment – Application of Sebal Remotely Sensed evapotranspiration measurement. A report prepared by Sinclair-Knight-Merz for the Namoi Catchment Management Authority.

Stewart, D. (2007) Nocturnal Bird & Mammal Calls of North East-NSW. Call playback CD. Naturesound: www.naturesond.com.au.

TSSC (2006) Advice to the Minister for the Environment and Heritage from the Threatened Species Scientific Committee (TSSC) on Amendments to the List of Ecological Communities under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). Available at: www.environment.gov.au/biodiversity/threatened/communities/pubs/box-gum.pdf

Appendix A: Director General's Requirements

NSW GOVERNMENT | Planning

Major Projects Assessment
Mining and Industry Projects
Phone: 02 9228 6587
Fax: 02 9228 6466
Email: paul.freeman@planning.nsw.gov.au

Our Ref: S03/03677

Mr Brian Cullen
General Manager - Technical Services
Werris Creek Coal Pty Limited
PO Box 125
WERRIS CREEK NSW 2341

Dear Mr Cullen,

Werris Creek Life of Mine Project (MP 10_0059)
Director-General's Requirements

The Department has received your application for the Werris Creek Life of Mine Project.

The Director-General's requirements for the project are attached. These requirements have been prepared in consultation with relevant agencies, based on the information you have provided to date. I have also attached a copy of the agencies' comments for your information.

Please note that the Director-General may alter these requirements at any time.

If your proposal is likely to have a significant impact on matters of National Environmental Significance, it will require an approval under the Commonwealth *Environment Protection Biodiversity Conservation Act 1999* (EPBC Act). This approval is in addition to any approvals required under NSW legislation. It is your responsibility to contact the Department of Environment, Water, Heritage and the Arts in Canberra (6274 1111 or http://www.environment.gov.au) to determine if the proposal requires an approval under the EPBC Act. If it is subsequently determined that an approval is required under the EPBC Act, please contact the Department of Planning immediately as supplementary Director-General's requirements may need to be issued.

I would appreciate it if you would contact the Department at least two weeks before you propose to submit your EA for the project. This will enable the Department to:

- determine the applicable fee (see Division 1A, Part 15 of the *Environmental Planning and Assessment Regulation 2000*); and
- confirm the number of copies (hard-copy and CD-ROM) of the Environmental Assessment (EA) that will be required for exhibition purposes.

Once it receives the EA, the Department will review it in consultation with the relevant agencies to determine if it adequately addresses the Director-General's requirements, and may require you to revise it prior to public exhibition.

The Department is required to make all the relevant information associated with the project publicly available on its website. Consequently, I would appreciate it if you would ensure that all the documents you subsequently submit to the Department are in a suitable format for the web, and arrange for an electronic version of the EA to be hosted on a suitable website.

If you have any enquiries about these requirements, please contact Paul Freeman.

Yours sincerely

Kitto 29/6/10

David Kitto
Director
Mining and Industry Projects
As delegate for the Director-General

Director-General's Requirements

Section 75F of the *Environmental Planning and Assessment Act 1979*

Application Number	MP 10_0059
Project	The Werris Creek Life of Mine project, which includes: • extending the existing open cut pit in a northerly direction; • increasing the maximum coal production rate from 2.0 million tonnes per annum (Mtpa) of run-of-mine (ROM) coal to 2.5 Mtpa; • crushing and screening this coal on-site; • transporting product coal by rail to the Port of Newcastle for export; • increasing the amount of coal able to be transported by road to domestic markets from 50,000 tonnes per annum (tpa) to 100,000 tpa; • relocating existing coal processing infrastructure and administrative facilities to the west of the proposed pit extension; • constructing new coal handling and transportation infrastructure and a rail loop from the Werris Creek Rail Siding; • increasing the storage capacity of both the existing ROM coal pad and the product coal stockpile area; • extending the existing out-of-pit overburden emplacement area and constructing an acoustic and visual amenity bund; • constructing a new entrance to the mine off Escott Road and upgrading the Escott Road/Werris Creek Road intersection; • increasing the hours of operation to 24 hours a day, 7 days a week; and • rehabilitating the site.
Location	Werris Creek, 11 kilometres north of Quirindi.
Proponent	Werris Creek Coal Pty Limited.
Date of Issue	29 June 2010.
General Requirements	The Environmental Assessment of the project must include: • an executive summary; • a detailed description of the project, including: – need for the project; – alternatives considered, including justification for the proposed mine plan; and – various stages of the project; • a risk assessment of the potential environmental impacts of the project, identifying the key issues for further assessment; • a detailed assessment of the key issues specified below, and any other significant issues identified in the risk assessment (see above), which includes: – a description of the existing environment, using sufficient baseline data; – an assessment of the potential impacts of the project, including any cumulative impacts, taking into consideration any relevant guidelines, policies, plans and statutory provisions (see below); and – a description of the measures that would be implemented to avoid, minimise and if necessary, offset the potential impacts of the project, including detailed contingency plans for managing any significant risks to the environment; • a statement of commitments, outlining all the proposed environmental management and monitoring measures; • a conclusion justifying the project on economic, social and environmental

	grounds, taking into consideration whether the project is consistent with the objects of the *Environmental Planning & Assessment Act 1979*; and • a signed statement from the author of the Environmental Assessment, certifying that the information contained within the document is neither false nor misleading.
Key Issues	• **Soil and Water** – including: – a detailed site water balance, including a description of site water demands, water supply and disposal methods; – detailed modelling and assessment of potential impacts on: o the quality and quantity of existing surface water and groundwater resources; o affected licensed water users and basic landholder rights; o the riparian, ecological, geomorphological and hydrological values of watercourses; and o impacts to agricultural lands. – a detailed description of the proposed water management system (including all infrastructure and storages) and water monitoring program; – a detailed description of measures to minimise all water discharges, and – a detailed description of measures to mitigate surface water and groundwater impacts. • **Biodiversity** – including: – an accurate quantification of any vegetation clearing; – a detailed assessment of potential impacts on terrestrial or aquatic threatened species or populations or their habitats, endangered ecological communities and groundwater dependent ecosystems; – a detailed description of the measures that would be implemented to avoid or mitigate impacts on biodiversity; and – an offset strategy to ensure the project maintains or improves the biodiversity values of the region in the medium to long term. • **Noise & Vibration** – including a quantitative assessment of potential construction, operational, blasting and transport noise impacts. • **Air Quality** – including a quantitative assessment of potential air quality impacts, including dust emissions from rail wagons. • **Traffic & Transport** – including a detailed assessment of potential impacts on the safety and performance of the rail and road networks. • **Greenhouse Gases** – including: – a quantitative assessment of the potential scope 1, 2 and 3 greenhouse gas emissions of the project; – a qualitative assessment of the potential impacts of these emissions on the environment; and – an assessment of all reasonable and feasible measures that could be implemented on site to minimise greenhouse gas emissions and ensure the project is energy efficient. • **Rehabilitation & Mine Closure** - a detailed description of the proposed rehabilitation and mine closure strategies for the project, having regard to the key principles in *Strategic Framework for Mine Closure*, including: – rehabilitation objectives, methodology, monitoring programs, performance standards and proposed completion criteria; – decommissioning and management of surface infrastructure; – nominated final land uses, having regard to any relevant strategic land use planning or resource management plans or policies; and – the potential for integrating the rehabilitation strategy with any other offset strategies in the region. • **Heritage** – both Aboriginal and non-Aboriginal. • **Visual** – including a detailed description of the measures that would be implemented to minimise the visual impact of the project.

	• **Waste** - including: – accurate estimates of the quantity and nature of the potential waste streams of the project; and – a description of the measures that would be implemented to minimise, handle and dispose of waste on site. • **Social & Economic** – including an assessment of the costs and benefits of the project as a whole, the demand on local infrastructure and services and whether it would result in a net benefit for the NSW community. • **Hazards** - including bushfires.
References	The environmental assessment of the key issues listed above must take into account relevant guidelines, policies, and plans. While not exhaustive, the following attachment contains a list of some of the guidelines, policies, and plans that may be relevant to the environmental assessment of this project.
Consultation	During the preparation of the Environmental Assessment, you should consult with the relevant local, State or Commonwealth Government authorities, service providers, community groups and affected landowners. In particular you must consult with the: • Department of Environment, Climate Change and Water, including the NSW Office of Water; • Industry and Investment NSW; • Department of Transport and Infrastructure; • Liverpool Plains Shire Council; • Namoi Catchment Management Authority; and • Werris Creek Coal Mine Community Consultative Committee. The consultation process and the issues raised must be described in the Environmental Assessment.
Deemed Refusal Period	90 days

Policies, Guidelines & Plans

Risk Assessment	
	AS/NZS 4360:2004 Risk Management (Standards Australia)
	HB 203: 203:2006 Environmental Risk Management – Principles & Process (Standards Australia)
Soil & Water	
Soil	Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites (ANZECC)
	Rural Land Capability Mapping (DLWC)
	Agricultural Land Classification (DPI)
Surface Water	National Water Quality Management Strategy: Australian Guidelines for Fresh and Marine Water Quality (ANZECC/ARMCANZ)
	National Water Quality Management Strategy: Australian Guidelines for Water Quality Monitoring and Reporting (ANZECC/ARMCANZ)
	National Water Quality Management Strategy: Guidelines for Sewerage Systems – Effluent Management (ARMCANZ/ANZECC)
	National Water Quality Management Strategy: Guidelines for Sewerage Systems – Use of Reclaimed Water (ARMCANZ/ANZECC)
	Using the ANZECC Guideline and Water Quality Objectives in NSW (DEC)
	State Water Management Outcomes Plan
	NSW Government Water Quality and River Flow Objectives (DECC)
	Approved Methods for the Sampling and Analysis of Water Pollutants in NSW (DEC)
	Managing Urban Stormwater: Soils & Construction (Landcom)
	Managing Urban Stormwater: Treatment Techniques (DECC)
	Managing Urban Stormwater: Source Control (DECC)
	A Rehabilitation Manual for Australian Streams (LWRRDC and CRCCH)
	Technical Guidelines: Bunding & Spill Management (DECC)
	Environmental Guidelines: Use of Effluent by Irrigation (DECC)
Groundwater	National Water Quality Management Strategy Guidelines for Groundwater Protection in Australia (ARMCANZ/ANZECC)
	NSW State Groundwater Policy Framework Document (DLWC, 1997)
	NSW State Groundwater Quality Protection Policy (DLWC, 1998)
	NSW State Groundwater Quantity Management Policy (DLWC, 1998)
	Guidelines for the Assessment & Management of Groundwater Contamination (DECC, 2007)
	NSW Inland Groundwater Shortage Zones Order No. 2 (2008)
Blasting and Vibration	
	ANZECC Guidelines to Minimise Annoyance Due to Blasting Overpressure & Ground Vibration
	Assessing Vibration – A Technical Guide 2006 (DEC)
	DIN 4150 Part 3 - Structural Vibration: effects of vibration on structures (ISO, 1999)
Noise	
	NSW Industrial Noise Policy (DECC)
	Environmental Criteria for Road Traffic Noise (NSW EPA)
	Interim Construction Noise Guideline (DECC)
Air Quality	
	Protection of the Environment Operations (Clean Air) Regulation 2002

	Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (DEC)
	Approved Methods for the Sampling and Analysis of Air Pollutants in NSW (DEC)
Biodiversity	
	Draft Guidelines for Threatened Species Assessment under Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act) (DEC)
	NSW State Groundwater Dependent Ecosystem Policy (DLWC)
	Policy & Guidelines - Aquatic Habitat Management and Fish Conservation (NSW Fisheries)
	Policy & Guidelines - Fish Friendly Waterway Crossings (NSW Fisheries)
	State Environmental Planning Policy No. 44 – Koala Habitat Protection
Rehabilitation	
	Mine Rehabilitation – Leading Practice Sustainable Development Program for the Mining Industry (Commonwealth of Australia)
	Mine Closure and Completion – Leading Practice Sustainable Development Program for the Mining Industry (Commonwealth of Australia)
	Strategic Framework for Mine Closure (ANZMEC-MCA)
Traffic & Transport	
	Guide to Traffic Generating Development (RTA)
Heritage	
Aboriginal	Draft Guidelines for Aboriginal Cultural Heritage Assessment and Community Consultation (DoP and DEC)
	Aboriginal Cultural Heritage Consultation Requirements for Proponents
Non-Aboriginal	NSW Heritage Manual (NSW Heritage Office)
	The Burra Charter (The Australia ICOMOS charter for places of cultural significance)
Greenhouse Gases	
	National Greenhouse Accounts Factors (Australian Department of Climate Change (DCC))
	Guidelines for Energy Savings Action Plans (DEUS)
Hazards	
	State Environmental Planning Policy No. 33 – Hazardous and Offensive Development
	Applying SEPP 33 – Hazardous and Offensive Development Application Guidelines (DUAP)
	Hazardous Industry Planning Advisory Paper No. 6 – Guidelines for Hazard Analysis
Waste	
	Waste Classification Guidelines (DECC)
Social & Economic	
	Draft Economic Evaluation in Environmental Impact Assessment (DoP)
	Techniques for Effective Social Impact Assessment: A Practical Guide (Office of Social Policy, NSW Government Social Policy Directorate)

NSW GOVERNMENT | Planning

Major Projects Assessment
Mining & Industry
Contact: Paul Freeman
Phone: (02) 9228 6587
Fax: (02) 9228 6466
Email: paul.freeman@planning.nsw.gov.au

Mr Brian Cullen
Technical Services Manager
Whitehaven Coal Limited
PO Box 600
GUNNEDAH NSW 2380

Dear Mr Cullen

Werris Creek Life of Mine Project - Supplement to the Director-General's Requirements

I refer to the Director-General's requirements issued for the Werris Creek Life of Mine Project on 29 June 2010.

As you are aware, this project has been declared a controlled action under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The Department of Environment, Water, Heritage and the Arts has accredited the NSW Part 3A assessment process for the project. Accordingly, the Department will undertake an environmental impact assessment of the project to satisfy the requirements of both NSW and Commonwealth legislation.

To ensure that sufficient information is provided to enable an appropriate level of assessment of relevant matters of National Environmental Significance, the Director-General has issued supplementary requirements for the Environmental Assessment under section 75F(3) of the *Environmental Planning and Assessment Act 1979*. A copy of the supplementary requirements is attached.

You must ensure that the Environmental Assessment adequately addresses the Director-General's requirements issued on 29 June 2010, and the supplementary requirements attached to this letter.

If you have any enquiries about these requirements, please contact Paul Freeman.

Yours sincerely

1/9/10

David Kitto
Director, Mining & Industry Projects
as delegate for the Director-General

Department of Planning, 23-33 Bridge St Sydney, NSW 2000 GPO Box 39 Sydney, NSW 2001
www.planning.nsw.gov.au

Supplementary Director-General's Requirements

Section 75F(3) of the *Environmental Planning and Assessment Act 1979*

The Commonwealth Minister for Environment Protection, Heritage and the Arts has declared the Werris Creek Life of Mine Project to be a controlled action under section 75 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The controlled action is likely to have a direct and indirect impact on matters of national environment significance, in particular, threatened species and/or threatened ecological communities listed under sections 18 and 18A, and migratory species listed under sections 20 and 20A of the EPBC Act.

In accordance with the one-off accredited assessment process for this project, the environmental assessment of the impacts of the controlled action is to be assessed under Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The assessment should include enough information about the controlled action and its relevant impacts to allow the Commonwealth Minister for Environment Protection, Heritage and the Arts to make an informed decision whether or not to approve the controlled action under the EPBC Act.

The following assessment requirements are to be integrated into the assessment required for Part 3A of the EP&A Act. The following matters in the EPBC Act and schedule 4 of the *Environment Protection and Biodiversity Conservation Regulations 2000* should be considered.

General information

1. The background of the action, including:
    a. the title of the action;
    b. the full name and postal address of the designated proponent;
    c. a clear outline of the objective of the action;
    d. the location of the action;
    e. the background to the development of the action;
    f. how the action relates to any other actions (of which the proponent should reasonably be aware) that have been, or are being, taken or that have been approved in the region affected by the action;
    g. the current status of the action; and
    h. the consequences of not proceeding with the action.

Description of the controlled action

2. A description of the action, including:
    a. all the components of the action;
    b. the precise location of any works to be undertaken, structures to be built or elements of the action that may have relevant impacts;
    c. how the works are to be undertaken and the design parameters for those aspects of the structures or elements of the action that may have relevant impacts;
    d. to an extent reasonably practicable, a description of any feasible alternatives to the controlled action that have been identified through the assessment, and their likely impact, including:
        i. if relevant, the alternative of taking no action;
        ii. a comparative description of the impacts of each alternative on the matters protected by the controlling provisions for the action; and
        iii. sufficient detail to clarify why any alternative is preferred to another.

A description of the relevant impacts of the controlled action

3. An assessment of all relevant impacts[1] with reference to the *EPBC Act Policy Statement 1.1 Significant Impact Guidelines Matters of National Environmental Significance (2009)* that the controlled action would have on:
    a. relevant migratory and threatened species and/or ecological communities listed under sections 18, 18A, 20 and 20A of the EPBC Act, including:
        - White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland;
        - Natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland;
        - Regent Honeyeater *(Anthochaera phrygia)*;
        - Swift Parrot *(Lathamus discolor)*;
        - Finger Panic Grass (*Digitaria porrecta)*; and
        - a leek orchid (*Prasophyllum sp. Wybong)*.

4. Information must include:
    a. a description of the relevant impacts of the action on matters of national environmental significance;
    b. a detailed assessment of the nature and extent of the likely short term and long term relevant impacts;
    c. a statement whether any relevant impacts are likely to be unknown, unpredictable or irreversible;
    d. analysis of the significance of the relevant impacts;
    e. any technical data and other information used or needed to make a detailed assessment of the relevant impacts.

5. The description of impacts should include an analysis of the vegetation condition on the site, as well as the methods by which this was determined. It should also include direct, indirect, cumulative and facilitative impacts on the:
    a. extent of the EPBC listed White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland Ecological Community (Box-Gum Woodland), including connectivity with other areas of the ecological community;
    b. quality or integrity of the Box-Gum Woodland (including, but not limited to, assisting invasive species, that are harmful to the ecological communities, to become established; or causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the communities which kill or inhibit the growth of species in the ecological community);
    c. EPBC Act listed species in, or in any way dependent upon, the Box-Gum Woodland;
    d. composition of the Box-Gum Woodland;
    e. habitat present on site critical to the survival of the Box-Gum Woodland[2]; and
    f. abiotic (non-living) factors (such as water, nutrients or soil) necessary for the Box-Gum Woodland's survival, for example increasing groundwater levels or making the site wetter, soil disturbance or substantial alteration of surface water drainage patterns.

[1] The term "relevant impact" is defined in section 82 of the EPBC Act.

[2] "habitat critical to the survival of a species or ecological community" refers to areas that are necessary:
- for activities such as foraging, breeding, roosting, or dispersal;
- for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators);
- to maintain genetic diversity and long term evolutionary development; or
- for the reintroduction of population or recovery of the species or ecological community.

Such habitat may be, but is not limited to: habitat identified in a recovery plan for the species or ecological community as habitat critical for that species or ecological community; and/or habitat listed on the register of Critical Habitat maintained by the Minister under the EPBC Act.

These impacts should be described for the construction and operation phases of the controlled action.

6. Where there is a potential habitat for EPBC Act listed species, surveys must be undertaken. These surveys must be timed appropriately and undertaken for a suitable period of time by a qualified person[3]. A subsequent description of the relevant impacts on such EPBC Act listed species should include, inter alia, direct, indirect, cumulative and facilitative impacts on the:
    a. population of the species at the site;
    b. area of occupancy of the species;
    c. habitat critical to the survival of the species;
    d. breeding cycle of the population; and
    e. availability or quality of habitat for the species.

Proposed safeguards and mitigation measures

7. A description of feasible mitigation measures, changes to the controlled action or procedures, which have been proposed by the proponent or suggested in public submissions, and which are intended to prevent or minimise relevant impacts. Information must include:
    a. a description, and an assessment of the expected or predicted effectiveness of, the mitigation measures;
    b. any statutory or policy basis for the mitigation measures;
    c. the cost of the mitigation measures;
    d. an outline of an environmental management plan that sets out the framework for continuing management, mitigation and monitoring programs for the relevant impacts of the action, including any provisions for independent environmental auditing;
    e. the name of the agency responsible for endorsing or approving each mitigation measure or monitoring program; and
    f. a consolidated list of mitigation measures proposed to be undertaken to prevent, minimise or compensate for the relevant impacts of the action.

Offsets

8. Should any residual impact exist that cannot be mitigated it may be necessary for offset measures to be considered in order to ensure the protection of matters of national environmental significance in perpetuity.

Other approvals and conditions

9. Any other requirements for approval or conditions that apply, or that the proponent reasonably believes are likely to apply, to the proposed action. Information must include:
    a. details of any local or State government planning scheme, or plan or policy under any local or State government planning system that deals with the proposed action, including:
        i. what environmental assessment of the proposed action has been, or is being, carried out under the scheme, plan or policy; and
        ii. how the scheme provides for the prevention, minimisation and management of any relevant impacts;
    b. a description of any approval that has been obtained from a State, Territory or Commonwealth agency or authority (other than an approval under the Act), including any conditions that apply to the action;
    c. a statement identifying any additional approval that is required; and
    d. a description of the monitoring, enforcement and review procedures that apply, or are proposed to apply, to the action.

[3] Where available, species-specific survey guidelines can be obtained on the department's *Species Profile and Threats Database*: http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl

Economic and social matters

10. A description of the short-term and long-term social and economic implications and/or impacts of the project.

Environmental record of person proposing to take the action

11. Details of any proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources against:
    a. the proponent; and
    b. for an action for which a person has applied for a permit, the person making the application.

12. Details of the proponent's environmental policy and planning framework.

Information sources

13. For information given in an environment assessment, the draft must state:
    a. the source of the information;
    b. how recent the information is;
    c. how the reliability of the information was tested; and
    d. what uncertainties (if any) are in the information.

Consultation

14. Any consultation about the action, including:
    a. any consultation that has already taken place;
    b. proposed consultation about relevant impacts of the action;
    c. if there has been consultation about the proposed action — any documented response to, or result of, the consultation.

15. Identification of affected parties, including a statement mentioning any communities that may be affected and describing their views.

Appendix B: Qualifications and Experience of Survey & Assessment Team

eco logical AUSTRALIA

CURRICULUM VITAE

Robert Humphries

MANAGER, BIOBANKING AND OFFSETS PROGRAMS

QUALIFICATIONS

- Bachelor of Applied Science, Ballarat C.A.E 1983-85.
- Master of Applied Science (Research) University of Ballarat 1986-89.

Robert is an ecologist, environmental planner and project manager with 25 years experience. Since graduating with Bachelors and Masters Degrees in wildlife management in 1985, Robert has worked mainly in the public sector with the Department of Environment and Conservation (Victoria) 1988-1996 and NSW National Parks and Wildlife Service, now Department of Environment & Climate Change 1996-2006. Robert joined Eco Logical Australia in March 2008 following 2 years as the General Manager of Eco Trades Pty Ltd, NSW's first specialist biodiversity offset provider.

Robert was the Manager of the Threatened Species Section of the Department of Conservation and Environment for over 10 years and has superior knowledge of NSW Threatened Species and Environmental Planning legislation, Government policy, the biodiversity of the Greater Sydney and Hunter Regions, the development industry and the new biodiversity certification and biobanking provisions.

Robert is a member of the Biobanking Ministerial Reference Group representing the NSW Urban task Force.

RELEVANT PROJECT EXPERIENCE

Biobanking and Offsets

- Biobanking Ministerial Reference Group (NSW Urban Task Force representative) 2007-present
- Development and Project Management of Biobank Accredited Assessor Training Course (2008, DECC)
- Development of the Credit pricing calculator for Biobank owners (2008, DECC)
- Likely demand for Biodiversity Credits in the Lower Hunter, Far North Coast, Western Sydney and South Coast Regions (2008, DECC)
- Crown Land Biodiversity Banking Scheme (2008-2009 Landcom and Department of Lands)
- Biobank Assessment case studies for Cessnock and Whitebridge (2008 Landcom)
- Biobank site assessment for Whitehaven Coal Regional Biodiversity Offset (2009, Whitehaven Coal Pty Ltd)
- Biobanking Assessment of the Oxley Highway upgrade (2009, RTA)
- Biobank site investigation and advice for 3 proposed Wind Farms (2008/09 Wind Prospect CWP Pty Ltd)
- Advice to NSW Aboriginal Land Council regarding costs, risks and obligation of establishing Biobank sites on Local Aboriginal Land Council community land (2009, NSW ALC)
- General Biobanking advice to the Indigenous Land Corporation regarding feasibility of registering ILC properties as Biobank sites (2007, ILC)
- Biobank Assessment for a 20 ha site near Camden as part of Growth Centres Conservation Fund offset strategy (2009, DECC)
- Kingsgrove to Revesby Quadruplication Project Offset Strategy (2008/09 K2RQ/TIDC Alliance).
- Biobanking Feasibility study for Penrith Lakes Development Corporation (2008, PLDC Pty Ltd)
- Biobanking Feasibility Study for Belrose 10 ha site (2009, WSN Environmental Solutions)
- Biobanking Feasibility Study of surplus RTA lands at Belmont, Lake Macquarie LGA (2009, RTA))
- Cost comparison of Biobank Credits and traditional offsets negotiated by the RTA for the M7 Motorway (2009, DECCW).

Threatened Species Recovery Programs

- Review of 13 EPBC Act Threatened Species Recovery Plans (2008 DECC)

- As Manager of Threatened Species Unit, NSW Department of Environment and Conservation 1996-2005, Project managed, prepared and/or supervised preparation of over 40 threatened species recovery plans under the NSW Threatened Species Conservation Act 1995 and Commonwealth Environmental Protection & Biodiversity Conservation Act including the following species Wollemi Pine (1998 & 2006), Allocasuarina portuensis (2000), Prostanthera junonsis (2000), Persoonia mollis sub.spp. Maxima (2000), Manly Endangered Population of Little Penguins (2000), Epacris hamiltonnii (2001), Leionema lachnaeoides (2001), Grevillea obtusiflora (2001), Pterostylis gibbossa (2001), Pterostylis sp. 15 (2001), Blue Mountains Water Skink (2001), Bathurst Copperwing Butterfly (2001), Acacia pubescens (2003), Darwinia biflora (2003), Irenepharsus tryphesus (2004), Daphnandra sp. C (2004), Zieria granulata (2004), Eastern Suburbs Banksia Scrub (2004), Gould's Petrel (2000), Grevillea caleyi (2001), Green and Golden Bell Frog (2003), Long-nosed Bandicoot (2003), Microtis angussi (2002), Southern Brown Bandicoot (2005), Pimelia spicata (2004), Persoonia nutans (2005), Prostanthera askania (2005), Zieria involucrata (2005), Large Forest Owls, Brush-tailed Rock-wallaby, Bush Stone Curlew, Critical Weight Range Mammals

- As Flora and Fauna Guarantee Officer, Victorian Department of Environment and Conservation (now Dept Sustainability and Environment (1988-1995), prepared or had significant input to FFG Action Statements for the following species:- Button Wrinklewort, *Rutidosis leptorrhynchoides*, Hairy Anchor Plant, *Discaria* pubescens, Brush-tailed Phascogale, *Phascogale tapoatafa*, Powerful Owl, *Ninox strenua*, Western (Basalt) Plains Grassland Community, Eastern Barred Bandicoot, Striped Legless Lizard, Plains Wanderer, Large - fruit Groundsel *Senecio macrocarpus*, Hairy-tails *Ptilotus erubescens*, Brolga

Environmental Impact Assessment

- Biobank Assessment for a proposed modification to the Tarrawonga Coal Mine (2009, Tarrawonga Coal Pty Ltd)
- Part 3A Environmental Assessment of the Boco Rock Wind Farm, Nimmitabel, NSW (2009, Wind Prospect CWP Pty Ltd)
- Native Grassland Assessment of proposed residential rezoning application at Beveridge, Victoria (2008 Nick Baldi Constructions)
- Threatened Species Assessment & advice for proposed retirement village at Beacon Hill, Warringah LGA, NSW (2009 Beacon Hill Retirement Pty Ltd).
- Threatened species review and advice for proposed rezoning at Ashtonfield, Maitland LGA, NSW (2008 Ashtonfield Developments Pty L:td)
- Threatened Species review and advice for proposed rezoning at Taylors Beach, Port Stephens LGA, NSW (2008 North Arm Cove Joint Venture Pty Ltd)

As Manager of DECC Threatened Species Section 1996-2005, Reviewed, assessed and determined major Projects including:-

- The RTAs M5 East, M7 (Western Sydney Orbital), F3 extension and Bangor By-pass.
- Sydney Ports Port Botany Expansion
- Dendrobium, Mt Owen, Ravensworth, Ulan, Donaldson, Mount Pleasant coal mines and mine expansions.
- Port Warratah and Kooragang Island coal loading terminal
- Sydney Waters Warragamba Dam Spill way, North Side Storage Tunnel, Cronulla STP
- Sydney Harbour and Foreshore Authorities Cooks Cove redevelopment
- Landcoms Prince Henry Hospital redevelopment
- Sydney Olympic Park Coordinating Authorities projects including waste water recycling scheme (WRAMS), equestrian and shooting centres.
- Parramatta-Chatswood Rail Link
- National Freight Centre, Chullora
- Residential and Commercial Developments
- Comm Lands ADI St Marys
- Spring Farm urban release area
- Prestons urban release area
- Erskine Park employment area
- Hunter Economic Zone
- Somersby Industrial Estate
- Australand's Kurnell Peninsula residential area
- North Head Quarantine Station adaptive reuse
- Stockland's Sandon Point development
- Belrose Industrial Park
- Lend Leases St Patrick's Estate
- North Lakes Residential release area
- Johnson Property Group and AV Jennings Wadalba residential release

- Crighton Properties Gwandalan residential release area
- Bradman Corps Picton Highlands Resort
- Glendale Athletics Centre
- New England Trading workshops, Kurri Kurri
- Moriah College, Queens Park expansion

Research Areas

- Threatened Species Recovery Programs
- Population Viability Analysis
- Ecological impacts of fire (Master Applied Science Thesis)
- Native Grassland management
- Predator control techniques including the use of cyanide baiting for Red Foxes
- Silvicultural systems and flora and fauna impacts
- Biology and ecology of threatened bandicoot species

CURRICULUM VITAE

Lucas McKinnon

ECOLOGIST

QUALIFICATIONS

- Bachelor of Environmental Science (Honours), University of Wollongong
  Thesis topic: *Validation and Field Assessment of Endangered Ecological Communities on Community Lands within the Wollongong LGA*
- BioBanking Accredited Assessor (No. 0076), *Threatened Species Conservation Act 1995*, TAFE NSW and DECCW
- Forest Soil and Water Protection, TAFE NSW

Lucas is an Environmental Scientist / Ecologist with 5years post graduate experience working in both the private and public sectors. After completing an honours thesis studying endangered ecological communities (EECs) in the Wollongong LGA, he went onto to further studies in vegetation at the University of Wollongong and with the Australian Museum. In 2005, he began work in native vegetation policy with the former NSW Department of Natural Resources, working on the implementation of the *Native Vegetation Regulation 2005*, and with the co-ordination of threatened species policy, and went on to work in biodiversity conservation policy at the former NSW Department of Environment and Climate, Change (DECC). Most recently he has finished up a term on the north coast of NSW working with the operational regulation of native forestry on private land.

Lucas has worked with property scale vegetation planning with qualifications in the assessment of broadscale clearing and farmscale private native forestry under the *Native Vegetation Act, 2003*, and he has recently received accreditation as a BioBanking Assessor under the *Threatened Species Conservation Act, 1995*, to undertake and prepare surveys and assessments for the Biodiversity Banking and Offset Scheme.

Lucas has highly developed skills in research, policy development and project management, and these skills are complemented by his field skills with flora and fauna survey. He started with ELA, October 2009, providing strategic input and review into a review of River Red Gum forestry practices for the NSW Natural Resources Commission.

RELEVANT PROJECT EXPERIENCE

- *Werris Creek Coal mine*: Project Manager and Lead Ecologist for **flora and fauna assessment** of Part 3A development proposal for Life of Mine Extension Project in Box-Gum Woodland Critically Endangered Ecological Community (CEEC) on the Liverpool Plains, NSW.
- *Thornton Park TOD*: Lead Ecologist for **flora, fauna and riparian assessment** of proposed 1200 lot Transit Oriented Development (TOD) at North Penrith.
- *Grasmere*: Lead Ecologist for **flora, fauna and riparian assessment** of proposed 30 lot sub-division of rural land containing Cumberland Plain Woodland (CEEC), at Grasmere, Camden LGA, south west of Sydney.
- *Yellow Rock*: Project Manager for **Management Plan** of Deerubbin Local Aboriginal Land Council lands at Yellow Rock, Blue Mountains LGA.
- *Molongolo*: **vegetation survey** – determination of the presence and extent of EPBC Box-Gum Woodland CEEC on the outskirts in Molongolo growth area of Canberra.
- *Tralee Station:* **Invertebrate survey** for the threatened Golden Sun Moth (*Synemon plana*) near Queanbeyan.
- *Metropolitan Colliery:* **vegetation survey and monitoring** for Metropolitan Colliery, west of Helensburgh in Sydney Catchment Area lands
- *Warringah Council:* **Impact Assessment** of infrastructure development adjacent to a sandstone community at Belrose, northern Sydney.
- *Penrith Lakes Development Corporation:* **preliminary ecological advice** on future development adjacent to the Nepean River.
- *Integral Energy:* **Impact assessment** for the proposed re-establishment of access tracks to infrastructure managed by Integral Energy off Mount Ousley Road and Appin Road
- *NSW Natural Resource Commission:* **strategic input and background research** for review of White Cypress Pine forestry in NSW.
- *NSW Natural Resources Commission:* **strategic input and review** into a review of River Red Gum forestry practices.

- *Private Native Forestry (PNF):* **operational administration** of regulatory activities under the *Native Vegetation Act 2003* and PNF Code of Practice (NSW Dept. of Environment, Climate Change & Water).
- *EEC Recovery Project:* **development and implementation** of identification package for endangered ecological communities (EECs), including simple I.D. Guidelines and Indicative EEC Mapping Series for coastal floodplain EECs (NSW Dept. of Environment and Climate Change).
- *Native Vegetation Act 2003*, **Implementation Committee Secretariat** (NSW Dept. of Natural Resources).

CURRICULUM VITAE

Dr Enhua Lee

ECOLOGIST

QUALIFICATIONS

- PhD in Ecology and Wildlife Management. The Ecological Effects of Sealed Roads in Australia's Arid Zone. – 2006
- Bachelor of Advanced Science (First Class Honours). Mitochondrial Adjustments in the Muscles of the Fat-tailed Dunnart, *Sminthopsis crassicaudata*, During Cold Acclimation - 2000

Enhua is an ecologist with a Doctor of Philosophy in wildlife management and over 3 years experience in environmental consulting. She has considerable expertise in rangeland ecology and has an interest in anthropogenic activities on natural environments.

Enhua has extensive practical experience in biodiversity survey. She is particularly experienced in designing and conducting small and large mammal, lizard and bird surveys. Enhua also has well developed research and analytical skills, and time management and project management skills. She is an effective communicator, as demonstrated through her work in developing biodiversity education programs and her invitations to present her research findings at specialist conferences and to lay audiences. She has trained people in conducting flora and fauna surveys in Australia's rangelands and has published peer-reviewed book chapters and papers in international and national scientific journals.

Since joining Eco Logical Australia in 2007, Enhua has completed work for the state and federal government agencies, local councils, as well as private businesses and property owners. She has a sound knowledge of environmental and planning legislation and has applied her knowledge to a range of projects including Part 4 and 5 assessments under the *Environmental Planning and Assessment Act*. Her work has ranged from completing ecological impact assessments, flora and fauna survey, vegetation, bushfire and fauna management plans, masterplans and literature reviews for clients, to conducting complex statistical analyses to inform management plans. She has also provided high level conservation advice to government agencies.

RELEVANT PROJECT EXPERIENCE

Ecological Constraints / Impact Assessment

- Glenmore Park Flora and Fauna Assessment (AMPCI)
- Commonwealth BER Flora and Fauna Assessments (Hansen Yunckin)
- Wedderburn Hazard Reduction Flora and Fauna Assessment (Campbelltown Council)
- Stanwell Tops Conference Centre Ecological Assessment (Borst and Conacher Architects)
- Crudine Ridge Wind Farm Ecological Assessment (Wind Prospect)
- Tubbo Farming Grassland Assessment (Tubbo Farming)
- Ecological Impact Assessments – various (Integral Energy)
- Sensitivity Mapping for NW and SW Growth Centre (Sydney Water)
- Western Parklands Ecological Constraints Assessment (DoP)
- Biobanking Pilot Assessments (DECC)
- El Caballo Blanco and Gledswood Rezoning Ecological and Bushfire Assessment (Landcom)
- South Randwick Feasibility Review: Environmental Issues and Constraints (Landcom)
- Whitebridge Constraints Assessment (Landcom)
- Ballanagamang Biobanking Assessment (Ecotrades)
- Fauna Report for the Gap Park Masterplan (Thompson Berril Landscape Design)
- Preliminary ecological assessment of Allenby Park (Stage 1) (AMPCI)
- Ecological Assessment of Allenby Park (Stage 2) (AMPCI)
- Ecological Assessment, Proposed Drainage Augmentation, Warringah Mall (AMPCI)
- Flora and Fauna Assessment: Compound Sites for Hume Highway Duplication (Leighton Contractors)

Management Plans
- Sunningdale Vegetation and Fauna Management Plan (Pacific Dunes)
- South Bandiana Landscape Management Plan (Defence)
- North Bandiana Landscape Management Plan (Defence)
- Kapooka Box-Gum Mapping and Monitoring Plan (Defence)
- Cooper Park Management Plan (Woollahra Council)
- SWC Carrier Flora and Fauna Assessment and Management Plan (Water Infrastructure Group)
- Sydney South West Property Environmental and Vegetation Management Plans (Sydney Water)
- Hawkesbury Roadside Vegetation Management Plan (Hawkesbury Council)
- Flying Fox Plan of Management – Parramatta Park (Parramatta Park Trust)
- *Acacia terminalis* Plan of Management – North Head Sewerage Treatment Plant (Sydney Water)
- North Head Sewage Treatment Plant Fire Management Plan (Sydney Water)

Vegetation Community Mapping
- Kapooka Box-Gum Mapping and Monitoring Plan (Defence)
- Wetland Vegetation Surveys for LiDAR, Lowbidgee and Gwydir wetlands (DECC)
- Molonglo River Vegetation and Habitat Survey and Mapping (ACT Planning)

Ecological Monitoring
- Kapooka Kangaroo Impact Monitoring (Defence)
- Latchford Barracks Kangaroo Impact Monitoring (Defence)
- Microbat Monitoring, Warringah Mall (AMPCI)
- Metropolitan Colliery Vegetation Monitoring (Metropolitan Colliery)

Ecological Reviews
- EPBC Conservation Advice (DEWHA)
- Review of Threatened Species Recovery Plans (DECC)
- Review of DA documents (Ku-ring-gai Council)

Statistical Analyses
- Habitat Modelling for Flora and Fauna species in the Gold Coast region (Gold Coast Council)
- Rufous Scrub-bird Monitoring Assessment (DECC)
- Habitat Modelling Pilot for Flora and Fauna Species: Swan Coastal Plain and Jarrah Forest IBRAs (WA DEC)
- Far South Coast Fire Assessment: Effects of Fire on Vegetation Composition (DECC)

Training/Education
- Biodiversity Awareness Training Course (DECC)
- Part 5 Training Course (Rockdale Council)

Other
- Ecological Character Description for the Paroo River Wetlands Ramsar Site (DEWHA)
- Information sheet for the Menindee Lakes System (Australian Floodplain Association)
- Flora assessment at Pinaroo Lake in north-western New South Wales (DEHWA)

CURRICULUM VITAE

Phil Gilmour

SENIOR BOTANIST

QUALIFICATIONS

- Bachelor of Science, (Botany Major) ANU, 1969

Phil is a highly respected ecologist and has over 30 years experience in botanical survey, mapping and assessment across all environments in NSW and with considerable experience in other parts of the country. He is a specialist field botanist, having conducted numerous botanical surveys within large biodiversity projects including the Southern and Northern NSW Comprehensive Regional (forestry) Assessments and numerous smaller contracts.

His skills include survey design, collection of site field data, identification of plant species and collection of herbarium specimens, vegetation mapping using air photo interpretation and modelling, statistical data analysis, assessment of conservation status of plant species and communities, preparation of recovery plans for rare species, management recommendations and report preparation. He is also a competent ornithologist.

His experience across a diverse array of Australian environments ensures his skills are in high demand and provides him with the opportunity to have input into a large range of ecological projects.

RELEVANT PROJECT EXPERIENCE

- Namoi CMA: EPBC grassland mapping
- NRAC: grassland profiles for NSW
- Coffs Harbour City Council: Beacon Hill ecological assessment
- Hunter CMA: establish a preliminary types list for Hunter CMA Vegetation Classification and Assessment
- Murray Darling Basin Commission: Level 1 riverine vegetation condition assessment
- DECC: NSW Vegetation Classification and Assessment for Nandewar and western New England Tablelands.
- Namoi CMA: vegetation community profiles
- Namoi CMA: pre-European vegetation mapping
- Namoi CMA: assessment of type and condition of riverine vegetation in the Namoi Catchment
- Eco Trades: Biobanking assessment Clifton Park, near Grafton
- DECC: Biobanking trial sites at Gunnedah and Bendemeer
- Namoi CMA: extant vegetation mapping
- DECC: site survey for far North Coast Comprehensive Coastal Assessment
- DECC: site survey and field validation for seven 1:110K mapsheets on NSW NW Slopes for Native Vegetation Mapping Program
- DECC: review statewide vegetation types database used in the PVP tool by CMAs in NSW.
- DEC: Nandewar Western Regional Assessment – vegetation mapping and survey
- DEC: preparation of Priority Action Statements for a number of threatened plant species.
- Dept of Territories and Regional Services: assessing conservation values of various parcels of land on Norfolk Island
- NSW NPWS: contract to establish monitoring plots for the Endangered plant *Zieria lasiocaulis*.
- NSW NPWS: preparation of vegetation map for Southern NSW Comprehensive Regional Assessment.
- Australian National Parks and Wildlife Service: Vegetation surveys on Norfolk Island
- NSW NPWS: an 'approved expert' in workshops on conservation requirements for rare plant species and forest ecosystems as part of the CRA Projects for the RFA for Southern and NE NSW.
- NSW NPWS: vegetation survey of Deua, Budawang, Mimosa Rocks NPs and Nadgee NR

CURRICULUM VITAE

Alicia Lyon

FAUNA ECOLOGIST

QUALIFICATIONS

- Bachelor of Science (Ecology and Biogeography), University of Wollongong

Alicia has worked as a fauna ecologist with ELA for the past three years following several years working in consultancy, Government, and for charitable conservation organisations in NSW and the United Kingdom. She brings to the company over 10 years experience in wildlife conservation, ecological survey/habitat assessment, environmental assessment and planning, management of pest species and native vegetation. She has a strong understanding of threatened species recovery planning and is experienced in community and stakeholder liaison. Alicia has a keen interest in the biology and ecology of microbats, and has experience in Anabat call analysis.

Alicia is skilled in the design, planning and execution of fauna and flora surveys, instruction and management of staff and volunteers in environmental programs, managing and mapping biological data, and a range of techniques for the control of vertebrate pest species.

Alicia is a highly organised and proficient operator with over 2 years experience in project management. She is an excellent communicator and has co-authored government reports and scientific papers. She has a working knowledge of landscapes and vegetation types of the North Coast, North-West Slopes and Northern Tablelands regions of NSW and is familiar with the relevant biodiversity datasets in the region. She is known and respected in the fields of wildlife conservation and management.

RELEVANT PROJECT EXPERIENCE

- Review of Environmental Factors for Exploration Drilling. (Silvermines Pty Ltd)
- Gwydir Highway REF (Roads and Traffic Authority). Replacement of Slaughterhouse Creek Bridge.
- Coffs Harbour Airport Lands Plan of Management (Coffs Harbour City Council).
- Microbat Translocation and Exclusion Survey and Monitoring Project (Roads and Traffic Authority)
- Bellwood Road Flora and Fauna Assessment (Developer).
- Arrawarra Caravan Park Species Impact Statement (Developer)
- Silver Mines Flora and Fauna Assessment (Mining Company)
- Mullaway Caravan Park Ecological Assessment (Developer)
- Hungry Head Road Habitat Assessment (Developer
- Mullaway Caravan Park Species Impact Statement (Developer)
- Finlays Road Ecological Assessment (Developer).
- Featherstone Road Habitat Assessment (Developer).
- Clifden Park Biobanking assessment (Developer).
- Review of the implementation of threatened species recovery plans in North East New South Wales (Department of Environment and Climate Change).
- Rufous Scrub-bird Monitoring Assessment: (DECCW).

This page has intentionally been left blank

Appendix C: Threatened Species Likelihood of Occurrence Table

An assessment of likelihood of occurrence was made for threatened ecological communities, populations, species and migratory species identified from the database search within 10km of the site. This assessment was based on database or other records, presence or absence of suitable habitat, features of the proposal site, results of the field survey and professional judgement. Five terms for the likelihood of occurrence of species are used in this report, these are:

"**Known**" =	the species was or has been observed on the Project Site.
"**Likely**" =	a medium to high probability that a species uses the Project Site.
"**Potential**" =	suitable habitat for a species occurs on the Project Site, but there is insufficient information to categorise the species as likely to occur, or unlikely to occur.
"**Unlikely**" =	a very low to low probability that a species uses the Project Site.
"**No**" =	habitat on the Project Site and in the vicinity is unsuitable for the species.

Legal Name	Conservation Status[1]		Habitat Associations	Likelihood of Occurrence
	TSC Act	EPBC Act		
Threatened Ecological Communities				
Brigalow (*Acacia harpophylla* dominant and co-dominant)	Endangered	Endangered	In the Namoi CMA region of NSW, this community occurs as an open forest or woodland up to 25 m. It is associated with Quaternary heavy, gilgaied, grey or brown cracking clay or clayey loam soils over sedimentary strata	Known - present
Natural grasslands on basalt and fine textured alluvial plains of Northern NSW and South Queensland (EPBC Act); or Native Vegetation on cracking clay soils of the Liverpool Plains (TSC Act)	Endangered	Critical	This vegetation is listed both nationally and at the state level though the community definition is slightly different. In the Namoi CMA area, these two communities are broadly defined as being associated with the highly fertile, rich cracking soils of the Liverpool Plains. It is mainly a native grassland community, and can maintain a similar species assemblage to native grasslands 'derived' from the clearing of canopy trees in the Grassy White Box woodlands.	No
Weeping Myall Woodlands (EPBC Act); Hunter Valley Weeping Myall Woodland (TSC Act)	Endangered	Critical	Not found in the area.	No

Legal Name	Conservation Status[1]		Habitat Associations	Likelihood of Occurrence
	TSC Act	EPBC Act		
White Box-Yellow Box-Blakely's Red Gum Woodland and Derived Native Grasslands	Endangered	Critical	This community is found throughout the NSW Wheatbelt, and has recently had its status 'uplisted' to Critical under both State and Commonwealth legislation. The dominant tree species is generally White Box (*Eucalyptus albens*) and grass species dominate the ground layer. Major plant species in these woodlands include White Box and Blakely's Red Gum (*Eucalyptus blakelyi*), Yellow Box (*Eucalyptus melliodora*) and an associated understorey of native grasses including Kangaroo and Tussock grasses.	Known – present

Scientific Name	Common Name	Conservation Status		Habitat Associations	Likelihood of Occurrence
		TSC Act	EPBC Act		
Threatened Flora					
Dichanthium setosum	Blue Grass	V	-	Bluegrass is associated with heavy basaltic black soils and occurs on the New England Tablelands, North West Slopes and Plains and the Central Western Slopes of NSW (it also occurs in Queensland and Western Australia.	No – not recorded during field surveys
Digitaria porrecta	Finger Panic Grass	E	E	Native grassland, woodlands or open forest with a grassy understorey, on richer soils (NSW Department of Environment and Climate Change [DECC] 2007). Often found along roadsides and travelling stock routes where there is light grazing and occasional fire (DECC 2007).	No – not recorded during field surveys
Diuris sheaffiana	Tricolor Diuris	V (No records found during NSW Wildlife Atlas database search)	V	Grows in sclerophyll forest among grass, often with *Callitris* spp (Harden 1994). It is found in sandy soils, either on flats or small rises (DECC 2007). Also recorded from a red earth soil in a Bimble Box community in western NSW (DECC 2007). Soils include gritty orange-brown loam on granite, shallow red loamy sand on stony porphyry, skeletal lateritic soil and alluvial grey silty loam (DECC 2007). Flowers from September to November or generally spring (DECC 2007).	No – no suitable habitat

Scientific Name	Common Name	Conservation Status		Habitat Associations	Likelihood of Occurrence
		TSC Act	EPBC Act		
Threatened Flora					
Philotheca ericifolia		V	V	Grows chiefly in dry sclerophyll forest and heath on damp sandy flats and gullies. It has been collected from a variety of habitats including heath, open woodland, dry sandy creek beds, and rocky ridge and cliff tops. Known only from the upper Hunter Valley and Pilliga to Peak Hill districts of NSW. The records are scattered over a range of over 400 km between West Wyalong and the Pilliga Scrub. Site localities include Pilliga East State Forest, Goonoo State Forest, Hervey Range, Wingen Maid Nature Reserve, Toongi, Denman, Rylestone district and Kandos Weir.	No – no suitable habitat
Prasophyllum sp. Wybong		-	E	Leek orchids are generally found in shrubby and grassy habitats in dry to wet soil, and *Prasophyllum* sp. Wybong is known to occur in open eucalypt woodland and grassland.	No – not recorded during field surveys

Scientific Name	Common Name	Conservation Status		Habitat Associations	Likelihood of Occurrence
		TSC Act	EPBC Act		
Threatened Flora					
Pterostylis cobarensis	Cobar Greenhood Orchid	V (No records found during NSW Wildlife Atlas database search)	V	Habitats are eucalypt woodlands, open mallee or Callitris shrublands on low stony ridges and slopes in skeletal sandy-loam soils. Associated species include: *Eucalyptus morrisii, E. viridis, E. intertexta, E. vicina, Callitris glaucophylla, Geijera parviflora, Casuarina cristata, Acacia doratoxylon, Senna* spp. and *Eremophila* spp. Known chiefly from the Nyngan-Cobar-Bourke district in the far western plains of New South Wales. Recorded districts include Narrabri, Nyngan, Cobar, Nymagee, Mt Gundabooka, Mt Grenfel and Mutawintji National Park. There are also records from the Darling Downs district of QLD.	No – no suitable habitat
Syzygium paniculatum	Magenta Lilly Pilly	E	V (No records found during EPBC Protected Matters search)	The Magenta Lilly Pilly is found only in NSW, in a narrow, linear coastal strip from Bulahdelah to Conjola State Forest.	No – no suitable habitat

Scientific Name	Common Name	Conservation Status		Habitat Associations	Likelihood of Occurrence
		TSC Act	EPBC Act		
Threatened Flora					
Thesium australe	Austral Toadflax	V	V	Occurs in grassland or grassy woodland. Often found in damp sites in association with Kangaroo Grass (*Themeda australis*) (DECC 2007). Flowers in spring–summer. Widespread but rare. NSW subdivisions: NC, CC, SC, NT, ST, NWS, CWS Other Australian states: Qld, Tas.	No – no suitable habitat
Tylophora linearis		E	E	Found in the Barraba, Mendooran, Temora and West Wyalong districts in the northern and central western slopes of NSW. Grows in dry scrub and open forest. Recorded from low-altitude sedimentary flats in dry woodlands of Eucalyptus fibrosa, Eucalyptus sideroxylon, Eucalyptus albens, Callitris endlicheri, Callitris glaucophylla and Allocasuarina luehmannii	No – no suitable habitat

Scientific Name	Common Name	Conservation Status		Habitat Associations	Likelihood of Occurrence
		TSC Act	EPBC Act		
Threatened Fauna					
AMPHIBIA					
Litoria booroolongensis	Booroolong Frog	E	E	Typically inhabits rocky western-flowing creeks and their headwaters, although a small number of animals have also been recorded in eastern-flowing streams (NSW Scientific Committee 2008).	No – no suitable habitat
AVES					
Anthochaera phrygia	Regent Honeyeater	E	E and M	Associated with temperate eucalypt woodland and open forest including forest edges, wooded farmland and urban areas with mature eucalypts, and riparian forests of River Oak (Casuarina cunninghamiana) (Garnett 1993). Areas containing Swamp Mahogany (Eucalyptus robusta) in coastal areas have been observed to be utilised (NPWS 1997). The Regent Honeyeater primarily feeds on nectar from box and ironbark eucalypts and occasionally from banksias and mistletoes (NPWS 1995). As such it is reliant on locally abundant nectar sources with different flowering times to provide reliable supply of nectar (EA 2000).	Potential – not recorded during field survey

Scientific Name	Common Name	Conservation Status		Habitat Associations	Likelihood of Occurrence
		TSC Act	EPBC Act		
Threatened Fauna					
Ardea alba	Great Egret, White Egret	-	M	The Great Egret is common and widespread in Australia (McKilligan, 2005). It forages in a wide range of wet and dry habitats including permanent and ephemeral freshwaters, wet pasture and estuarine mangroves and mudflats (McKilligan, 2005).	Potential – not recorded during site survey
Ardea ibis	Cattle Egret	-	M	Cattle Egrets forage on pasture, marsh, grassy road verges, rain puddles and croplands, but not usually in the open water of streams or lakes and they avoid marine environments (McKilligan, 2005). Some individuals stay close to the natal heronry from one nesting season to the next, but the majority leave the district in autumn and return the next spring. Cattle Egrets are likely to spend the winter dispersed along the coastal plain and only a small number have been recovered west of the Great Dividing Range (McKilligan, 2005).	Potential – not recorded during site survey

Scientific Name	Common Name	Conservation Status		Habitat Associations	Likelihood of Occurrence
		TSC Act	EPBC Act		
Threatened Fauna					
Climacteris picumnus victoriae	Brown Treecreeper (Eastern sub-species)	V	-	Distributed through central NSW on the western side of the Great Dividing Range and sparsely scattered to the east of the Divide in drier areas such as the Cumberland Plain of Western Sydney, and in parts of the Hunter, Clarence, Richmond and Snowy River valleys. The Brown Treecreeper occupies eucalypt woodlands, particularly open woodland lacking a dense understorey. It is sedentary and nests in tree hollows within permanent territories (NSW Scientific Committee 2001).	Known – found on site
Gallinago hardwickii	Latham's snipe	-	M	A variety of permanent and ephemeral wetlands, preferring open fresh water wetlands with nearby cover (Marchant and Higgins 1999). Occupies a variety of vegetation around wetlands (Marchant and Higgins 1999) including wetland grasses and open wooded swamps (Simpson and Day 1999).	No – no suitable habitat

Scientific Name	Common Name	Conservation Status		Habitat Associations	Likelihood of Occurrence
		TSC Act	EPBC Act		
Threatened Fauna					
Haliaeetus leucogaster	White-bellied Sea Eagle	-	M	Forages over large open fresh or saline waterbodies, coastal seas and open terrestrial areas (Marchant & Higgins 1993, Simpson & Day 1999). Breeding habitat consists of tall trees, mangroves, cliffs, rocky outcrops, silts, caves and crevices and is located along the coast or major rivers. Breeding habitat is usually in or close to water, but may occur up to a kilometre away (Marchant & Higgins 1993).	No – no suitable habitat
Hirundapus caudacutus	White-throated Needletail	-	M	Forages aerially over a variety of habitats usually over coastal and mountain areas, most likely with a preference for wooded areas (Marchant & Higgins 1993; Simpson & Day 1999). Has been observed roosting in dense foliage of canopy trees, and may seek refuge in tree hollows in inclement weather (Marchant & Higgins 1993).	Unlikely

Scientific Name	Common Name	Conservation Status		Habitat Associations	Likelihood of Occurrence
		TSC Act	EPBC Act		
Threatened Fauna					
Lathamus discolor	Swift Parrot	E	E and M	Breeds in Tasmania between September and January. Migrates to mainland in autumn, where it forages on profuse flowering Eucalypts (Blakers et al. 1984; Schodde and Tidemann 1986; Forshaw and Cooper 1981). Hence, in this region, autumn and winter flowering eucalypts are important for this species. Favoured feed trees include winter flowering species such as Swamp Mahogany (Eucalyptus robusta), Spotted Gum (Corymbia maculata), Red Bloodwood (C. gummifera), Mugga Ironbark (E. sideroxylon), and White Box (E. albens) (DECC 2007).	Potential – not recorded during field survey
Merops ornatus	Rainbow bee-eater	-	M	Resident in coastal and subcoastal northern Australia; regular breeding migrant in southern Australia, arriving September to October, departing February to March, some occasionally present April to May (Pizzey and Doyle 1988). Occurs in open country, chiefly at suitable breeding places in areas of sandy or loamy soil: sand-ridges, riverbanks, road-cuttings, sand-pits, occasionally coastal cliffs (ibid). Nest is a chamber at the end of a burrow, up to 1.6 m long, tunnelled in flat or sloping ground, sandy back or cutting (ibid).	Unlikely

Scientific Name	Common Name	Conservation Status		Habitat Associations	Likelihood of Occurrence
		TSC Act	EPBC Act		
Threatened Fauna					
Melanodryas cucullata ssp. *cucullata*	Hooded Robin	V (Not found during NPWS Wildlife Atlas search)	-	Associated with a wide range of Eucalypt woodlands, Acacia shrubland and open forests (Blakers et al. 1984). In temperate woodlands, the species favours open areas adjoining large woodland blocks, with areas of dead timber and sparse shrub cover (NSW Scientific Committee 2001). Hooded Robin home ranges are relatively large, averaging 18ha for birds from the New England Tableland (NSW Scientific Committee 2001).	Known – previously detected on site
Myiagra cyanoleuca	Satin Flycatcher	-	M	Wetter, denser forest, often at high elevations (Simpson & Day 2004).	No – no suitable habitat
Pyrrholaemus sagittatus	Speckled Warbler	V	-	Occupies a wide range of eucalypt dominated communities with a grassy understorey, often on rocky ridges or in gullies. Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy. Large, relatively undisturbed remnants are required for the species to persist in an area. Pairs are sedentary and occupy a breeding territory of about ten hectares, with a slightly larger home-range when not breeding (DECC 2007).	Potential – not found during survey

Scientific Name	Common Name	Conservation Status		Habitat Associations	Likelihood of Occurrence
		TSC Act	EPBC Act		
Threatened Fauna					
Neophema pulchella	Turquoise Parrot	V	-	Steep rocky ridges and gullies, rolling hills, valleys and river flats and the plains of the Great Dividing Range compromise the topography inhabited by this species (Marchant & Higgins 1993). Spends much of the time on the ground foraging on seed and grasses (DECC 2007). It is associated with coastal scrubland, open forest and timbered grassland, especially low shrub ecotones between dry hardwood forests and grasslands with high proportion of native grasses and forbs (Environment Australia 2000).	Potential – not found during survey
Rostratula australis	Australian Painted Snipe	E	M	Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber (DECC 2007). Nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds (*ibid.*). Breeding is often in response to local conditions; generally occurs from September to December (DECC 2007). Roosts during the day in dense vegetation (NSW Scientific Committee 2004). Forages nocturnally on mud-flats and in shallow water (DECC 2007). Feeds on worms, molluscs, insects and some plant-matter (*ibid.*).	No – no suitable habitat

Scientific Name	Common Name	Conservation Status		Habitat Associations	Likelihood of Occurrence
		TSC Act	EPBC Act		
Threatened Fauna					
Stagonopleura guttata	Diamond Firetail	V	-	Typically found in grassy eucalypt woodlands, but also occurs in open forest, mallee, Natural Temperate Grassland, and in secondary grassland derived from other communities (DECC 2007). It is often found in riparian areas and sometimes in lightly wooded farmland (DECC 2007). Appears to be sedentary, though some populations move locally, especially those in the south (DECC 2007).	Potential – not found during survey
Rostratula benghalensis	Painted Snipe	E	M	Treated as conspecific with Australian Painted Snipe (*R. australis*)	As above
Xanthomyza phrygia	Regent Honeyeater	E	E and M	See *Anthochaera phrygia* *Honeyeater*	As above
MAMMALIA					
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	The Large-eared Pied Bat has been recorded in a variety of habitats, including dry sclerophyll forests, woodland, sub-alpine woodland, edges of rainforests and wet sclerophyll forests (Churchill 1998; DECC 2007). This species roosts in caves, rock overhangs and disused mine shafts and as such is usually associated with rock outcrops and cliff faces (Churchill 1998; DECC 2007).	Potential – not detected during survey

Scientific Name	Common Name	Conservation Status		Habitat Associations	Likelihood of Occurrence
		TSC Act	EPBC Act		
Threatened Fauna					
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V (Not found during NPWS Wildlife Atlas search)	-	Prefers moist habitats with trees taller than 20m (DECC 2007). Roosts in tree hollows but has also been found roosting in buildings or under loose bark (DECC 2007).	Known – detected on site
Miniopterus schreibersii oceanensis	Eastern Bent-wing Bat	V (Not found during NPWS Wildlife Atlas search)	-	Associated with a range of habitats such as rainforest, wet and dry sclerophyll forest, monsoon forest, open woodland, paperbark forests and open grassland (Churchill 1998). It forages above and below the tree canopy on small insects (AMBS 1995, Dwyer 1995, Dwyer 1981). Will utilise caves, old mines, and stormwater channels, under bridges and occasionally buildings for shelter (Environment Australia 2000, Dwyer 1995).	Known – detected on site
Nyctophilus timoriensis	Eastern Long-eared Bat	V (Not found during NPWS Wildlife Atlas search)	V	This species prefers wetter habitats, ranging from rainforest and monsoon forest to riverine forests of paperbark, but may be found in open woodland, tall open forest and dry sclerophyll woodland (Churchill 1998). These forest bats have been recorded roosting under peeling bark, among epiphytes, in tree hollows and in foliage (Churchill 1998). Individuals are likely to change roost sites nightly (DECC 2007).	Potential – not detected during survey

Scientific Name	Common Name	Conservation Status		Habitat Associations	Likelihood of Occurrence
		TSC Act	EPBC Act		
Threatened Fauna					
Pteropus poliocephalus	Grey-headed Flying-fox	V (Not found during NPWS Wildlife Atlas search)	V	Inhabits a wide range of habitats including rainforest, mangroves, paperbark forests, wet and dry sclerophyll forests and cultivated areas (Churchill 1998, Eby 1998). Camps are often located in gullies, typically close to water, in vegetation with a dense canopy (Churchill 1998).	Potential – not detected during survey
Saccolaimus flaviventris	Yellow-bellied Sheath-tail Bat	V (Not found during NPWS Wildlife Atlas search)	-	Found in almost all habitats, from wet and dry sclerophyll forest, open woodland (Churchill 1998), open country, mallee, rainforests, heathland and waterbodies (SFNSW 1995). Roosts in tree hollows; may also use caves; has also been recorded in a tree hollow in a paddock (Environment Australia 2000) and in abandoned sugar glider nests (Churchill 1998). The Yellow-bellied Sheath-tail Bat is dependent on suitable hollow-bearing trees to provide roost sites, which may be a limiting factor on populations in cleared or fragmented habitats (Environment Australia 2000).	Known – detected on site

Scientific Name	Common Name	Conservation Status		Habitat Associations	Likelihood of Occurrence
		TSC Act	EPBC Act		
Threatened Fauna					
Scoteanax rueppellii	Greater Broad-nosed Bat	V (Not found during NPWS Wildlife Atlas search)	-	Associated with moist gullies in mature coastal forest, or rainforest, east of the Great Dividing Range (Churchill, 1998), tending to be more frequently located in more productive forests (Hoye & Richards 1998). Within denser vegetation types use is made of natural and manmade openings such as roads, creeks and small rivers, where it hawks backwards and forwards for prey (Hoye & Richards 1998).	Known – detected on site
REPTILIA					
Anomalopus mackayi	Five-clawed Worm-skink	E (No records found during NSW Wildlife Atlas database search)	V (Not predicted by EPBC Protected Matters search)	Open woodland with moist black soils, scattered eucalypts and cropped grass cover. Burrowing species usually found under timber (Swan et al 2004). Reported by Hoser (1989) as occurring at Boggabri, NW of Werris Creek, though the animal he depicts is an *Anomalopus* sp., it is *Lerista punctatovittata*.	No
Aprasia parapulchella	Pink-tailed Worm Lizard Pink-tailed Legless Lizard	V (No records found during NSW Wildlife Atlas database search)	V (Not predicted by EPBC Protected Matters search)-	The Pink-tailed Worm-lizard has been found in the Gunnedah area which is a considerable range extension north from previously known localities.	Potential – not found during survey

Scientific Name	Common Name	Conservation Status		Habitat Associations	Likelihood of Occurrence
		TSC Act	EPBC Act		
Threatened Fauna					
Delma torquata	Collared Delma	-	V	Endemic to SE QLD.	No
Elseya belli	Bell's Turtle	V	V	Shallow to deep pools in upper reaches or small tributaries of major rivers in granite country. Occupied pools are most commonly less than 3 m deep with rocky or sandy bottoms and patches of vegetation. Most typically uses narrow stretches of rivers or streams 30 - 40 m wide, running through habitat that has now been converted to grazing land. In NSW, currently found only in the upper reaches of the Namoi and Gwydir River systems, on the escarpment of the North West Slopes.	No – no suitable habitat
Hoplocephalus bitorquatus	Pale-headed Snake	V (No records found during NSW Wildlife Atlas database search)	-	From rainforest to drier sclerophyll forests on Western Slopes. Usually found near watercourses (Swan et al 2004). Known from scattered localities along the slopes and tablelands, although none have been recorded in the immediate area. Primarily a frog eater, it tends to favour tree-lined watercourses (Swan, G., per comm., 2010).	No – no suitable habitat

Scientific Name	Common Name	Conservation Status		Habitat Associations	Likelihood of Occurrence
		TSC Act	EPBC Act		
Threatened Fauna					
Underwoodisaurus sphyrurus	Border Thick-tailed Gecko	V	V	Found only on the tablelands and slopes of northern NSW and southern Queensland, reaching south to Tamworth and west to Moree (DECC 2007). Most common in the granite country of the New England Tablelands (DECC 2007). Rocky hills with dry open eucalypt forest or woodland (DECC 2007). Favours forest and woodland areas with boulders, rock slabs, fallen timber and deep leaf litter (DECC 2007).	Potential – not found during site survey
OSTEICHTYES (Bony Fish)					
Maccullochella peelii peelii	Murray Cod	-	V	Widespread throughout the Murray-Darling system originally being found in virtually all waterways of that system. Habitat varies greatly, from quite small clear, rocky, upland streams with riffle and pool structure on the upper western slopes of the Great Dividing Range to large, meandering, slow-flowing, often silty rivers in the alluvial lowland reaches of the Murray-Darling Basin. Prefer deep holes with cover in the form of large rocks, fallen trees, stumps, clay banks and overhanging vegetation.	No – no suitable habitat

Disclaimer: Data extracted from the Atlas of NSW Wildlife and EPBC Act Protected Matters Report are only indicative and cannot be considered a comprehensive inventory. Migratory marine species' and 'listed marine species' listed on the EPBC Act (and listed on the DEW protected matters report) have not been included in this table, since they are considered unlikely to occur within the study area due to the absence of marine habitat
CE = Critically Endangered; E = Endangered; E2 = Endangered Population; E4 = Extinct; V = Vulnerable, M = Migratory.

References used in threatened species habitat assessment.

BirdLife International (2004). *Apus pacificus*. *2006 IUCN Red List of Threatened Species*. IUCN 2006

Blakers, M., Davies, S., and Reilly, P.N (1984) *The Atlas of Australian Birds*. RAOU Melbourne University Press.

Churchill, S. (1998) *Australian Bats*, Reed New Holland, Sydney.

Cogger, H.G. (2000) *Reptiles and Amphibians of Australia*, 6th ed. Reed Books, Sydney.

Debus, S.J.S. and Chafer, C.J. (1994) 'The Powerful Owl *Ninox strenua* in New South Wales', *Australian Birds*. 28:s21-s38.

Debus, S.J.S. (1994) 'The Sooty Owl *Tyto tenebricosa* in New South Wales', *Australian Birds*, 28:s4-s19.

Debus, S.J.S. (1997) 'The Barking Owl in New South Wales', Australian Birds, *30(3).*

Debus S.J.S. and Rose, A.B. (1994) 'The Masked Owl *Tyto novaehollandiae* in New South Wales', *Australian Birds,* 28:s21-s39.

Department of Environment and Conservation NSW (2007) Threatened Species Pr*ofiles* http://www.threatenedspecies.environment.nsw.gov.au/index.aspx

Department of Environment, Water, Heritage and the Arts, 2007, Grassy White Box Woodlands profile.

http://www.environment.gov.au/biodiversity/threatened/publications/gras-white.html

Department of the Environment and Heritage (2005a). *Background paper to the wildlife conservation plan for migratory shorebirds*, Commonwealth Dept of Environment and Heritage, Canberra.

Department of Natural Resources (2000) *Water for the environment: wetlands*, NSW Department of Natural Resources,

http://www.dlwc.nsw.gov.au/care/wetlands/facts/paa/birds/waders_and_plovers.html #RuddyTurnstone

Duncan, A, Baker, GB and Montgomery, N (eds) (1999) *The Action Plan for Australian Bats*, Environment Australia, Canberra.

Ehmann, E. (1997) *Threatened Frogs of New South Wales: Habitats, status and conservation*, Frog and Tadpole Study Group, Sydney.

Garnett, S. (Ed) (1993). *Threatened and extinct birds of Australia. Royal Australian Ornithologists Union and Australian NPWS*, Royal Australian Ornithologists Union Report, No. 82.

Harden G (ed.) (1991) *Flora of NSW* Volume 2, UNSW Press, Sydney.

Harden G (ed.) (1993) *Flora of NSW* Volume 4, UNSW Press, Sydney.

Harden G. (ed) (2002) *Flora of New South Wales*, Volume 2 revised edition, UNSW Press.

Higgins, P.J. and Davies, S.J. (1996) *Handbook of Australian, New Zealand and Antarctic Birds, Volume 3: Snipe to Pigeons*, Oxford University Press, Melbourne.

Hoser, R. T. (1989) Australian Reptiles and Frogs. Pierson, Mosman.

Kavanagh, R.P. (1984) 'Seasonal changes in habitat use by gliders and possums in southeastern New South Wales', Pp. 527-543 in A.P. Smith & I.D. Hume (eds) Possums and Gliders. Australian Mammal Society, Sydney.

Kavanagh, R.P. and Peake, P. (1993) 'Distribution and habitats of nocturnal forest birds in south-eastern New South Wales', In: Olsen, P. (Ed.). *Proceedings of the 10th Anniversary Conference, Canberra*, pp 86-100, Australian Raptor Association, Royal Ornithologists Union, Sydney.

Marchant and Higgins (1993) *Handbook of Australian, New Zealand and Antarctic Birds*. Oxford University Press, Melbourne.

McKilligan, N. (2005) *Herons, Egrets and Bitterns*, CSIRO Publishing.

Morcombe, M. (2004) *Field Guide to Australian Birds*, Steve Parish Publishing.

NSW National Parks and Wildlife Service (1995) *Endangered Fauna of Western New South Wales*, NSW National Parks and Wildlife Service, Hurstville.

NSWSC (1996-2010) Determinations to list threatened species under the *Threatened Species Conservation Act 1995.*NSW Scientific Committee. Available at:
http://www.environment.nsw.gov.au/committee/ListofScientificCommitteeDeterminations.htm

Olsen, P. (1995) *Australian Birds of Prey*. University of New South Wales Press, Sydney.

Pizzey, G. and Knight, F. (1997) *Field Guide to the Birds of Australia*, Harper Collins Publishers, Sydney.

Robinson, M. (1993) *A Field Guide to Frogs of Australia: from Port Augusta to Fraser Island including Tasmania*, Australian Museum/Reed New Holland, Chatswood.

Schodde, R. and Tidemann, S. (Eds) (1986). *Readers Digest complete book of Australian Birds*, 2nd edn., Reader's Digest Services Pty Ltd, Sydney.

Simpson, K. and Day, N. (1999). *Field guide to the birds of Australia 6th edn.,* Penguin Books Australia Ltd, Ringwood Victoria.

Simpson, K. and Day, N. (2004). *Field guide to the birds of Australia 7th edn.,* Penguin Books Australia Ltd, Ringwood Victoria.

Strahan, R. (Ed.) (1998) *The Australian Museum Complete Book of Australian Mammals*, Angus and Robertson Publishers, Sydney.

Swan, G., Shea, G. and Sadlier, R. (2004) A field guide to Reptiles of NSW, 2nd Edition. Reed New Holland, Sydney.

Turner, V. and Ward, S. (1995) 'Eastern Pygmy Possum *Cercartetus nanus*', In: Strahan, R. (Ed.) *The Mammals of Australia*, pp 217-218, Reed Books, Sydney

Webb J.K. and Shine R. (1998) 'Ecological characteristics of a threatened snake species *Hoplocephalus bungaroides* (Serpentes: Elapidae)', *Animal Conservation*, 1: 185-193.

Appendix D: Flora Species Lists

Native flora recorded at Project Site.

	SCIENTIFIC NAME	COMMON NAME	IMPORTANT SPECIES (*)	APR-04	NOV-08	APR-10
1	*Acacia harpophylla*	Brigalow				x
2	*Amaranthus mitchellii*	Boggabri			x	
3	*Aristida leptopoda*	White Speargrass				x
4	*Aristida ramosa*	Purple Wire-Grass			x	x
5	*Aristida* sp.	Wiregrass		x		
6	*Asperula conferta*	Common Woodruff	Important			x
7	*Atriplex spinibractea*	Spiny-fruit Saltbush		x	x	
8	*Austrodanthonia bipartita*	Wallaby Grass				x
9	*Austrodanthonia duttoniana*	Wallaby Grass		x	x	
10	*Austrodanthonia racemosa ssp. racemosa*	Wallaby Grass				x
11	*Austrodanthonia richardsonii*	Wallaby Grass			x	
12	*Austrodanthonia* sp.	Wallaby Grass		x	x	
13	*Austrostipa aristiglumis*	Plains Grass		x	x	x
14	*Austrostipa scabra*					x
15	*Austrostipa scabra* ssp. *scabra*	Speargrass				x
16	*Austrostipa* sp.	Speargrass		x	x	
17	*Austrostipa verticillata*	Slender Bamboo Grass		x	x	x
18	*Boerhavia dominii*			x	x	x
19	*Bothriochloa macra*	Redgrass, Redleg Grass		x	x	x

	SCIENTIFIC NAME	COMMON NAME	IMPORTANT SPECIES (*)	APR-04	NOV-08	APR-10
20	*Bracteantha bracteata*	Golden Everlasting		x		
21	*Brunoniella australis*	Blue Trumpet				x
22	*Bulbine bulbosa*	Bulbine Lily, Native Onion, Native Leek, Golden Lily	Important	x	x	x
23	*Calotis lappulacea*	Yellow Burr-daisy, Yellow Daisy-burr	Important	x	x	x
24	*Carex inversa*					x
25	*Chamaesyce drummondii*	Caustic Weed		x	x	
26	*Cheilanthes sieberi*	Rock Fern		x	x	
27	*Chenopodium* sp.	Crumbweed		x	x	
28	*Chloris truncata*	Windmill Grass		x	x	x
29	*Chloris ventricosa*	Tall Chloris		x	x	x
30	*Chrysocephalum apiculatum*	Yellow Buttons		x		
31	*Chrysocephalum semipapposum*	Clustered Everlasting				x
32	*Convolvulus erubescens*	Australian Bindweed, Blushing Bindweed		x	x	x
33	*Crassula sieberiana*	Australian Stonecrop		x	x	
34	*Crassula* sp.	Stonecrop		x		
35	*Cullen tenax*	Emu-foot, Emu Grass, Tough Scurf-pea	Important	x		x
36	*Cymbonotus* sp.	Bear's Ear		x		
37	*Cynodon dactylon*	Couch		x	x	x
38	*Cyperus gracilis*	Slender Flat-sedge		x		x
39	*Cyperus* sp.			x		
40	*Datura ferox*	Fierce Thornapple		x		
41	*Desmodium varians*	Slender Tick-trefoil		x	x	
42	*Dianella laevis*	Spreading Flax-lily		x		
43	*Dichanthium sericeum*	Queensland Blue-grass	Important	x	x	x
44	*Dichanthium sericeum* subsp. *sericeum*					x
45	*Dichelachne sp.*	Plume Grass			x	

	SCIENTIFIC NAME	COMMON NAME	IMPORTANT SPECIES (*)	APR-04	NOV-08	APR-10
46	*Dichondra repens*	Kidney Grass, Kidney Weed		x	x	x
47	*Dichondra* sp					x
48	*Dichopogon* sp.	Chocolate Lily		x	x	
49	*Digitaria brownii*	Cotton Panic Grass			x	x
50	*Digitaria divaricatissima*	Umbrella Grass			x	x
51	*Echium plantagineum*	Paterson's Curse		x	x	
52	*Einadia hastata*	Saloop			x	
53	*Einadia nutans*	Climbing Saltbush		x	x	
54	*Einadia trigonos*	Fishweed				x
55	*Elymus scaber*	Common Wheatgrass		x	x	
56	*Enneapogon gracilis*	Slender Bottlewashers			x	
57	*Enneapogon* sp.	Bottlewashers		x		
58	*Enteropogon acicularis*	Curly Windmill Grass		x	x	
59	*Elymus scaber*	Common Wheatgrass				
60	*Eragrostis lacunaria*	Purple Love-grass				x
61	*Eragrostis molybdea*	Granite Lovegrass		x	x	
62	*Eremophila debilis*	Winter Apple				x
63	*Eriochloa* sp.	Early Spring Grass		x		
64	*Erodium crinitum*	Blue Crowfoot		x	x	
65	*Eucalyptus albens*	White Box				x
66	*Eucalyptus dealbata*	Tumbledown Red Gum				x
67	*Eucalyptus melliodora*	Yellow Box				x
68	*Geranium sp.*	Storksbill			x	
69	*Glycine sp.*	Glycine		x		
70	*Glycine stenophylla*				x	
71	*Glycine tabacina*	Glycine Pea, Variable Glycine	Important			x

	SCIENTIFIC NAME	COMMON NAME	IMPORTANT SPECIES (*)	APR-04	NOV-08	APR-10
72	*Gnaphalium sphaericum*	Japanese Cudweed		x		
73	*Goodenia* sp.			x	x	
74	*Hydrocotyle laxiflora*	Stinking Pennywort		x	x	
75	*Hypericum gramineum*	Small St John's Wort		x		
76	*Juncus* sp.	A rush		x	x	
77	*Linum marginale*	Native Flax			x	
78	*Lolium rigidum*	Annual Ryegrass		x	x	
79	*Lomandra* sp.	Matrush			x	
80	*Lomandra* sp.1	Matrush		x		
81	*Lomandra* sp.2	Matrush		x		
82	*Maireana enchylaenoides*	Wingless Fissureweed		x		
83	*Maireana microphylla*	Small-leaf Bluebush				x
84	*Mentha satureioides*	Creeping Mint				x
85	*Notelaea microcarpa*	Native Olive				x
86	*Oxalis perennans*					x
87	*Oxalis* sp.	Yellow Wood Sorrel		x	x	
88	*Panicum decompositum*	Native Millet				x
89	*Panicum queenslandicum*	Coolabah Grass				x
90	*Paspalidium constrictum*	Knottybutt Grass		x	x	x
91	*Plantago turrifera*	Sago Weed		x		
92	*Polygonum* sp.	Wireweed			x	
93	*Portulaca oleracea*	Common Pigweed, Common Purslane, Munyeroo		x	x	x
94	*Rostellularia adscendens* ssp. *adscendens*	Pink Tongues		x		x
95	*Rumex brownii*	Slender Dock		x	x	
96	*Salvia verbenaca*	Wild Sage		x	x	
97	*Scirpus* sp.	Club-rush		x	x	

	SCIENTIFIC NAME	COMMON NAME	IMPORTANT SPECIES (*)	APR-04	NOV-08	APR-10
98	*Scleria mackaviensis*					x
99	*Sida corrugata*	Corrugated Sida	Important	x	x	x
100	*Sida spicata*				x	
101	*Sida spinosa*				x	x
102	*Solanum cinereum*	Narrawa Burr		x	x	
103	*Solanum esuriale*	Quena		x		
104	*Sporobolus creber*	Western Rat-tail Grass				x
105	*Sporobolus elongatus*	Ratstail Grass		x	x	
106	*Stackhousia viminea*	Slender Stackhousia		x		
107	*Themeda australis*	Kangaroo Grass		x		
108	*Tragus australianus*	Small Burr Grass		x	x	
109	*Tribulus terrestris*	Cathead		x	x	
110	*Urtica incisa*	Scrub Nettle		x	x	
111	*Vittadinia cervicularis* var. *cervicularis*	New Holland Daisy		x	x	
112	*Vittadinia cuneata*					x
113	*Vittadinia muelleri*			x	x	x
114	*Vittadinia* sp.	New Holland Daisy		x	x	
115	*Vittadinia sulcata*	Fuzzweed			x	
116	*Wahlenbergia communis*	Tufted Bluebell		x	x	

** Important species as identified in TSSC (2006)*

Exotic flora recorded at Project Site.

	SCIENTIFIC NAME	COMMON NAME	NOXIOUS WEEDS CATEGORY (+)	APR-04	NOV-08	APR-10
1	*Alternanthera pungens*	Khaki Weed		x		
2	*Alternanthera repens*	Khaki Weed			x	

	SCIENTIFIC NAME	COMMON NAME	NOXIOUS WEEDS CATEGORY (+)	APR-04	NOV-08	APR-10
3	*Amaranthus* sp.	Amaranth		x		x
4	*Anagallis arvensis*	Scarlet Pimpernel		x	x	
5	*Arctotheca calendula*	Capeweed		x	x	
6	*Avena sativa*	Oats		x	x	
7	*Avena* sp.	Wild Oats		x	x	
8	*Bidens subalternans*	Greater Beggar's Ticks			x	x
9	*Bromus catharticus*	Prairie Grass		x	x	
10	*Bromus molliformis*	Silky Brome		x	x	
11	*Capsella bursa-pastoris*	Shepherd's Purse		x	x	
12	*Carthamus lanatus*	Saffron Thistle		x	x	
13	*Cenchrus incertus*	Spiny Burrgrass			x	
14	*Centaurea solstitialis*	Maltese Cockspur, Cockspur Thistle, Saucy Jack		x	x	x
15	*Chondrilla juncea*	Skeleton Weed		x	x	
16	*Cirsium vulgare*	Spear Thistle		x	x	
17	*Conyza bonariense*	Flaxleaf Fleabane			x	
18	*Conyza* sp.	Fleabane		x		
19	*Cucumis myriocarpus*	Paddy Melon		x		
20	*Dittrichia graveolens*	Stinkwort			x	
21	*Echinochloa colonum*	Barnyard Grass		x	x	
22	*Eragrostis cilianensis*	Stinking Lovegrass		x	x	
23	*Foeniculum vulgare*	Fennel		x	x	
24	*Gomphocarpus fruticosus*	Swan Plant			x	
25	*Hedypnois rhagadioloides* subsp. *Cretica*	Cretan Weed			x	
26	*Hordeum leporinum*	Barley Grass		x	x	

	SCIENTIFIC NAME	COMMON NAME	NOXIOUS WEEDS CATEGORY (+)	APR-04	NOV-08	APR-10
27	*Hypericum perforatum*	St John's Wort			x	
28	*Hypochaeris radicata*	Flatweed		x	x	
29	*Lactuca serriola*	Prickly Lettuce		x	x	
30	*Lamarckia aurea*	Golden Top		x	x	
31	*Lepidium africanum*	Peppercress		x	x	
32	*Malva parviflora*	Small-flowered Mallow		x	x	
33	*Marrubium vulgare*	Horehound		x	x	
34	*Medicago minima*	Small Woolly Burr Medic		x	x	
35	*Medicago polymorpha*	Burr Medic		x		
36	*Medicago sativa*	Lucerne		x	x	x
37	*Medicago scutellata*	Snail Medic		x	x	
38	*Medicago* spp.	Medic		x	x	x
39	*Medicago truncatula*	Barrel Medic		x	x	
40	*Opuntia stricta*	Prickly Pear		x		
41	*Paspalum dilatatum*	Paspalum			x	
42	*Petrorhagia nanteuilii*	Proliferous Pink			x	
43	*Petrorhagia* sp.	Pink		x		
44	*Physalis* sp.	Ground Cherry		x	x	
45	*Plantago lanceolata*	Ribwort		x	x	
46	*Polycarpon tetraphyllum*	Four-leaved Allseed		x		
47	*Rapistrum rugosum*	Turnip Weed		x	x	
48	*Rostraria cristata*	Annual Cat's Tail		x	x	
49	*Salvia reflexa*	Mint Weed		x		
50	*Schkuhria pinnata* var. *abrotanoides*	Dwarf Marigold		x	x	

	SCIENTIFIC NAME	COMMON NAME	NOXIOUS WEEDS CATEGORY (+)	APR-04	NOV-08	APR-10
51	*Sida rhombifolia*	Paddy's Lucerne			x	
52	*Silybum marianum*	Variegated Thistle		x	x	
53	*Sisymbrium* sp.	Wild Mustard		x	x	
54	*Solanum nigrum*	Black-berry Nightshade		x	x	
55	*Sonchus oleraceus*	Common Sowthistle		x	x	
56	*Spergularia rubra*	Sand Spurrey		x		
57	*Stachys arvensis*	Stagger Weed		x		
58	*Trifolium angustifolium*	Narrow-leaf Clover		x		
59	*Trifolium arvense*	Haresfoot Clover		x	x	
60	*Trifolium campestre*	Hop Clover		x	x	
61	*Trifolium dubium*	Yellow Suckling Clover			x	
62	*Trifolium glomeratum*	Cluster Clover		x	x	
63	*Trifolium repens*	White Clover		x		
64	*Trifolium subterraneum*	Subterranean Clover		x		
65	*Trifolium tomentosum*	Woolly Clover		x		
66	*Triticum aestivum*	Wheat		x		
67	*Urochloa panicoides*					x
68	*Urtica urens*	Small Nettle		x		
69	*Verbena bonariensis*	Wild Stattice		x		
70	*Verbena* sp.	Verbena			x	
71	*Xanthium pungens*	Bathurst Burr		x		
72	*Xanthium spinosum*	Bathurst Burr		x	x	

+ = As listed in the NSW Noxious Weeds Act 2003

Appendix E: Fauna Species Lists

CLASS	FAMILY	SPECIES	COMMON NAME	APR-04	MAY-04	JUL-04	OCT-04	MAR-06	FEB-07	MAR-08	DEC-08	MAR-09	OCT-09	NOV-09	JAN-10	APR-10	JUL-10	DETECTION METHOD (ELA 20
Amphibia	Hylidae	*Litoria caerulea*	Green Tree Frog	x				x										Previous survey
	Hylidae	*Litoria peronii*	Peron's Tree Frog	x					x					x				Previous survey
	Hylidae	*Litoria rubella*	Desert Tree Frog	x										x				Previous survey
	Myobatrachidae	*Crinia signifera*	Common Eastern Froglet													x		Incidental call identification
	Myobatrachidae	*Limnodynastes dumerilii*	Eastern Banjo Frog	x														Previous survey
	Myobatrachidae	*Limnodynastes salmini*	Salmon-striped Frog	x														Previous survey
	Myobatrachidae	*Limnodynastes tasmaniensis*	Spotted Marsh Frog	x														Previous survey
	Myobatrachidae	*Neobatrachus sudelli*	Painted Burrowing Frog	x														Previous survey
	Myobatrachidae	*Uperoleia laevigata*	Smooth Toadlet	x										x				Previous survey
Aves	Acanthizidae	*Acanthiza chrysorrhoa*	Yellow-rumped Thornbill														x	Incidental sighting
	Accipitridae	*Elanus axillaris*	Black-shouldered Kite							x		x				x	x	Spotlighting; incidental; Area sea
	Accipitridae	***Hieraaetus morphnoides***	**Little Eagle**									x				x		**Area search; Incidental sightin**
	Anatidae	*Anas gracilis*	Grey Teal													x		Area search; Incidental sighting
	Anatidae	*Anas superciliosa*	Pacific Black Duck			x	x			x						x	x	Area search; Incidental sighting
	Anatidae	*Chenonetta jubata*	Australian Wood Duck		x	x	x			x		x				x	x	Area search; Incidental sighting
	Anatidae	*Dendrocygna eytoni*	Plumed Whistling-Duck													x		Area search; Incidental sighting
	Ardeidae	*Egretta novaehollandiae*	White-faced Heron			x	x			x		x				x	x	Area search; Incidental sighting
	Artamidae	*Artamus cyanopterus*	Dusky Woodswallow		x	x	x			x	x	x				x		Incidental sighting
	Artamidae	*Cracticus nigrogularis*	Pied Butcherbird		x	x	x				x	x				x	x	Area search; Incidental sighting
	Artamidae	*Cracticus torquatus*	Grey Butcherbird							x	x					x		Area search; Incidental sighting
	Artamidae	*Gymnorhina tibicen*	Australian Magpie		x	x	x			x	x	x				x	x	Area search; Incidental sighting
	Artamidae	*Strepera graculina*	Pied Currawong				x									x		Area search; Incidental sighting
	Cacatuidae	*Cacatua galerita*	Sulphur-crested Cockatoo			x	x			x	x	x				x		Area search; Incidental sighting
	Cacatuidae	*Eolophus roseicapillus*	Galah		x	x	x			x	x	x				x	x	Area search; Incidental sighting
	Cacatuidae	*Nymphicus hollandicus*	Cockatiel								x					x		Area search; Incidental sighting
	Campephagidae	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike		x	x	x			x						x		Area search; Incidental sighting
	Campephagidae	*Coracina papuensis*	White-bellied Cuckoo-shrike													x		Area search; Incidental sighting
	Charadriidae	*Vanellus miles*	Masked Lapwing			x	x			x								Previous survey
	Climacteridae	***Climacteris picumnus***	**Brown Treecreeper**													x		Incidental sighting
	Columbidae	*Columba livia*	Rock Dove *									x				x		Area search
	Columbidae	*Geopelia striata*	Peaceful Dove *			x	x											Previous survey
	Columbidae	*Ocyphaps lophotes*	Crested Pigeon *								x	x				x		Area search; Incidental sighting
	Coraciidae	*Eurystomus orientalis*	Dollarbird			x	x											Previous survey
	Corvidae	*Corvus bennetti*	Little Crow			x	x			x								Previous survey
	Corvidae	*Corvus coronoides*	Australian Raven		x	x	x					x				x	x	Area search; Incidental sighting

CLASS	FAMILY	SPECIES	COMMON NAME	APR-04	MAY-04	JUL-04	OCT-04	MAR-06	FEB-07	MAR-08	DEC-08	MAR-09	OCT-09	NOV-09	JAN-10	APR-10	JUL-10	DETECTION METHOD (ELA 2010)
	Dicaeidae	*Dicaeum hirundinaceum*	Mistletoebird													x		Area search; Incidental sighting
	Dicruridae	*Grallina cyanoleuca*	Magpie-lark									x				x	x	Area search; Incidental sighting
	Dicruridae	*Rhipidura leucophrys*	Willie Wagtail		x	x	x					x				x	x	Area search; Incidental sighting
	Falconidae	*Falco berigora*	Brown Falcon									x					x	Previous survey
	Falconidae	*Falco cenchroides*	Nankeen Kestrel		x	x	x			x		x				x	x	Area search; Incidental sighting
	Falconidae	*Falco peregrinus*	Peregrine Falcon			x	x					x						Previous survey
	Halcyonidae	*Dacelo novaeguineae*	Laughing Kookaburra			x	x			x		x				x	x	Area search
	Hirundinidae	*Cheramoeca leucosternus*	White-backed Swallow									x				x		Area search
	Hirundinidae	*Hirundo neoxena*	Welcome Swallow													x	x	Area search; Incidental sighting
	Hirundinidae	*Petrochelidon nigricans*	Tree Martin			x	x									x	x	Area search; Incidental sighting
	Maluridae	*Malurus cyaneus*	Superb Fairy-wren													x		Area search; Incidental sighting
	Maluridae	*Malurus lamberti*	Variegated Wren									x						Previous survey
	Meliphagidae	*Lichenostomus chrysops*	Yellow-faced Honeyeater													x		Area search; Incidental sighting
	Meliphagidae	*Lichenostomus penicillatus*	White-plumed Honeyeater													x		Area search; Incidental sighting
	Meliphagidae	*Manorina melanocephala*	Noisy Miner		x	x	x			x	x	x				x	x	Area search; Incidental sighting
	Meliphagidae	*Philemon corniculatus*	Noisy Friarbird		x	x	x									x		Area search; Incidental sighting
	Motacillidae	*Anthus australis*	Australian (Richard's) Pipit									x						Previous survey
	Pardalotidae	*Pardalotus punctatus*	Spotted Pardalote		x	x	x										x	Previous survey
	Pardalotidae	*Pardalotus striatus*	Striated Pardalote		x	x	x									x		Area search; Incidental sighting
	Passeridae	*Passer domesticus*	House Sparrow													x		Area search
	Petroicidae	***Melanodryas cucullata***	**Hooded Robin**				x											**Previous survey**
	Petroicidae	*Microeca fascinans*	Jacky Winter													x		Area search
	Phasianidae	*Coturnix pectoralis*	Stubble Quail		x	x	x			x		x						Previous survey
	Phasianidae	*Coturnix ypsilophora*	Brown Quail													x	x	Incidental sighting
	Podargidae	*Podargus strigoides*	Tawny Frogmouth		x	x	x					x						Previous survey
	Podicipedidae	*Tachybaptus novaehollandiae*	Australasian Grebe													x	x	Area search; Incidental sighting
	Psittacidae	*Glossopsitta concinna*	Musk Lorikeet							x						x	x	Area search; Incidental sighting
	Psittacidae	***Glossopsitta pusilla***	**Little Lorikeet**			x	x											**Previous survey**
	Psittacidae	*Platycercus adscitus eximius*	Eastern Rosella		x	x	x			x	x	x				x	x	Area search; Incidental sighting
	Psittacidae	*Psephotus haematonotus*	Red-rumped Parrot			x	x			x	x	x				x	x	Area search; Incidental sighting
	Psittacidae	*Psephotus varius*	Mulga Parrot			x	x											Previous survey
	Strigidae	*Ninox novaeseelandiae*	Southern Boobook			x	x			x		x						Previous survey
	Sturnidae	*Sturnus vulgaris* *	European Starling			x						x				x	x	Area search; Incidental sighting
	Sturnidae	*Turdus merula* *	Common Myna									x						Previous survey
	Threskiornithidae	*Threskiornis molucca*	Australian White Ibis		x	x	x											Previous survey
	Tytonidae	*Tyto alba*	Barn Owl									x				x		Area search; Incidental sighting
Mammalia	Bovidae	*Bos taurus**	Cow			x				x						x		Incidental sighting
	Canidae	*Canis lupus familiaris* *	Dog			x				x						x		Previous survey
	Canidae	*Vulpes vulpes* *	European Red Fox			x				x						x	x	Spotlighting
	Felidae	*Felis catus**	Feral Cat			x				x								Previous survey

CLASS	FAMILY	SPECIES	COMMON NAME	APR-04	MAY-04	JUL-04	OCT-04	MAR-06	FEB-07	MAR-08	DEC-08	MAR-09	OCT-09	NOV-09	JAN-10	APR-10	JUL-10	DETECTION METHOD (ELA 2010)
	Leporidae	*Oryctolagus cuniculus* *	European Rabbit			x				x						x	x	Spotlighting
	Macropodidae	*Macropus giganteus*	Eastern Grey Kangaroo			x				x	x					x		Incidental sighting
	Macropodidae	*Macropus robustus*	Wallaroo			x										x	x	Spotlighting; scat samples
	Macropodidae	*Macropus rufogriseus*	Red-necked Wallaby			x												Previous survey
	Muridae	*Mus musculus**	House Mouse			x				x						x		Spotlighting
	Muridae	*Rattus rattus**	Black Rat			x										x		Incidental sighting
	Phalangeridae	*Trichosurus vulpecula*	Common Brushtail Possum			x				x						x	x	Scat sample
	Tachyglossidae	*Tachyglossus aculeatus*	Short-beak Echidna			x										x		Previous survey
Chiroptera (Bats)	**Emballonuridae**	***Saccolaimus flaviventris***	**Yellow-bellied Sheath-tail Bat**							x		x				x		**Anabat**
	Molossidae	*Mormopterus species 3*	Undescribed Little Mastiff-bat @ 25KHz			x				x		x	x			x		Anabat
	Molossidae	*Mormopterus species 4*	Undescribed Little Mastiff-bat @ 30KHz							x		x	x			x		Anabat
	Molossidae	*Tadarida australis*	White-striped Free-tail Bat							x		x				x		Anabat
	Vespertilionidae	*Chalinolobus gouldii*	Gould's Wattled Bat			x				x		x	x			x		Anabat
	Vespertilionidae	*Chalinolobus morio*	Chocolate Wattled Bat							x			x			x		Anabat
	Vespertilionidae	***Falsistrellus tasmaniensis***	**Eastern False Pipistrelle**										x			x		**Anabat**
	Vespertilionidae	***Miniopterus schreibersii oceanensis***	**Eastern Bent-wing Bat**			x							x			x		**Anabat**
	Vespertilionidae	*Nyctinomus australis*	White-striped Mastiff-bat			x				x								Previous survey
	Vespertilionidae	*Nyctophilus geoffroyi*	Lesser Long-eared Bat			x												Previous survey
	Vespertilionidae	*Nyctophilus sp.*										x				x		Anabat
	Vespertilionidae	***Scoteanax rueppellii***	**Greater Broad-nosed Bat**			x							x			x		**Anabat**
	Vespertilionidae	*Scotorepens balstoni*	Inland Broad-nosed Bat									x	x			x		Anabat
	Vespertilionidae	*Scotorepens greyii*	Little Broad-nosed Bat										x					
	Vespertilionidae	*Vespadelus darlingtoni*	Large Forest Bat			x				x		x						Previous survey
	Vespertilionidae	*Vespadelus vulturnus*	Little Forest Bat							x			x	x	x	x	x	Anabat
Reptilia	Agamidae	*Pogona barbata*	Eastern Bearded Dragon											x	x			Previous survey
	Chelidae	*Chelodina longicollis*	Eastern Snake-necked Turtle	x											x	x		Targeted transect search
	Elapidae	*Demansia psammophis*	Yellow-faced Whipsnake	x								x		x	x	x		Targeted transect search
	Elapidae	*Pseudechis guttatus*	Blue-bellied Black Snake													x		Targeted transect search
	Elapidae	*Pseudonaja textilis*	Eastern Brown Snake									x						Previous survey
	Gekkonidae	*Gehyra dubia*	Dubious Dtella													x		Targeted transect search
	Gekkonidae	*Gehyra variegata*	Common Dtella	x					x			x				x		Targeted transect search
	Gekkonidae	*Gehyra variegata* (egg shells)	Common Dtella															Targeted transect search
	Gekkonidae	*Oedura robusta*	Robust Velvet Gecko													x		Targeted transect search
	Gekkonidae	*Strophurus williamsi*	Eastern Spiny-tailed Gecko	x						x				x				Previous survey
	Gekkonidae	*Underwoodisaurus milii*	Barking Gecko	x				x										Previous survey
	Pygopodidae	*Delma inornata*	Plain Snake-lizard											x				Previous survey
	Pygopodidae	*Delma plebeia*	Basalt Snake-lizard	x														Previous survey
	Pygopodidae	*Lialis burtonis*	Burton's Snake-lizard	x				x										Previous survey
	Scincidae	*Anomalopus leuckartii*	Two-clawed Worm-skink	x								x		x		x		Targeted transect search

CLASS	FAMILY	SPECIES	COMMON NAME	APR-04	MAY-04	JUL-04	OCT-04	MAR-06	FEB-07	MAR-08	DEC-08	MAR-09	OCT-09	NOV-09	JAN-10	APR-10	JUL-10	DETECTION METHOD (ELA 2010)
	Scincidae	*Carlia tetradactyla*	Southern Rainbow Skink											x				Previous survey
	Scincidae	*Cryptoblepharus pannosus*	Ragged Snake-eyed Skink															Previous survey
	Scincidae	*Cryptoblepharus pulcher*	Elegant Snake-eyed Skink	x						x		x		x	x	x		Targeted transect search
	Scincidae	*Ctenotus robustus*	Eastern Striped Skink	x								x		x		x		Targeted transect search
	Scincidae	*Egernia striolata*	Tree skink						x							x		Targeted transect search
	Scincidae	*Eulamprus tenuis*	Greater Bar-sided Skink	x						x				x	x	x		Targeted transect search
	Scincidae	*Menetia greyii*	Dwarf Skink	x				x	x							x		Targeted transect search
	Scincidae	*Morethia boulengeri*	Boulenger's Morethia	x						x		x		x	x	x		Targeted transect search
	Scincidae	Unknown Reptile eggshells	(Possibly *M. boulengeri*)					x	x							x		Targeted transect search
	Typhlopidae	*Ramphotyphlops wiedii*	Blind Snake	x														Previous survey

Bold text denotes a threatened species

* Denotes an exotic species

Appendix F: Part 3A Impact Assessment

TSC Act – Impact Assessments for threatened species

The following threatened species impact assessments have been prepared for all species that are "known" to occur at the Project Site. Only species "known" are considered in this impact assessment, as the survey effort between 2004 and 2010 was considered sufficient to identify if "potential" or "likely" species actually occurred. The survey effort at the Project Site is compliant with '*Threatened Biodiversity Survey and Assessment Guidelines'* (DEC 2004) for all species. Survey effort is actually more comprehensive for all flora and fauna groups than the suggested survey effort (See **Table 7**, **Section 3**).

Impact assessment on these species and ecological communities is consistent with the Part 3A, EP&A Act, '*Draft Guidelines for Threatened Species Assessment'* (DEC and DPI 2005).

No threatened flora listed under the TSC Act have been recorded at the Project Site, as such, no impact assessment has been undertaken.

Brown Treecreeper (Eastern sub-species) (Climacteris picumnus victoriae) – Vulnerable

This species inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey within coastal areas. They nest in hollows in standing dead or live trees and tree stumps. Fallen timber is an important habitat component for this species (DECCW 2010). It is considered a sedentary species, with territories ranging between approximately 1ha to 11ha, though some birds may disperse locally after breeding (DECCW 2010). Populations consist of pairs to groups of three to six. They prefer open woodlands with much open ground and fallen timber, thus benefiting from vegetation clearing by man (Readers Digest 1984).

This species was recorded within the study area in 2010, in the woodland area surrounding the "Cintra" property to the north of the LOM Project footprint. This represents the first recording of the species on the Project Site.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The Brown Treecreeper is likely to be a resident of the woodland surrounding the "Cintra" homestead, though it may migrate between other woodland remnants in the surrounding area. This remnant would remain mostly intact although the LOM Project disturbance footprint would eventually encroach on part of this woodland at its southern edge (**Figure 2**).

At a landscape scale, the LOM Project would result in the removal of 58.5 ha of grassy woodland habitat, an impact of <0.01% of this vegetation type in the local area. Whilst the direct impact of the vegetation clearance and indirect impacts associated with the LOM Project would likely result in the population migrating from this woodland, the available habitat in the local area is abundant and an additional 1,600 ha would be conserved through the LOM Project BOS to meet the needs of this species at a landscape scale (See **Section 5**).

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The LOM Project is a temporary impact, with rehabilitation of the final landform to native woodland vegetation included as part of a Landscape Management Plan (AECOM 2010). This would be augmented to encompass the future proposed landform should the LOM Project be approved. The proposed LOM Project BOS also provides for an east-west corridor of approximately 1,600 ha, thus impacts to the habitat of this species would be affected in a positive manner at landscape scale.

This species requires hollows in standing dead or live trees and tree stumps for nesting. The LOM Project would result in the removal of 58.5 ha of grassy woodlands, which equates to <0.01% of this vegetation type in the local area, providing ample habitat for the species to persist. Currently, the rehabilitation of the Project Site has included the placement of dead fallen timbers and stags to maintain a habitat resource for hollow dependant fauna, as a mitigation measure for the loss of this resource during the time between the clearing and final rehabilitation of the mine landform.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

No. The Brown Treecreeper is a widespread species occurring along the east coast of Australia from the Cape York Peninsula to the Flinders Ranges in SA.

How is the proposal likely to affect current disturbance regimes?

The Project Site and adjoining lands are currently used as an operating coal mine or agricultural enterprises involving grazing, pasture improvement and/or cropping. The LOM Project would result in the direct loss of approximately 195 ha of remnant Box-Gum grassy woodland EEC. Given the highly modified nature of most of the vegetation being impacted and it's configuration in the landscape, other than adding to the cumulative loss of habitat at the local level, the LOM Project would not significantly add to loss of connectivity, or fragmentation of Box-Gum woodlands or fauna habitat. In the medium term, the proposed LOM Project BOS would result in approximately 1,600 ha of land managed for biodiversity conservation and would increase the area of woodland vegetation and structural complexity of the vegetation, providing enhanced habitat values, over and above what would result if the land was continued to be used for productive agriculture.

How is the proposal likely to affect habitat connectivity?

As the LOM Project is only a temporary land use, this disturbance would be partially offset with the implementation of the post mining Landscape Management Plan (AECOM 2010) and Biodiversity Offsets Strategy (Eco Logical 2010c). This would be augmented should the LOM Project be approved. With these strategies in place, this would eventually provide for an increase in actual extent of the Box-Gum Woodland TEC locally and provide for the conservation of land under covenant linking currently isolated pockets of the Box-Gum Woodland to the north, south and southwest of the Project Site.

Whilst the LOM Project involves the removal of a significant area of Box-Gum Woodland TEC, **Figure 2** illustrates that the community would remain connected through vegetation corridors of the same vegetation communities along the northern, eastern, southern and western boundaries of the Project Site. The vegetation corridor to the south of the Project Site is an 'in perpetuity' offset originating from the existing development consent and extends from the western ridgeline, across the southern (non-operational) portion of the Project Site (where revegetation is to be undertaken), through to remnant areas of Box-Gum Woodland to the east of Werris Creek Road.

The final rehabilitation of the Project Site would provide for further connectivity in the landscape through revegetation of the final landform and in-perpetuity conservation management of existing remnants on neighbouring land owned by the Proponent.

How is the proposal likely to affect critical habitat?

The Brown Treecreeper is a vulnerable species. Critical habitat cannot be declared for a vulnerable species.

Conclusions

Whilst the impact of the LOM Project would remove approximately 195 ha of Box-Gum woodland in various condition states, this impact is not considered to be significant when the following is taken into account:

- The amount of Box-Gum woodland in the local area is significant (~25,000ha).
- This impact would constitute the removal of <0.01% of this local extent of this vegetation type.
- The implementation of the LOM Project BOS would provide conservation security for >800 ha of native vegetation, including 600 ha of Box-Gum woodlands.
- Over 400 ha of post mining rehabilitation providing an increase in actual extent of woodland in the local area.
- The incremental nature of the clearing coupled with the rehabilitation of the final landform providing an intermediary habitat resource for fauna movement and dispersal of floral genetic resources.

Hooded Robin (Melanodryas cucullata ssp. cucullata) – Vulnerable

The Hooded Robin is a large Australian robin reaching 17 cm in length. The Hooded Robin is common in few places, and rarely found on the coast. It is considered a sedentary species, but local seasonal movements are possible. The south-eastern form is found from Brisbane to Adelaide throughout much of inland NSW, with the exception of the north-west. The species is widespread, found across Australia, except for the driest deserts and the wetter coastal areas - northern and eastern coastal Queensland and Tasmania.

The Hooded Robin prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas. The Hooded Robin requires structurally diverse habitats featuring mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses (DECCW 2010).

The Hooded Robin is threatened by clearance and fragmentation of habitat including removal of dead timber. The species appears unable to survive in remnants smaller than 100 to 200ha (Egan et al. 1997; N. Schrader, unpub.). Isolation of populations in small remnants increases vulnerability to local extinction as a result of stochastic events and can decrease their genetic viability in the long term. Low population densities and relatively large home ranges also exacerbate their vulnerability within a highly fragmented and predominantly cleared landscape (NSWSC 2001).

This species has not been recorded on the Project Site since 2004, though extensive survey has been undertaken onsite since this time (See **Section 3**). It was recently recorded on a neighbouring property to the west of the Project Site ("Marengo" property), which has consequently been included the LOM Project BOS (**Section 5**).

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The Hooded Robin is a widespread species, and highly mobile with a large home range. It is likely that the species has used the Project Site in the past for foraging though it has not been observed on the Project Site in over 6 years. A recent recording of the species on a neighbouring property attests to its persistence in the local area.

The LOM Project would result in the removal of 58.5ha of grassy woodland habitat, an impact of <0.01% of this vegetation type in the local area. It is unlikely that this vegetation clearance would affect the lifecycle of Hooded Robin in the local area.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The LOM Project would result in the clearing of 58.5ha of grassy woodland habitat, an impact of <0.01% of this vegetation type in the local area. The LOM Project is a temporary impact, with rehabilitation of the final landform proposed to be woodland vegetation. The proposed LOM Project BOS also provides for an east-west corridor of approximately 1655.2 ha, thus impacts to the habitat of this species would be affected in a positive manner at a landscape scale.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

No. Hooded Robin is a widespread species occurring from Brisbane to Adelaide throughout much of inland NSW, with the exception of the north-west, across the Australian continent, except for the driest deserts and the wetter coastal areas - northern and eastern coastal Queensland and Tasmania.

How is the proposal likely to affect current disturbance regimes?

The Project Site and adjoining lands are currently used as an operating coal mine or agricultural enterprises involving grazing, pasture improvement and/or cropping. The LOM Project would result in the direct loss of approximately 195 ha of remnant Box-Gum grassy woodland EEC. Given the highly modified nature of most of the vegetation being impacted and it's configuration in the landscape, other than adding to the cumulative loss of habitat at the local level, the Project would not significantly add to loss of connectivity, or fragmentation of Box-Gum woodlands or fauna habitat. In the medium term, the proposed LOM Project BOS would result in approximately 1,600 ha of land managed for biodiversity conservation and would increase the area of woodland vegetation and structural complexity of the vegetation, providing enhanced habitat values, over and above what would result if the land was continued to be used for productive agriculture.

How is the proposal likely to affect habitat connectivity?

As the proposed LOM Project is only a temporary land use, this disturbance would be partially offset with the implementation of the post mining Landscape Management Plan (AECOM 2010) and Biodiversity Offsets Strategy (Eco Logical 2010c). This would be augmented should the LOM Project be approved. With these strategies in place, this would eventually provide for an increase in actual extent of the Box-Gum Woodland TEC locally and provide for the conservation of land under covenant linking currently isolated pockets of the Box-Gum Woodland to the north, south and southwest of the Project Site.

Whilst the LOM Project involves the removal of a significant area of Box-Gum Woodland TEC, Figure 2 illustrates that the community would remain connected through vegetation corridors of the same vegetation communities along the northern, eastern, southern and western boundaries of the Project Site. The vegetation corridor to the south of the Project Site is an 'in perpetuity' offset originating from the existing development consent and extends from the western ridgeline, across the southern (non-operational) portion of the Project Site (where revegetation is to be undertaken), through to remnant areas of Box-Gum Woodland to the east of Werris Creek Road.

The final rehabilitation of the Project Site would provide for further connectivity in the landscape through revegetation of the final landform and in-perpetuity conservation management of existing remnants on neighbouring land owned by the Proponent.

How is the proposal likely to affect critical habitat?

The Hooded Robin is a vulnerable species. Critical habitat cannot be declared for a vulnerable species and therefore would not be affected. .

Conclusions

Whilst the impact of the LOM Project would encroach on "known" habitat for Hooded Robin, this impact is not considered to be significant due to:

- the amount of habitat available in the local area;
- the LOM Project BOS providing conservation security for >800ha of potential habitat for this species;

- over 400ha of post mining rehabilitation providing an increase in actual extent of woodland in the local area; and
- the incremental nature of the clearing coupled with the rehabilitation of the final landform providing an intermediary habitat resource for fauna movement.

Little Lorikeet

The Little Lorikeet is a Vulnerable species listed under the NSW TSC Act. It is a small parrot which is distributed widely across coastal areas of eastern Australia and the Great Divide from Cape York to South Australia. Within NSW the species occurs from coastal areas to as far west as Dubbo and Albury.

The species primarily forages in the canopy of open eucalypt forest and woodland though also utilises other trees including Angophora spp., Melaleuca spp and other tree species. Riparian habitats are commonly used, due to higher soil fertility and greater productivity. Forages mostly on nectar and pollen and only occasionally on native fruits such as mistletoes.

The species roosts in canopy vegetation, often at distances from feeding habitat. Nesting occurs in hollow bearing eucalypts in proximity to feeding areas if possible, most typically selecting hollows in the limb or trunk of smooth-barked Eucalypts. Hollows are typically small and located high above the ground with riparian trees often chosen, including *Allocasuarina* spp.

The Little Lorikeet is threatened by a number of processes including the extensive clearing of woodlands for agriculture, particularly large old Eucalypt trees on fertile soils which produce more nectar. Additionally, the loss of old hollow bearing trees has reduced nest sites, and increased competition with other native and exotic species including the introduced Honeybee.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

Factors likely to have an adverse effect on the life cycle of the Little Lorikeet would include a substantial loss and/or fragmentation of foraging habitat and loss of suitable nesting habitat.

At a landscape scale, the LOM Project would result in the removal of 58.5 ha of grassy woodland habitat, an impact of <0.01% of this vegetation type in the local area. Whilst the direct impact of the vegetation clearance and indirect impacts associated with the LOM Project would likely result in the population migrating from this woodland, the available habitat in the local area is abundant and an additional 1,600 ha would be conserved through the LOM Project BOS to meet the needs of this species at a landscape scale (See Section 5).

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The LOM Project is a temporary impact, with rehabilitation of the final landform to native woodland vegetation included as part of a Landscape Management Plan (AECOM 2010). This would be augmented to encompass the future proposed landform should the LOM Project be approved. The proposed LOM Project BOS also provides for an east-west corridor of approximately 1,600 ha, thus impacts to the habitat of this species would be affected in a positive manner at landscape scale.

This species requires hollows in live trees for nesting. The LOM Project would result in the removal of 58.5 ha of grassy woodlands, which equates to <0.01% of this vegetation type in the local area, providing ample habitat for the species to persist. Currently, the rehabilitation of the Project Site has included the placement of dead fallen timbers and stags to maintain a habitat resource for hollow dependant fauna, as a mitigation measure for the loss of this resource during the time between the clearing and final rehabilitation of the mine landform.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

No. The Little Lorikeet is a widespread species occurring along the east coast of Australia from Cairns in northern Queensland to Adelaide, South Australia.

How is the proposal likely to affect current disturbance regimes?

The Project Site and adjoining lands are currently used as an operating coal mine or agricultural enterprises involving grazing, pasture improvement and/or cropping. The LOM Project would result in the direct loss of approximately 195 ha of remnant Box-Gum grassy woodland EEC. Given the highly modified nature of most of the vegetation being impacted and it's configuration in the landscape, other than adding to the cumulative loss of habitat at the local level, the LOM Project would not significantly add to loss of connectivity, or fragmentation of Box-Gum woodlands or fauna habitat. In the medium term, the proposed LOM Project BOS would result in approximately 1,600 ha of land managed for biodiversity conservation and would increase the area of woodland vegetation and structural complexity of the vegetation, providing enhanced habitat values, over and above what would result if the land was continued to be used for productive agriculture.

How is the proposal likely to affect habitat connectivity?

As the LOM Project is only a temporary land use, this disturbance would be partially offset with the implementation of the post mining Landscape Management Plan (AECOM 2010) and Biodiversity Offsets Strategy (Eco Logical 2010c). This would be augmented should the LOM Project be approved. With these strategies in place, this would eventually provide for an increase in actual extent of the Box-Gum Woodland TEC locally and provide for the conservation of land under covenant linking currently isolated pockets of the Box-Gum Woodland to the north, south and southwest of the Project Site.

Whilst the LOM Project involves the removal of a significant area of Box-Gum Woodland TEC, **Figure 2** illustrates that the community would remain connected through vegetation corridors of the same vegetation communities along the northern, eastern, southern and western boundaries of the Project Site. The vegetation corridor to the south of the Project Site is an 'in perpetuity' offset originating from the existing development consent and extends from the western ridgeline, across the southern (non-operational) portion of the Project Site (where revegetation is to be undertaken), through to remnant areas of Box-Gum Woodland to the east of Werris Creek Road.

The final rehabilitation of the Project Site would provide for further connectivity in the landscape through revegetation of the final landform and in-perpetuity conservation management of existing remnants on neighbouring land owned by the Proponent.

How is the proposal likely to affect critical habitat?

The Little Lorikeet is a vulnerable species. Critical habitat cannot be declared for a vulnerable species.

Conclusions

The proposed development is unlikely to result in a significant impact on any local populations of Little Lorikeets as the impacts associated with proposed development:

- would not isolate an area of known habitat from currently interconnecting areas of potential habitat for this species;
- will result in the incremental removal and modification of potential foraging and nesting habitat, although there are extensive areas of this habitat type across the wider locality.
- Whilst the impact of the LOM Project would remove approximately 195 ha of Box-Gum woodland in various condition states, this impact is not considered to be significant when the following is taken into account:
- The amount of Box-Gum woodland in the local area is significant (~25,000ha).
- This impact would constitute the removal of <0.01% of this local extent of this vegetation type.
- The implementation of the LOM Project BOS would provide conservation security for >800 ha of native vegetation, including 600 ha of Box-Gum woodlands.
- Over 400 ha of post mining rehabilitation providing an increase in actual extent of woodland in the local area.
- The incremental nature of the clearing coupled with the rehabilitation of the final landform providing an intermediary habitat resource for fauna movement and dispersal of floral genetic resources.

Little Eagle (Hieraaetus morphnoides) – Vulnerable

The Little Eagle is widespread in mainland Australia, central and eastern New Guinea. The Little Eagle is seen over woodland and forested lands and open country, extending into the arid zone. It tends to avoid rainforest and heavy forest (BIB, 2006). It is a highly mobile species, with the population of Little Eagle in NSW considered to be a single population (DECCW 2010). This species was recently listed as vulnerable due to a moderate reduction in population size based on geographic distribution and habitat quality (NSWSC 2010).

This species was first recorded at the Project Site in March 2009 (CES 2009), though the location was not specified. It was again recorded during survey in 2010, in the woodland area surrounding the "Cintra" property to the north of the LOM Project footprint (**Figure 2)**.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The Little Eagle is a widespread species, highly mobile with a large home range. The species was recorded soaring over a remnant patch of woodland during the 2010 survey and no nesting sites were found in the area. This species preys on birds, reptiles and small mammals, with the European Rabbit providing an important prey resource for this species, due to the decline of small native mammals.

The LOM Project would result in the removal of approximately 195ha of potential foraging habitat (60ha of grassy woodland habitat and approximately 135ha of grasslands), though this only an impact of <0.01% (woodland and grassland) of these vegetation types in the local area. It is also noted that this vegetation clearance would be incremental, thus maintaining a majority of this foraging habitat at any point in time.

The LOM Project would not impact significantly on the foraging resource of this species in the local area, it would not impact on any known breeding sites and as such it is unlikely that this vegetation clearance would affect the lifecycle of Little Eagle.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The LOM Project would result in the removal of approximately 195ha of potential foraging habitat (60ha of grassy woodland habitat and approximately 135ha of grasslands), though this only an impact of <0.01% of these vegetation types in the local area. The LOM Project is a temporary impact, with rehabilitation of the final landform proposed to be woodland vegetation. It is also noted that this vegetation clearance would be incremental, thus maintaining a majority of this foraging habitat at any point in time. The proposed LOM Project BOS also provides for an east-west corridor of approximately 1655.2 ha, thus impacts to the habitat of this species would be affected in a positive manner at landscape scale.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

No. Little Eagle is a widespread species occurring from across the Australian continent.

How is the proposal likely to affect current disturbance regimes?

The Project Site and adjoining lands are currently used as an operating coal mine or agricultural enterprises involving grazing, pasture improvement and/or cropping. The LOM Project would result in the direct loss of approximately 195 ha of remnant Box-Gum grassy woodland EEC. Given the highly modified nature of most of the vegetation being impacted and it's configuration in the landscape, other than adding to the cumulative loss of habitat at the local level, the Project would not significantly add to loss of connectivity, or fragmentation of Box-Gum woodlands or fauna habitat. In the medium term, the proposed LOM Project BOS would result in approximately 1,600 ha of land managed for biodiversity conservation and would increase the area of woodland vegetation and structural complexity of the vegetation, providing enhanced habitat values, over and above what would result if the land was continued to be used for productive agriculture.

How is the proposal likely to affect habitat connectivity?

As the LOM Project is only a temporary land use, this disturbance would be partially offset with the implementation of the post mining Landscape Management Plan (AECOM 2010) and Biodiversity Offsets Strategy (Eco Logical 2010c). This would be augmented should the LOM Project be approved. With these strategies in place, this would eventually provide for an increase in actual extent of the Box-Gum Woodland TEC locally and provide for the conservation of land under covenant linking currently isolated pockets of the Box-Gum Woodland to the north, south and southwest of the Project Site.

Whilst the LOM Project involves the removal of a significant area of Box-Gum Woodland TEC, **Figure 20** illustrates that the community would remain connected through vegetation corridors of the same vegetation communities along the northern, eastern, southern and western boundaries of the Project Site. The vegetation corridor to the south of the Project Site is an 'in perpetuity' offset originating from the existing development consent and extends from the western ridgeline, across the southern (non-operational) portion of the Project Site (where revegetation is to be undertaken), through to remnant areas of Box-Gum Woodland to the east of Werris Creek Road.

The final rehabilitation of the Project Site would provide for further connectivity in the landscape through revegetation of the final landform and in-perpetuity conservation management of existing remnants on neighbouring land owned by the Proponent.

How is the proposal likely to affect critical habitat?

The Little Eagle is a vulnerable species. Critical habitat cannot be declared for vulnerable species and would therefore not be affected.

Conclusions

Whilst the impact of the LOM Project would encroach on "known" habitat for Little Eagle, this impact is not considered to be significant due to:

- the amount of habitat available in the local area;
- the LOM Project BOS providing conservation security for >800ha of potential habitat for this species;
- over 400ha of post mining rehabilitation providing an increase in actual extent of woodland in the local area;
- the incremental nature of the clearing coupled with the rehabilitation of the final landform providing an intermediary habitat resource for fauna movement.

Eastern Bent-wing Bat (Miniopterus schreibersii oceanensis) – Vulnerable

The Eastern Bent-wing Bat is listed as a vulnerable species under the TSC Act. This species occupies a range of forested environments (including wet and dry sclerophyll forests), along the coastal portion of eastern Australia, and through the Northern Territory and Kimberley area (subject to subdivision of this species).

This species has a fast, level flight exhibiting swift shallow dives. It forages from just above the tree canopy, to many times the canopy height in forested areas, and will utilise open areas where it is known to forage at lower levels. Moths appear to be the main dietary component. This highly mobile species is capable of large regional movements in relation to seasonal differences in reproductive behaviour and winter hibernation. Though individuals often use numerous roosts, it congregates in large numbers at a small number of nursery caves to breed and hibernate. Although roosting primarily occurs in caves, it has also been recorded in mines, culverts, stormwater channels, buildings, and occasionally tree-hollows. This species occupies a number of roosts within specific territorial ranges usually within 300 km of the maternity cave, and may travel large distances between roost sites (DECCW 2010a).

The Eastern Bent-wing Bat is threatened by a number of processes including loss of foraging habitat, damage to or disturbance of roosting caves (particularly during winter or breeding), application of pesticides in or adjacent to foraging areas, and predation by feral cats and foxes.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

Factors likely to have an adverse effect on the life cycle of the Eastern Bent-wing Bat would include a substantial loss and/or fragmentation of foraging habitat, loss of suitable roosting or breeding habitat, and predation by feral cats and foxes.

This species is a cave-dwelling bat and there are no known caves on the Project Site. As such, there would be no loss of suitable roosting or breeding habitat, and predation by feral cats and foxes would not be exacerbated due to the LOM Project.

The loss of vegetation due to the LOM Project would constitute a loss of foraging habitat, though this is considered minimal in the local area (<0.01%).

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The Project Site constitutes an area of foraging habitat for the Eastern Bent-wing Bat, and the LOM Project would involve the removal of <0.01% of this habitat in the local area. This vegetation removal would be incremental and complemented by the rehabilitation of the final mining landform. The proposed LOM Project BOS also provides for an east-west corridor of approximately 1600ha, thus impacts to the habitat of this species would be affected in a positive manner at landscape scale.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

No. Eastern Bent-wing Bat occurs along the coast from QLD to Victoria.

How is the proposal likely to affect current disturbance regimes?

The Project Site and adjoining lands are currently used as an operating coal mine or agricultural enterprises involving grazing, pasture improvement and/or cropping. The LOM Project would result in the direct loss of approximately 195 ha of remnant Box-Gum grassy woodland EEC. Given the highly modified nature of most of the vegetation being impacted and it's configuration in the landscape, other than adding to the cumulative loss of habitat at the local level, the LOM Project would not significantly add to loss of connectivity, or fragmentation of Box-Gum woodlands or fauna habitat. In the medium term, the proposed LOM Project BOS would result in approximately 1,600 ha of land managed for biodiversity conservation and would increase the area of woodland vegetation and structural complexity of the vegetation, providing enhanced habitat values, over and above what would result if the land was continued to be used for productive agriculture.

How is the proposal likely to affect habitat connectivity?

As the LOM Project is only a temporary land use, this disturbance would be partially offset with the implementation of the post mining Landscape Management Plan (AECOM 2010) and Biodiversity Offsets Strategy (Eco Logical 2010c). This would be augmented should the LOM Project be approved. With these strategies in place, this would eventually provide for an increase in actual extent of the Box-Gum Woodland TEC locally and provide for the conservation of land under covenant linking currently isolated pockets of the Box-Gum Woodland to the north, south and southwest of the Project Site.

Whilst the LOM Project involves the removal of a significant area of Box-Gum Woodland TEC, **Figure 2** illustrates that the community would remain connected through vegetation corridors of the same vegetation communities along the northern, eastern, southern and western boundaries of the Project Site. The vegetation corridor to the south of the Project Site is an 'in perpetuity' offset originating from the existing development consent and extends from the western ridgeline, across the southern (non-operational) portion of the Project Site (where revegetation is to be undertaken), through to remnant areas of Box-Gum Woodland to the east of Werris Creek Road.

The final rehabilitation of the Project Site would provide for further connectivity in the landscape through revegetation of the final landform and in-perpetuity conservation management of existing remnants on neighbouring land owned by the Proponent.

How is the proposal likely to affect critical habitat?

The Eastern Bent-wing Bat is a vulnerable species. Critical habitat cannot be declared for a vulnerable species and therefore would not be affected.

Conclusions

The proposal is unlikely to constitute a significant impact on Eastern Bent-wing Bat given that:

- the proposed works would constitute a minor disturbance to an area of foraging habitat within the local area;
- the proposed works would not disturb any maternity caves;
- large areas of suitable foraging habitat are present within the surrounding landscape; and
- the LOM Project would not isolate or fragment any currently connecting areas of habitat in terms of use by highly mobile species.

The following three bats have similar habitat requirements, lifecycles and threats imposed upon them by the LOM Project. As such, impacts are considered collectively.

Eastern False Pipistrelle (Falsistrellus tasmaniensis) – Vulnerable

The Eastern False Pipistrelle is found on the South-east coast and ranges of Australia, from Southern Queensland to Victoria and Tasmania. It generally roosts in Eucalypts hollows but has also been found under loose bark on trees or in buildings showing preference for moist habitats and trees taller than 20m. The Eastern False Pipistrelle forages above or just below the tree canopy for beetles, moths, weevils and other flying insects (DECCW 2010). This species has been recorded to move up to 12km from roost to foraging area (Van Dyck and Strahan 2008).

Greater Broad-nosed Bat (Scoteanax rueppellii) – Vulnerable

The Greater Broad-nosed Bat is a large bat that feeds on moths and other large insects along edges of forest, cleared paddocks and tree-lined water courses (Churchill 1998). This species uses mostly tree hollows for roosting and they have been recorded in a wide variety of vegetation types from woodland to rainforest (Churchill 1998).

Yellow-bellied Sheath-tail Bat (Saccolaimus flaviventris) – Vulnerable

The Yellow-bellied sheath-tail Bat roosts singly or in groups of up to six, in tree hollows and buildings. In treeless areas they are known to utilise mammal burrows. They forage in most habitats throughout their very wide range, including areas with and without trees and appear to defend an aerial territory DECC (2010).

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

Factors likely to have an adverse effect on the life cycle of a viable population of these species would include: disturbance to roosting and breeding sites; loss of trees for foraging and hollow bearing trees for roosting; application of pesticides or adjacent to foraging areas.

The LOM Project proposes to remove 58.5ha of mature grassy woodland, potential roosting, breeding, and foraging habitat for these species. Estimates of hollow bearing trees (HBTs) in this vegetation at the Project Site been estimated at between 11.5 and 30 HBTs/ha, which extrapolates to between 700 and 1700 HBTs to be removed from the landscape (See Section 6.2.1**)**.

These species are widespread and highly mobile, with the Eastern False Pipistrelle recorded to move up to 12km between roost sites and foraging sites. Whilst there is a large amount of potential habitat proposed for clearing at the Project Site, it is considered that proportionally this represents a small fraction of the habitat available for the species in the local area and is unlikely to impact significantly on the long-term survival of the species within the locality.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

Given, the proportionally small area of potential habitat to be removed in the local area, that potential habitat would remain on the Project Site and in adjacent areas and that these species are highly mobile, it is unlikely that the LOM Project would place the local population of this species at risk of extinction.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

No. Yellow-bellied Sheath-tailed Bat occurs across the Australian continent. Greater Broad-nosed Bat occurs from the Atherton Tablelands, QLD, to the north-eastern Victorian Alps. Eastern False Pipistrelle occurs along the east coast from south-east QLD to south-eastern SA.

How is the proposal likely to affect current disturbance regimes?

The Project Site and adjoining lands are currently used as an operating coal mine or agricultural enterprises involving grazing, pasture improvement and/or cropping. The LOM Project would result in the direct loss of approximately 195 ha of remnant Box-Gum grassy woodland EEC. Given the highly modified nature of most of the vegetation being impacted and it's configuration in the landscape, other than adding to the cumulative loss of habitat at the local level, the LOM Project would not significantly add to loss of connectivity, or fragmentation of Box-Gum woodlands or fauna habitat. In the medium term, the proposed LOM Project BOS would result in approximately 1,600 ha of land managed for biodiversity conservation and would increase the area of woodland vegetation and structural complexity of the vegetation, providing enhanced habitat values, over and above what would result if the land was continued to be used for productive agriculture.

How is the proposal likely to affect habitat connectivity?

As the LOM Project is only a temporary land use, this disturbance would be partially offset with the implementation of the post mining Landscape Management Plan (AECOM 2010) and Biodiversity Offsets Strategy (Eco Logical 2010c). This would be augmented should the LOM Project be approved. With these strategies in place, this would eventually provide for an increase in actual extent of the Box-Gum Woodland TEC locally and provide for the conservation of land under covenant linking currently isolated pockets of the Box-Gum Woodland to the north, south and southwest of the Project Site.

Whilst the LOM Project involves the removal of a significant area of Box-Gum Woodland TEC, **Figure 2** illustrates that the community would remain connected through vegetation corridors of the same vegetation communities along the northern, eastern, southern and western boundaries of the Project Site. The vegetation corridor to the south of the Project Site is an 'in perpetuity' offset originating from the existing development consent and extends from the western ridgeline, across the southern (non-operational) portion of the Project Site (where revegetation is to be undertaken), through to remnant areas of Box-Gum Woodland to the east of Werris Creek Road.

The final rehabilitation of the Project Site would provide for further connectivity in the landscape through revegetation of the final landform and in-perpetuity conservation management of existing remnants on neighbouring land owned by the Proponent.

How is the proposal likely to affect critical habitat?

The Eastern False Pipistrelle, Greater Broad-nosed Bat and Yellow-bellied Sheath-tailed Bat are all vulnerable species. Critical habitat cannot be declared for vulnerable species and therefore would not be affected.

Conclusions

The LOM Project would result in the removal of approximately 58.5ha of potential foraging, roosting, and breeding habitat for Eastern False Pipistrelle, Yellow-bellied Sheath-tailed Bat or Greater Broad-nosed Bat. However, the proposed removal is unlikely to have a significant impact on these species such that it would put a local population at risk of extinction or substantially isolate any areas of potential habitat as:

- the proposed works would constitute a minor disturbance to an area of foraging habitat within the locality;
- larger areas of suitable foraging habitat are present within the surrounding landscape;
- the LOM Project would not isolate or fragment any currently connecting areas of habitat in terms of use by these highly mobile species;
- potential foraging and roosting habitat would be conserved with the Project Site and adjacent to the Project Site; and
- clearance area is very small proportionally to that available in the local area (<0.01%).

White Box-Yellow Box-Blakely's Red Gum Woodland and Derived Native Grasslands – Endangered

For a full description of the ecological community see **Section 3**.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

Not applicable.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

Vegetation mapping of the proposed LOM Project has identified the presence of approximately 195 ha of White Box-Yellow Box-Blakely's Red Gum woodlands (hereafter, Box-Gum Woodland EEC) as defined under the TSC Act (**Figure 11**). The mapping of this community has been further broken down according to the condition class in accordance with the EPBC Act Conservation Advice (TSSC 2006) of this community as follows:

Condition class	Definition	Impact Area
4	Both a native understorey and an overstorey of eucalypts exist in conjunction;	58.5 ha
3	A native understorey exists, but the trees have been cleared;	135.3 ha
2	An overstorey of eucalypt trees exist, but there is no substantial native understorey;	0.0 ha
1	Cleared and / or cultivated lands	N/A
	Total	193.8 ha

Of the Condition Class 4 Box-Gum Woodland (58.5 ha), much exhibits species diversity well below the nominated benchmark level. i.e. much of the intact Box-Gum Woodland is in a moderate or degraded condition as a result of a long history of agricultural activity prior to the current mine operation.

Although 58.5 ha of this vegetation community has been classified as Condition Class 4, it should be noted the condition of this vegetation varies considerably and is not in pristine or 'benchmark' condition. Vegetation 'benchmarks' are quantitative measures that describe the range of variability in condition of vegetation with relatively little evidence of alteration, disturbance or modification by humans since European settlement (DECCW, 2010).

In NSW, vegetation benchmarks are currently applicable for vegetation assessment under the Environmental Outcomes Assessment Methodology, Native Vegetation Act 2003, and the Biobanking Methodology, Threatened Species Conservation Act 1995. DECCW Vegetation Benchmark Database (DECCW, 2010) has been referred to with reference to vegetation condition below.

The benchmark for native species richness in the vegetation community identified as 'White Box Grassy Woodlands of the Brigalow Belt South and Nandewar Bioregions' is 23 species (DECCW, 2010). Survey work undertaken in 2010 identified between 13 and 22 native species in sample plots (0.04 ha) or transects and 0-30% exotic cover, demonstrating the level of pre-existing disturbance to the Box-Gum woodland at the Project Site.

The proposed clearing represents a very minor proportion of the total extent of Box-Gum Woodland in the local area, i.e. the proposed clearing does not threaten the viability of this community in the local area. Significant areas of this community type exist in the immediate vicinity of the LOM Project and have been proposed for inclusion in the Biodiversity Offset Package (Section 5), creating a corridor close to 1,600 ha and linking two sub-regional corridors.

For comparison at a regional context, the Box-Gum Woodland TEC is the equivalent of two Regional Vegetation Communities (Eco Logical Australia, 2010b):

BOX-GUM WOODLAND CONDITION CLASS	REGIONAL VEGETATION COMMUNITY (ECO LOGICAL 2010B) EQUIVALENT
4	White Box Grassy Woodland of the Nandewar and Brigalow Belt South Bioregions (Box-Gum Woodland)
3	Derived Native Grasslands, Brigalow Belt South and Nandewar Bioregions (Derived Native Grasslands)

Figure 12 shows the distribution of these communities within a 10 km radius of the site. The extant vegetation of these communities is equivalent to:

BOX-GUM WOODLAND CONDITION CLASS	EXTANT VEGETATION COMMUNITY WITHIN 10KM
4	6,414 ha
3	19,117 ha
Total	25,531 ha

As outlined above, the LOM Project would involve the removal of approximately 60 ha of Box-Gum Woodland and approximately 135 ha of Derived Native Grasslands. In the regional context (i.e. within 10 km of the Project Site) this equates to the removal of <0.01% of this vegetation community (**Figure 12**).

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

N/A. Not a threatened species or population. White Box-Yellow Box-Blakely's Red Gum woodlands are widespread, occurring from QLD throughout central NSW and the ACT to Victoria.

How is the proposal likely to affect current disturbance regimes?

The Project Site and adjoining lands are currently used as an operating coal mine or agricultural enterprises involving grazing, pasture improvement and/or cropping. The LOM Project would result in the direct loss of approximately 195 ha of remnant Box-Gum grassy woodland EEC. Given the highly modified nature of most of the vegetation being impacted and it's configuration in the landscape, other than adding to the cumulative loss of habitat at the local level, the LOM Project would not significantly add to loss of connectivity, or fragmentation of Box-Gum woodlands. In the medium term, the proposed LOM Project BOS would result in approximately 1,600 ha of land managed for biodiversity conservation and would increase the area of woodland vegetation and structural complexity of the vegetation, providing enhanced habitat values, over and above what would result if the land was continued to be used for productive agriculture.

How is the proposal likely to affect habitat connectivity?

As the LOM Project is only a temporary land use, this disturbance would be partially offset with the implementation of the post mining Landscape Management Plan (AECOM 2010) and Biodiversity Offsets Strategy (Eco Logical 2010c). This would be augmented should the LOM Project be approved. With these strategies in place, this would eventually provide for an increase in actual extent of the Box-Gum Woodland TEC locally and provide for the conservation of land under covenant linking currently isolated pockets of the Box-Gum Woodland to the north, south and southwest of the Project Site.

Whilst the LOM Project involves the removal of a significant area of Box-Gum Woodland TEC, **Figure 2** illustrates that the community would remain connected through vegetation corridors of the same vegetation communities along the northern, eastern, southern and western boundaries of the Project Site. The vegetation corridor to the south of the Project Site is an 'in perpetuity' offset originating from the existing development consent and extends from the western ridgeline, across the southern (non-operational) portion of the Project Site (where revegetation is to be undertaken), through to remnant areas of Box-Gum Woodland to the east of Werris Creek Road.

The final rehabilitation of the Project Site would provide for further connectivity in the landscape through revegetation of the final landform and in-perpetuity conservation management of existing remnants on neighbouring land owned by the Proponent.

How is the proposal likely to affect critical habitat?

Critical habitat has not been declared for this endangered ecological community.

Conclusions

Whilst the impact of the LOM Project would remove approximately 195ha of Box-Gum woodland in various condition states, this impact is not considered to be significant when the following is taken into account:

- the amount of Box-Gum woodland in the local area is significant (~25,000ha),
- this impact would constitute the removal of <0.01% of this local extent of this vegetation type;
- the implementation of a Biodiversity Offset Strategy would provide conservation security for >800vha of native vegetation, including 600vha of Box-Gum woodlands;

- over 400 ha of post mining rehabilitation providing an increase in actual extent of woodland in the local area; and
- the incremental nature of the clearing coupled with the rehabilitation of the final landform providing an intermediary habitat resource for fauna movement and dispersal of floral genetic resources.

Brigalow within the Brigalow Belt South, Nandewar and Darling Riverine Plains bioregions – Endangered

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

Not applicable.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The LOM Project would result in the immediate reduction of this community in the local context, but would increase the extent of this community in the longer term by 10 times

The LOM Project would result in the removal 0.35 ha of the Brigalow (*Acacia harpophylla* dominant and co-dominant) ecological community (hereafter referred to as Brigalow). This is the only remnant of this community mapped within 10km of the Project Site and as such would result in a reduction in the extent of this community in the local area in the immediate term.

In the longer term, however, the extent of the community is likely to increase due to the commitment incorporated into the existing Landscape Management Plan (AECOM 2010), which commits to the revegetation of 3.71ha of this community on the final landform.

The species composition of the community is below the benchmark for this community and does not maintain an assemblage of native species common to the listed EPBC Community

Whilst the species richness at the site is approximately 75% of the benchmark for this community (see Box-Gum Woodland TEC section above for discussion of benchmarks), the patch only maintains 3 of 23 flora species considered common to the community described in the 'EPBC Species Profiles and Threats Database' (i.e. Brigalow-Belah Woodland of the Nandewar and Brigalow Belt South Bioregions, Benson *et al*. 2006). It is also noted that no significant flora (i.e. threatened or local significance) have been found in the remnant. Whilst the complete removal of the vegetation in the local area is considered to be important, due to the low diversity of species within this remnant it is possible that the species composition would be maintained during revegetation in alternate locations.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

Not applicable. Brigalow is not a threatened species or population.

How is the proposal likely to affect current disturbance regimes?

The Project Site and adjoining lands are currently used as an operating coal mine or agricultural enterprises involving grazing, pasture improvement and/or cropping. The LOM Project would result in the direct loss of approximately 0.35 ha Brigalow EEC. In the medium term, the proposed Mine Rehabilitation Management Plan would result in approximately 3.71 ha of rehabilitation of this community (**Section 7**).

How is the proposal likely to affect habitat connectivity?

Remnant at the eastern edge of its range and remnant size is considerably smaller than other mapped remnants in the region

This remnant is found at the eastern edge of the communities range and is isolated from similar vegetation types by at least 10km. There are approximately six mapped remnants of this community within approximately 30km of the Project Site, which are further removed from other remnants of this community to the north west by >130kms. These remnants range in size from 3 ha to 30 ha, making this remnant an order of magnitude smaller in size than other remnants in the area (it should also be noted that it is not always possible or desirable to delineate vegetation remnants <0.5ha during vegetation mapping processes).

Whilst the community is found in good condition, it is not considered that its range would expand without active intervention and its long term viability is uncertain

Although the remnant maintains a low diversity of species, it is considered to be in good condition and has a low occurrence of exotic species. Due to current land uses it is not considered that the community would expand substantially beyond its current boundaries without active intervention and given its small patch size its viability in the longer term is uncertain.

How is the proposal likely to affect critical habitat?

Critical habitat has not been declared for this endangered ecological community.

Conclusion

The 0.35 ha Brigalow remnant that would be impacted is in a modified condition and has a low diversity of species common to this vegetation type (3 out of 15), although its landscape position is at the extreme southeast of its range, and thus provides a locally adapted genetic resource that may prove important for the recovery of this EEC. In order to maintain this resource, it is proposed that this remnant is supplanted locally into the revegetation area of the already approved post mining landform. It is currently proposed to rehabilitate an area of 3.7ha of Brigalow vegetation on this landform, and it is proposed that the Brigalow trees be mechanically harvested from the currently isolated position into this new area.

Unlike most Australian Acacia species, *Acacia harpophylla* (Brigalow) rarely flowers and does not have a hard-coated persistent seed, but it is capable of prolific vegetative reproduction (root suckering) following disturbances such as pulling (Johnson 1964 in Dwyer *et al.* 2009). Given this, it is considered that the Brigalow should sucker from root stock when supplanted, maintaining the local genetic stock and expanding the area currently occupied. This would also provide an avenue for the reintroduction of understorey species into the community from local provenance seeds, that are currently absent from the community.

Whilst the proposed revegetation of Brigalow vegetation would provide for a positive outcome for this EEC remnant that currently has an uncertain future genetically (due to its isolation) and in terms of diversity (as it maintains few species common to this vegetation type), the success of the revegetation is not certain and is proposed as an additional component of revegetation requirements under current approvals.

It is considered that the complete displacement of an old growth remnant of this EEC would constitute a significant impact, although with the proposed rehabilitation taken into account the removal of this remnant ecological community would be significantly reduced. When this is coupled with the creation of a 1,655.2 ha conservation corridor, the overall environmental outcome should be taken to be positive.

Appendix G: EPBC Act Matters of NES Impact Assessments

No threatened species listed under the EPBC were recorded at the site though significant survey effort has been undertaken. Two *critically endangered* and *endangered species* were identified as having the potential to occur at the Project Site, and an assessment of any potential impacts to these species was requested in the Supplementary Director Generals Requirements (DoP 2010b). The Supplementary DGR's were issued by NSW Department of Planning in order to align Environmental Assessment under Part 3A of the EP&A Act with the requirements of the Commonwealth Department of Environment, Heritage and the Arts under the EPBC Act.

The Significant Impact Guidelines present the following criteria to identify if an action is likely to have a significant impact on a *critically endangered* or *endangered species*, if there is a real chance or possibility that it will:

- lead to a long-term decrease in the size of a population
- reduce the area of occupancy of the species
- fragment an existing population into two or more populations
- adversely affect habitat critical to the survival of a species
- disrupt the breeding cycle of a population
- modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
- result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat
- introduce disease that may cause the species to decline, or
- interfere with the recovery of the species.

Impacts of the LOM Project to these species are discussed below consistent with these criteria.

Swift Parrot (Lathamus discolor) – Endangered

Swift Parrots are winter migrants to the south-eastern Australia mainland (March – October) from Tasmania, where they feed on winter-flowering eucalypts, such as *Eucalyptus tereticornis* (DECCW 2010b). The Swift Parrot is a highly mobile species able to utilise a variety of nectar sources over large areas (DECCW 2010b).

On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as *Eucalyptus robusta* (Swamp Mahogany), *Corymbia maculata* (Spotted Gum), *C. gummifera* (Red Bloodwood), *E. sideroxylon* (Mugga Ironbark), and *E. albens* (White Box). Commonly used lerp infested trees include *E. microcarpa* (Inland Grey Box), *E. moluccana* (Coastal Grey Box) and *E. Pilularis* (Blackbutt). This species breeds from September to January, nesting in old trees with hollows and feeding in forests dominated by *Eucalyptus globulus* (Tasmanian Blue Gum) (DECCW 2010b).

There are no records of this species on or in the vicinity of the Project Site in the '*EPBC Protected Matters Search Tool'* or the '*Atlas of NSW Wildlife*'. Extensive fauna survey has also been undertaken onsite between 2004 and 2010 (CES 2004, 2008, 2009; Ecotone, 2009; ELA, this study) and this species has not been recorded. The most recent records of this species are from the Tamworth area in 2002, approximately 40 km north-east of the Project Site.

Whilst it is considered that there is potential for the Swift Parrot to use the Project Site as a foraging resource (due to the presence of temperate eucalypt woodland), it is considered unlikely that a population occurs in the vicinity given that it has not been recorded during the extensive amount of survey effort.

The LOM Project proposes to remove approximately 58.5 ha of Box-Gum Woodland, a habitat resource for the Swift Parrot. This vegetation removal constitutes <0.01% of this vegetation type within 10 km of the site (6,414 ha). It is not considered likely that the species would decline as a result of this vegetation removal.

Regent Honeyeater (Anthochaera phrygia) – Endangered

The Regent Honeyeater is associated with temperate eucalypt woodland and open forest including forest edges, wooded farmland and urban areas with mature eucalypts, and riparian forests of River Oak (*Casuarina cunninghamiana*) (Garnett, 1993). The Regent Honeyeater primarily feeds on nectar from box and ironbark eucalypts and occasionally from banksias and mistletoes (Readers Digest, 1986; NPWS, 1995). As such it is reliant on locally abundant nectar sources with different flowering times to provide reliable supply of nectar.

This previously common species has seen a rapid decline (as with many other woodland birds) in the past 60 years due to the clearing of temperate eucalypt woodlands throughout the central west of NSW and as such is now considered to be endangered under both State and Commonwealth legislation.

There are no records of this species on or in the vicinity of the site in the '*EPBC Protected Matters Search Tool'* or the '*Atlas of NSW Wildlife*'. Extensive fauna survey has also been undertaken on the Project Site between 2004 and 2010 (CES 2004, 2008; Ecotone, 2009; ELA this study) and this species has not been recorded. The most recent records of this species in the local area (<10 km) are over 20 years ago (1989).

Whilst it is considered that there is potential for the Regent Honeyeater to use the Project Site as a foraging resource (due to the presence of temperate eucalypt woodland), it is considered unlikely that a population occurs in the vicinity given that it has not been recorded during the extensive amount of survey effort.

The LOM Project proposes to remove approximately 58.5 ha of Box-Gum Woodland, a habitat resource for the Regent Honeyeater. This vegetation removal constitutes <0.01% of this vegetation type within 10km of the site (6,414 ha). It is not considered likely that the species would decline as a result of this vegetation removal.

No threatened flora species listed under the EPBC were recorded at the site though significant survey effort has been undertaken. Two *critically endangered* and *endangered species* were identified as having the potential to occur at the Project Site, and an assessment of any potential impacts to these species was requested in the Supplementary Director Generals Requirements (DoP 2010b). The Supplementary DGR's were issued by NSW Department of Planning in order to align Environmental Assessment under Part 3A of the EP&A Act with the requirements of the Commonwealth Department of Environment, Heritage and the Arts under the EPBC Act.

The Significant Impact Guidelines present the following criteria to identify if an action is likely to have a significant impact on a *critically endangered* or *endangered species*, if there is a real chance or possibility that it will:

- lead to a long-term decrease in the size of a population
- reduce the area of occupancy of the species
- fragment an existing population into two or more populations
- adversely affect habitat critical to the survival of a species
- disrupt the breeding cycle of a population
- modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
- result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat
- introduce disease that may cause the species to decline, or
- interfere with the recovery of the species.

Impacts of the LOM Project to these species are discussed below consistent with these criteria.

Dichanthium porrecta (Finger Panic Grass) – Endangered

The habitat for this species includes native grassland, woodlands or open forest with a grassy understorey, on richer soils (DECCW 2010). Often found along roadsides and travelling stock routes where there is light grazing and occasional fire (DECC 2010).

There has been a significant amount of survey undertaken at the Project Site, and this species has not been detected (See **Section 2**). Whilst habitat for this species includes open eucalypt woodland and grassland, it is a loosely tufted perennial tussock grass and quite conspicuous and it is unlikely that it occurs on the Project Site.

Prasophyllum sp. Wybong (A leek orchid) – Critically Endangered

Leek orchids are generally found in shrubby and grassy habitats in dry to wet soil, and *Prasophyllum* sp. Wybong is known to occur in open eucalypt woodland and grassland. It is known from seven populations in eastern NSW near Ilford, Premer, Muswellbrook, Wybong, Yeoval, Inverell and Tenterfield (DEWHA 2010b – SPRAT).

There has been a significant amount of survey undertaken at the Project Site, and this species has not been detected (See **Section 2**). Whilst habitat for this species includes open eucalypt woodland and grassland, it is listed as threatened due its restricted geographical range and has not been recorded within not known from the immediate area. It is highly unlikely that it occurs on the Project Site, and as such the LOM Project would not impact upon this species.

EPBC ACT – Impact Assessments for Matters of National Environmental Significance

White Box-Yellow Box-Blakely's Red Gum and Derived Native Grasslands – Critically Endangered Ecological Community

Of the Box-Gum Woodland TEC to be removed, only 41% (57.7ha) retains both a native understorey and an overstorey of eucalypts.

Vegetation mapping of the LOM Project has identified the presence of approximately 133 ha of White Box-Yellow Box-Blakely's Red Gum and Derived Native Grasslands (hereafter, Box-Gum Woodland TEC) as defined under the EPBC Act (**Figure 11**). The mapping of this community has been further broken down according to the condition class in accordance with the Conservation Advice (TSSC 2006) of this community as follows:

Condition class	Definition	Impact Area
4	Both a native understorey and an overstorey of eucalypts exist in conjunction;	58.5 ha
3	A native understorey exists, but the trees have been cleared;	74.6 ha
2	An overstorey of eucalypt trees exist, but there is no substantial native understorey;	0.0 ha
1	Cleared and / or cultivated lands	N/A
	Total	133.1 ha

Of the Condition Class 4 Box-Gum Woodland (58.5ha), much exhibits species diversity well below the nominated benchmark level, i.e. much of the Box-Gum Woodland is in only moderate or degraded condition.

Although 58.5 ha of this vegetation community has been classified as Condition Class 4, it should be noted the condition of this vegetation varies considerably and is not in pristine or 'benchmark' condition. Vegetation 'benchmarks' are quantitative measures that describe the range of variability in condition of vegetation with relatively little evidence of alteration, disturbance or modification by humans since European settlement (DECCW, 2010).

In NSW, vegetation benchmarks are currently applicable for vegetation assessment under the Environmental Outcomes Assessment Methodology, *Native Vegetation Act 2003*, and the Biobanking Methodology, *Threatened Species Conservation Act 1995*. In the absence of equivalent benchmark information at the Commonwealth level, benchmark data from the DECCW Vegetation Benchmark Database (DECCW, 2010) has been referred to with reference to vegetation condition below.

The benchmark for native species richness in the vegetation community identified as 'White Box Grassy Woodlands of the Brigalow Belt South and Nandewar Bioregions' is 23 species (DECCW, 2010). Survey work undertaken in 2010 identified between 13 and 22 native species in sample plots (0.4ha) or transects and 0-30% exotic cover, demonstrating the level of pre-existing disturbance to the Box-Gum woodland at the Project Site.

The proposed clearing represents a very minor proportion of the total extent of Box-Gum Woodland in the local area, i.e. the proposed clearing does not threaten the viability of this community in the local area. Significant areas of this community type exist in the immediate vicinity of the LOM Project and have been proposed for inclusion in the Biodiversity Offset Package (Section 5), creating a corridor close to 1,600ha and linking two sub-regional corridors.

For comparison at a regional context, the Box-Gum Woodland TEC is the equivalent of two Regional Vegetation Communities (Eco Logical Australia, 2010b):

BOX-GUM WOODLAND CONDITION CLASS	REGIONAL VEGETATION COMMUNITY (ECO LOGICAL 2010B) EQUIVALENT
4	White Box Grassy Woodland of the Nandewar and Brigalow Belt South Bioregions (Box-Gum Woodland)
3	Derived Native Grasslands, Brigalow Belt South and Nandewar Bioregions (Derived Native Grasslands)

Figure 12 shows the distribution of these communities within a 10km radius of the site. The extant vegetation of these communities is equivalent to:

BOX-GUM WOODLAND CONDITION CLASS	EXTANT VEGETATION COMMUNITY WITHIN 10KM
4	6,414 ha
3	19,117 ha
Total	25,531 ha

As outlined above, the LOM Project would involve the removal of approximately 60 ha of Box-Gum Woodland and approximately 80ha of Derived Native Grasslands. In the regional context (i.e. within 10 km of the Project Site) this equates to the removal of <0.01% of this vegetation community (Figure 12).

The LOM Project would increase the actual extent of Box-Gum Woodland TEC, enhance the ecological integrity of the remaining remnants and conserve an east-west corridor of Box-Gum Woodland TEC in perpetuity linking existing ridgelines

As the proposed LOM Project is only a temporary land use, this disturbance would be partially offset with the implementation of the current post mining Landscape Management Plan (AECOM 2010) and Biodiversity Offsets Strategy (Eco Logical 2010c), along with the proposed LOM Project BOS discussed in **Section 5.** With these strategies in place, this would eventually provide for an increase in actual extent of the Box-Gum Woodland TEC locally and provide for the conservation of land under covenant linking currently isolated patches of the Box-Gum Woodland to the north, south and southwest of the Project Site.

Whilst the LOM Project involves the removal of a significant area of Box-Gum Woodland TEC, **Figure 21** illustrates that the community would remain connected through vegetation corridors of the same vegetation communities along the northern, eastern, southern and western boundaries of the Project Site. The vegetation corridor to the south of the Project Site is an 'in perpetuity' offset originating from the existing development consent and extends from the western ridgeline, across the southern (non-operational) portion of the Project Site (where rehabilitation/revegetation is to be undertaken), through to remnant areas of Box-Gum Woodland to the east of Werris Creek Road.

The final rehabilitation of the Project Site would provide for further connectivity in the landscape through revegetation of the final landform and in-perpetuity conservation management of existing remnants on neighbouring land owned by the Proponent.

The species composition of the Box-Gum Woodland TEC would be maintained through local offsetting programs already in place and the capacity for local provenance recolonisation of the post mining landform and revegetation areas

The LOM Project proposes to remove all vegetation within the footprint area, though the change to species composition outside of the direct impact area would not be impacted upon. That is, by retaining significant remnants within the land surrounding the impact area (as part of the LOM Project BOS); the Project Site would be allowed access to recolonisation from local provenance vegetation, reducing the impact of any immediate disruption to the species composition. Revegetation would also be focussed on the use of locally sourced seed which in turn would encourage recolonisation of other local flora species including herbaceous and other more cryptic species.

Conclusion

As discussed above, the LOM Project is only a temporary land use and this disturbance would be mitigated by the implementation of the Landscape Management Plan (AECOM 2010), Biodiversity Offsets Strategy (BOS) (Eco Logical 2010c) and the proposed LOM Project BOS (Eco Logical Australia 2010d).

The Box-Gum Woodland TEC located within the LOM Project footprint is found in a degraded state, with woodland remnants below or substantially below 'benchmark' levels and approximately ⅔ of the area found as derived native grasslands.

The rehabilitation of the Project Site, to be undertaken in accordance with an updated Landscape Management Plan, would provide for the revegetation and encourage the recolonisation of the final landform by species common to the Box-Gum Woodland TEC.

The LOM Project BOS would provide for the conservation of significant remnants of the Box-Gum Woodland TEC, complemented by other vegetation types, surrounding the area to be disturbed and provide for the creation of a conserved habitat corridor between the significant areas of remnant TEC to the east and west of the Project Site.

These management and offsets plans would increase the area of this community included in the final rehabilitation of the mine, which would ultimately increase the area of the community locally, as well as link the currently isolated pockets of the Box-Gum Woodlands to the north, south and southwest of the open cut.

Whilst it is clear that in the regional context the vegetation clearing associated with the proposed LOM Project is not substantial (i.e. <0.01% of extant within 10km), the clearing of 133.1 ha of a Critically Endangered Ecological Community is considered to be significant. With the implementation of the current Landscape Management Plan and BOS, along with the LOM Project BOS, it is considered that this impact is sufficiently mitigated by providing for an outcome over and above a 'no net loss', but rather reaching a 'net gain' outcome in the community in the local area and providing a conservation corridor of approximately 1655.2 ha.

Brigalow (Acacia harpophylla dominant and co-dominant) – Endangered Ecological Community

The LOM Project would result in the immediate reduction of this community in the local context, but would increase the extent of this community in the longer term by 10 times

The LOM Project would result in the removal 0.35 ha of the Brigalow (*Acacia harpophylla* dominant and co-dominant) ecological community (hereafter referred to as Brigalow). This is the only remnant of this community mapped within 10km of the site and as such would result in a reduction in the extent of this community in the local area in the immediate term.

In the longer term, however, the extent of the community is likely to increase due to the commitment incorporated into the existing Landscape Management Plan (AECOM 2010), which commits to the revegetation of 3.5ha of this community on the final landform.

The species composition of the community is below the benchmark for this community and does not maintain an assemblage of native species common to the listed EPBC Community

Whilst the species richness at the site is approximately 75% of the benchmark for this community (see Box-Gum Woodland TEC section above for discussion of benchmarks), the patch only maintains 3 of 23 flora species considered common to the community described in the 'EPBC Species Profiles and Threats Database' (i.e. Brigalow-Belah Woodland of the Nandewar and Brigalow Belt South Bioregions, Benson *et al*. 2006). It is also noted that no significant flora (i.e. threatened or local significance) have been found in the remnant. Whilst the complete removal of the vegetation in the local area is considered to be important, due to the low diversity of species within this remnant it is possible that the species composition would be maintained during revegetation in alternate locations.

Remnant at the eastern edge of its range and remnant size is considerably smaller than other mapped remnants in the region

This remnant is found at the eastern edge of the communities range and is isolated from similar vegetation types by at least 10km. There are approximately six mapped remnants of this community within approximately 30km of the Project Site, which are further removed from other remnants of this community to the north west by >130kms. These remnants range in size from 3 ha to 30 ha, making this remnant an order of magnitude smaller in size than other remnants in the area (it should also be noted that it is not always possible or desirable to delineate vegetation remnants <0.5ha during vegetation mapping processes).

Whilst the community is found in good condition, it is not considered that its range would expand without active intervention and its long term viability is uncertain

Although the remnant maintains a low diversity of species, it is considered to be in good condition and has a low occurrence of exotic species. Due to current land uses it is not considered that the community would expand substantially beyond its current boundaries without active intervention and given its small patch size its viability in the longer term is uncertain.

Conclusion

The 0.35 ha Brigalow remnant that would be impacted is in a modified condition and has a low diversity of species common to this vegetation type (3 out of 15), although its landscape position is at the extreme southeast of its range, and thus provides a locally adapted genetic resource that may prove important for the recovery of this EEC. In order to maintain this resource, it is proposed that this remnant is supplanted locally into the revegetation area of the already approved post mining landform. It is currently proposed to rehabilitate an area of 3.7ha of Brigalow vegetation is revegetated on this landform, and it is proposed that the Brigalow trees be mechanically harvested from the currently isolated position into this new area.

Unlike most Australian Acacia species, *Acacia harpophylla* (Brigalow) rarely flowers and does not have a hard-coated persistent seed, but it is capable of prolific vegetative reproduction (root suckering) following disturbances such as pulling (Johnson 1964 in Dwyer *et al.* 2009). Given this, it is considered that the Brigalow should sucker from root stock when supplanted, maintaining the local genetic stock and expanding the area currently occupied. This would also provide an avenue for the reintroduction of understorey species into the community from local provenance seeds, that are currently absent from the community.

Whilst the proposed revegetation of Brigalow vegetation would provide for a positive outcome for this EEC remnant that currently has an uncertain future genetically (due to its isolation) and in terms of diversity (as it maintains few species common to this vegetation type), the success of the revegetation is not certain and is proposed as an additional component of revegetation requirements under current approvals.

It is considered that the complete displacement of an old growth remnant of this EEC would constitute a significant impact, though with this revegetation taken into account the removal of this remnant ecological community would be significantly reduced. When this is coupled with the creation of a 1655.2 ha conservation corridor, the overall environmental outcome should be taken to be positive.

This impact assessment was considered as part of a Referral to the DSEWPAC (ELA 2010e). Due to the size of the remnant, it was not considered by DSEWPAC to require further assessment under the Supplementary DGR's (DoP 2010b).

Natural Grasslands on basalt and fine-textured alluvial plains of northern NSW and southern Queensland critically endangered ecological community.

This community does not occur at the Project Site and will therefore not be impacted by the LOM Project.

Previous reports referring to the presence of this community in the area surrounding the Project Site have incorrectly identified this community. The native grassland in the area are in fact the DNG component of the White Box-Yellow Box-Blakely's Red Gum and Derived Native Grasslands – Critically Endangered Ecological Community as indicated by the presence of ringbarked White Box trees and regenerating White Box across the DNG area.

Appendix H: Biobanking Plot Data

Vegetation Type: White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions

Vegetation Condition: Moderate – Good

PLOT NAME	NO. NATIVE SPECIES	NATIVE OVERSTOREY (%)	NATIVE MIDSTOREY (%)	NATIVE GROUNDCOVER GRASSES (%)	NATIVE GROUNDCOVER SHRUBS (%)	NATIVE GROUNDCOVER OTHER (%)	EXOTIC COVER (%)	HOLLOW BEARING TREES	FALLEN TIMBER (M)	REGENERATION
Veg Q1	29	20	0	100	0	30	0	2	54	1
Veg Q2	35	11	0	84	4	52	0	3	82	0
Veg Q3	14	0	0	76	0	0	10	0	0	0
Veg Q4	31	15	0	38	2	0	30	3	194	1
Veg Q5	8	0	0	92	0	6	0	0	0	0
Veg Q6	32	14	2	78	4	20	0	3	97	1
Veg Q7	27	20	0	90	0	4	0	1	19	0
Veg Q9	26	19.5	0	62	0	4	0	6	14	0
Veg Q10	13	0	0	46	0	2	30	0	0	0

Vegetation Type: Brigalow - Belah woodland on alluvial often gilgaied clay soil mainly in the Brigalow Belt South Bioregion

Vegetation Condition: Moderate – Good

PLOT NAME	NO. NATIVE SPECIES	NATIVE OVERSTOREY (%)	NATIVE MIDSTOREY (%)	NATIVE GROUNDCOVER GRASSES (%)	NATIVE GROUNDCOVER SHRUBS (%)	NATIVE GROUNDCOVER OTHER (%)	EXOTIC COVER (%)	HOLLOW BEARING TREES	FALLEN TIMBER (M)	REGENERATION
Veg Q8	**15**	**30**	**0**	**34**	**0**	**42**	**0**	**0**	**96**	**1**

Flora species lists are provided per quadrat as a separate spreadsheet (Flora quadrat data.xls)

Figure 32: Map of flora survey effort between 2004 and 2010

(LOM = quadrats from the Life of Mine Project; BOA = quadrats from Biodiversity Offset Area Monitoring Program)

Appendix I: Biobanking Credit Reports

Development/Impact Site

Note: As this is not a formal Biobanking assessment, the area figures shown below do not correlate directly with final impact totals in **Tables 13a** and **13b**, as the LOM Footprint has been modified since the calculations were undertaken to reduce the impacts of the proposal. However, the number of credits required per hectare have been used to estimate the total number of credits required in the offset strategy.

BioBanking
Biodiversity Banking and Offsets Scheme

Biobanking Credit Report

This report identifies the number and type of credits required at a DEVELOPMENT SITE.

Date of report: 12/08/2010 Time: 13:20 Tool Version: 1.1

Development Details

Proposal ID: 0079/2010/D001

Development Name: Werris Creek Coal LOM Project
Development Location: Werris Creek
Development Address: Werris Creek Road, Werris Creek

CMA: Namoi

Proponent Name: Werris Creek Coal
Proponent Address: C/- RW Corkery
Proponent Phone:

Assessor Name: Lucas McKinnon
Assessor Address:
Assessor Phone:
Assessor Accreditation Number: 0079

The following information is required to be submitted with this BioBanking Statement (where ticked)

☐ **Local reference data is required for the following vegetation zones**

☐ **An Expert Report for the following species**

☑ **The minimum number of plots were not entered for the following vegetation zones**
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions

Department of **Environment & Climate Change** NSW

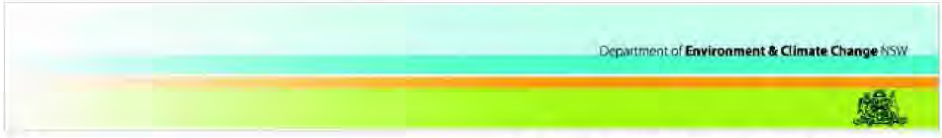
Page 1 of 4 Date of report: 12/08/2010 Time: 13:20 Tool Version: 1.1

Improving or maintaining biodiversity values

The proposal has 1 or more Red Flag areas, as listed below:

Red Flag	Reason
Brigalow - Belah woodland on alluvial often gilgaied clay soil mainly in the Brigalow Belt South Bioregion (Benson 35)	Vegetation type being > 70% cleared; Vegetation type contains an endangered ecological community;
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Vegetation type being > 70% cleared; Vegetation type contains an endangered ecological community;

The development does not improve or maintain biodiversity values and a biobanking statement cannot be issued.



Ecosystem Credits

Vegetation Type	Area (ha)	Credits Required	Red Flag
Brigalow - Belah woodland on alluvial often gilgaied clay soil mainly in the Brigalow Belt South Bioregion (Benson 35) [NA117]	1.7	82	Yes
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions [NA226]	79.1	2,379	Yes
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions [NA226]	57.7	3,773	Yes

Credit Profiles

Group: 1 Brigalow - Belah woodland on alluvial often gilgaied clay soil mainly in the Brigalow Belt South Bioregion (Benson 35)

Ecosystem credits: 82 credits

Total area of vegetation(s): 1.7 ha

1. Surrounding vegetation cover	2. Patch size, including low condition
Description: Minimum surrounding vegetation cover in which the credits must be obtained.	Description: Minimum area of contiguous vegetation in which credits must be obtained.
Minimum percent cover: 10%	**Minimum area: 25 ha**

3. CMA subregion & vegetation types
Credits must be obtained in any one or more of the following CMA Sub-regions and vegetation types:

Namoi

CMA Sub-Region(s)	Veg Type(s)
Peel	Brigalow - Belah woodland on alluvial often gilgaied clay soil mainly in the Brigalow Belt South Bioregion (Benson 35) (NA117)

Group: 2 White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions

Ecosystem credits: 2,379 credits

Total area of vegetation(s): 79.1 ha

1. Surrounding vegetation cover	2. Patch size, including low condition
Description: Minimum surrounding vegetation cover in which the credits must be obtained.	Description: Minimum area of contiguous vegetation in which credits must be obtained.
Minimum percent cover: 10%	**Minimum area: 25 ha**

3. CMA subregion & vegetation types
Credits must be obtained in any one or more of the following CMA Sub-regions and vegetation types:

Namoi

CMA Sub-Region(s)	Veg Type(s)
Peel	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions (NA226)

Group: 3 White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions

Ecosystem credits: 3,773 credits

Total area of vegetation(s): 57.7 ha

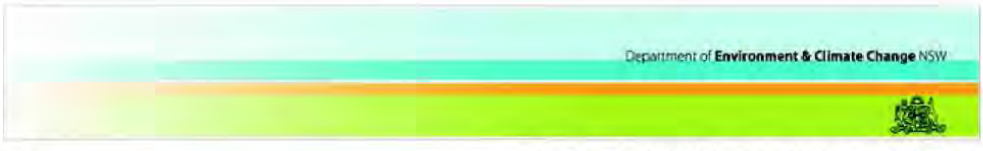
1. Surrounding vegetation cover	2. Patch size, including low condition
Description: Minimum surrounding vegetation cover in which the credits must be obtained.	Description: Minimum area of contiguous vegetation in which credits must be obtained.
Minimum percent cover: 10%	**Minimum area: 25 ha**

3. CMA subregion & vegetation types
Credits must be obtained in any one or more of the following CMA Sub-regions and vegetation types:

Namoi

CMA Sub-Region(s)	Veg Type(s)
Peel	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions (NA226)

Species Credits



Rehabilitation Site

The following calculations were made to provide an indicative credit potential for rehabilitation of White Box Grassy Woodland in the post mining landscape. The calculations are derived from a zero starting point, and landscape improvements are varied in accordance with Appendix 5 of the Biobanking Assessment Methodology (DECC 2009).

BioBanking
Biodiversity Banking and Offsets Scheme

Biobanking Agreement Credit Report

This report identifies the number and type of credits that may be created at a BIOBANK SITE.

Date of report: 12/08/2010 Time: 10:02 Tool Version: 1.1

Property Details

Proposal ID: 0079/2010/B001

Biobank Name: WCC Brigalow
Biobank Location: Werris Creek Coal Mine
Biobank Adress: Werris Creek Rd, Werris Creek

CMA: Namoi

Landholder Name: Whitehaven Coal P/L
Landholder Address: Werris Creek Rd, Werris Creek
Landholder Phone:

Assessor Name: Lucas McKinnon
Assessor Address:
Assessor Phone:
Assessor Accreditation Number: 0079

The following information is required to be submitted with this BioBanking Agreement (where ticked)

☐ **All or part of the biobank site is covered by a covenant, has received govt funding or is crown land**

White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions

☐ **Expert Report for the following species:**

☑ **Justification for request of additional increase in site value score with management for the following vegetation zones:**

White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions

☑ **The minimium number of plots were not entered for the following vegetation zones**

White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions

Department of **Environment & Climate Change** NSW

Page 1 of 3 Date of report: 12/08/2010 Time: 10:02 Tool Version: 1.1

Ecosystem Credits

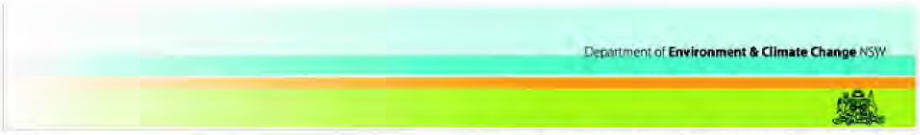
Vegetation Type	Area (ha)	Credits created
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	100	814

Credit Profile

Group 1 : Ecosystem credits: 814 credits

CMA	Namoi
CMA Sub-region	Peel (813)
Vegetation type	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions
Surrounding vegetation cover class	11-30%
Patch size, including low condition	>100 ha

Total area of Vegetation zone(s) included in this group: 100 ha

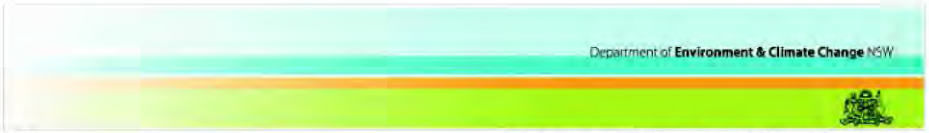


Species Credits

Additional Management Actions

The following management actions are required at the property. These actions are in addition to the standard management actions required at the property

Cat and/or Fox control	
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions (NA226)	100 ha
Exclude miscellaneous feral species	
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions (NA226)	100 ha
Feral and/or native herbivore control/ exclusion (eg rabbit, goats, deer etc)	
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions (NA226)	100 ha



Offset Site

The following calculations have been derived using on ground data collected as part of the LOM Project Impact Assessment, including additional data obtained later in 2010 from adjacent sites that are included in the Biodiversity Offset Area of the original mine development (see flora.xls).

BioBanking
Biodiversity Banking and Offsets Scheme

Biobanking Agreement Credit Report

This report identifies the number and type of credits that may be created at a BIOBANK SITE.

Date of report: 01/12/2010 Time: 16:30 Tool Version: 1.1

Property Details

Proposal ID: 0079/2010/B001

Biobank Name: WCC
Biobank Location: Werris Creek Coal Mine
Biobank Adress: Werris Creek Rd, Werris Creek

CMA: Namoi

Landholder Name: Whitehaven Coal P/L
Landholder Address: Werris Creek Rd, Werris Creek
Landholder Phone:

Assessor Name: Lucas McKinnon
Assessor Address:
Assessor Phone:
Assessor Accreditation Number: 0079

The following information is required to be submitted with this BioBanking Agreement (where ticked)

☐ **All or part of the biobank site is covered by a covenant, has received govt funding or is crown land**

☐ **Expert Report for the following species:**

☑ **Justification for request of additional increase in site value score with management for the following vegetation zones:**
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions

☑ **The minimum number of plots were not entered for the following vegetation zones**
Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion
White Box - White Cypress Pine - Silver-leaved Ironbark shrubby open forest of the Nandewar Bioregion
White Box - White Cypress Pine - Silver-leaved Ironbark shrubby open forest of the Nandewar Bioregion
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions

Department of Environment & Climate Change NSW

Page 1 of 6 Date of report: 01/12/2010 Time: 16:30 Tool Version: 1.1

Ecosystem Credits

Vegetation Type	Area (ha)	Credits created
Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion	3.05	37
Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion	1.28	14
Rusty Fig - Wild Quince - Native Olive dry rainforest of rocky areas of the Nandewar Bioregion	1	11
White Box - White Cypress Pine - Silver-leaved Ironbark shrubby open forest of the Nandewar Bioregion	24.85	262
White Box - White Cypress Pine - Silver-leaved Ironbark shrubby open forest of the Nandewar Bioregion	152.1	1,605
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	59.3	742
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	19.64	252
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	447.7	5,961
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	120	1,328

Credit Profile

Group 1 : Ecosystem credits: 37 credits

CMA	Namoi
CMA Sub-region	Peel (813)
Vegetation type	Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion
Surrounding vegetation cover class	11-30%
Patch size, including low condition	>100 ha

Total area of Vegetation zone(s) included in this group: 3.05 ha

Group 2 : Ecosystem credits: 14 credits

CMA	Namoi
CMA Sub-region	Peel (813)
Vegetation type	Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion
Surrounding vegetation cover class	11-30%
Patch size, including low condition	>100 ha

Total area of Vegetation zone(s) included in this group: 1.28 ha

Group 3 : Ecosystem credits: 11 credits

CMA	Namoi
CMA Sub-region	Peel (813)
Vegetation type	Rusty Fig - Wild Quince - Native Olive dry rainforest of rocky areas of the Nandewar Bioregion
Surrounding vegetation cover class	11-30%
Patch size, including low condition	>100 ha

Total area of Vegetation zone(s) included in this group: 1 ha

Group 4 : Ecosystem credits: 262 credits

CMA	Namoi
CMA Sub-region	Peel (813)
Vegetation type	White Box - White Cypress Pine - Silver-leaved Ironbark shrubby open forest of the Nandewar Bioregion
Surrounding vegetation cover class	11-30%
Patch size, including low condition	>100 ha

Total area of Vegetation zone(s) included in this group: 24.85 ha

Group 5 : Ecosystem credits: 1605 credits

CMA	Namoi
CMA Sub-region	Peel (813)
Vegetation type	White Box - White Cypress Pine - Silver-leaved Ironbark shrubby open forest of the Nandewar Bioregion
Surrounding vegetation cover class	11-30%
Patch size, including low condition	>100 ha

Total area of Vegetation zone(s) included in this group: 152.1 ha

Group 6 : Ecosystem credits: 742 credits

CMA	Namoi
CMA Sub-region	Peel (813)
Vegetation type	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions
Surrounding vegetation cover class	11-30%
Patch size, including low condition	>100 ha

Total area of Vegetation zone(s) included in this group: 59.3 ha

Group 7 : Ecosystem credits: 252 credits

CMA	Namoi
CMA Sub-region	Peel (813)
Vegetation type	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions
Surrounding vegetation cover class	11-30%
Patch size, including low condition	>100 ha

Total area of Vegetation zone(s) included in this group: 19.64 ha

Group 8 : Ecosystem credits: 5961 credits

CMA	Namoi
CMA Sub-region	Peel (813)
Vegetation type	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions
Surrounding vegetation cover class	11-30%
Patch size, including low condition	>100 ha

Total area of Vegetation zone(s) included in this group: 447.7 ha

Group 9 : Ecosystem credits: 1328 credits

CMA	Namoi
CMA Sub-region	Peel (813)
Vegetation type	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions
Surrounding vegetation cover class	11-30%
Patch size, including low condition	>100 ha

Total area of Vegetation zone(s) included in this group: 120 ha

Species Credits

Additional Management Actions

The following management actions are required at the property. These actions are in addition to the standard management actions required at the property

Cat and/or Fox control	
Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion (NA197)	1.28 ha
Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion (NA197)	3.05 ha
Rusty Fig - Wild Quince - Native Olive dry rainforest of rocky areas of the Nandewar Bioregion (NA198)	1 ha
White Box - White Cypress Pine - Silver-leaved Ironbark shrubby open forest of the Nandewar Bioregion (NA224)	24.85 ha
White Box - White Cypress Pine - Silver-leaved Ironbark shrubby open forest of the Nandewar Bioregion (NA224)	152.1 ha
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions (NA226)	19.64 ha
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions (NA226)	59.3 ha
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions (NA226)	120 ha
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions (NA226)	447.7 ha

Exclude miscellaneous feral species	
Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion (NA197)	1.28 ha
Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion (NA197)	3.05 ha
Rusty Fig - Wild Quince - Native Olive dry rainforest of rocky areas of the Nandewar Bioregion (NA198)	1 ha
White Box - White Cypress Pine - Silver-leaved Ironbark shrubby open forest of the Nandewar Bioregion (NA224)	24.85 ha
White Box - White Cypress Pine - Silver-leaved Ironbark shrubby open forest of the Nandewar Bioregion (NA224)	152.1 ha
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions (NA226)	19.64 ha
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions (NA226)	59.3 ha
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions (NA226)	120 ha
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions (NA226)	447.7 ha
Feral and/or native herbivore control/ exclusion (eg rabbit, goats, deer etc)	
Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion (NA197)	1.28 ha
Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion (NA197)	3.05 ha
Rusty Fig - Wild Quince - Native Olive dry rainforest of rocky areas of the Nandewar Bioregion (NA198)	1 ha
White Box - White Cypress Pine - Silver-leaved Ironbark shrubby open forest of the Nandewar Bioregion (NA224)	24.85 ha
White Box - White Cypress Pine - Silver-leaved Ironbark shrubby open forest of the Nandewar Bioregion (NA224)	152.1 ha
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions (NA226)	19.64 ha
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions (NA226)	59.3 ha
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions (NA226)	120 ha
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions (NA226)	447.7 ha

Appendix J: Statement Addressing NSW and Commonwealth Offset Criteria

These offset principles were accessed from the NSW Governments Department of Environment, Climate Change Water website, 21/09/2010, http://www.environment.nsw.gov.au/biocertification/offsets.htm, and the Commonwealth Governments 'Draft Policy Statement: Use of environmental offsets under the *Environment Protection and Biodiversity Conservation Act 1999*' (DEWR 2007).

NSW **Impacts must be avoided first by using prevention and mitigation measures (#1)** *Offsets are then used to address remaining impacts. This may include modifying the proposal to avoid an area of biodiversity value or putting in place measures to prevent offsite impacts.*
Commonwealth Equivalent **Environmental offsets should be developed as a package of actions - which may include both direct and indirect offsets (#4)** *When available, direct offsets (e.g. reservation or covenanting of land) are more desirable than indirect offsets (e.g. contribution to research) as they are more likely to lead to long-term conservation outcomes and it is easier to demonstrate a consistent, transparent and equitable relationship between the offset and the impact.* *In some cases, however, a package of offsets incorporating direct and indirect actions may deliver the best results. A package of measures increases the scope of possible conservation outcomes, spreads the risk of offsets failing to deliver, and may provide greater flexibility for proponents to successfully deliver a sustainable outcome.*
How addressed by the Proponent A comprehensive Biodiversity Offsets Strategy has been developed for the proposed LOM Project, in **Section 8** of this report. Prevention and mitigation measures are discussed in this section.

NSW

All regulatory requirements must be met (#2)

Offsets cannot be used to satisfy approvals or assessments under other legislation, e.g. assessment requirements for Aboriginal heritage sites, pollution or other environmental impacts (unless specifically provided for by legislation or additional approvals).

How addressed by the Proponent

The offset has been designed to meet the requirements of 'improve or maintain' as per Part 3A of the EP&A Act, as discussed Section 8.

NSW

Offsets must never reward ongoing poor performance (#3).

Offset schemes should not encourage landholders to deliberately degrade or mismanage offset areas in order to increase the value from the offset.

How addressed by the Proponent

The environmental history of the Proponent is outlined in **Appendix K.**

NSW

Offsets will complement other government programs (#4).

A range of tools is required to achieve the NSW Government's conservation objectives, including the establishment and management of new national parks, nature reserves, state conservation areas and regional parks and incentives for private landholders.

How addressed by the Proponent

The LOM Project BOS has been designed to secure a conservation corridor between two sub-regional corridors of over 1,600 ha in total. This land will be managed privately.

NSW

Offsets must be underpinned by sound ecological principles (#5).

They must:

- *include the consideration of structure, function and compositional elements of biodiversity, including threatened species*
- *enhance biodiversity at a range of scales*
- *consider the conservation status of ecological communities*
- *ensure the long-term viability and functionality of biodiversity.*
- *Biodiversity management actions, such as enhancement of existing habitat and securing and managing land of conservation value for biodiversity, can be suitable offsets. Reconstruction of ecological communities involves high risks and uncertainties for biodiversity outcomes and is generally less preferable than other management strategies, such as enhancing existing habitat.*

How addressed by the Proponent

The LOM Project BOS meets the above objectives through the creation of a 1,600 ha corridor which includes:

- 'Like for like' ecological communities
- Removal of grazing from derived native grasslands to allow for natural resilience to regenerate over cleared landscapes
- Creates a connection between two sub-regional biodiversity corridors that is currently absent in the landscape
- Provides the eco-tonal elements associated with ridge-top vegetation types within the conservation corridor that are currently unsecured secured in locality.

NSW

Offsets should aim to result in a net improvement in biodiversity over time (#6).

Enhancement of biodiversity in offset areas should be equal to or greater than the loss in biodiversity from the impact site.

Setting aside areas for biodiversity conservation without additional management or increased security is generally not sufficient to offset against the loss of biodiversity. Factors to consider include protection of existing biodiversity (removal of threats), time-lag effects, and the uncertainties and risks associated with actions such as revegetation.

Offsets may include enhancing habitat, reconstructing habitat in strategic areas to link areas of conservation value, or increasing buffer zones around areas of conservation value and removal of threats by conservation agreements or reservation.

Commonwealth Equivalent

Environmental offsets should deliver a real conservation outcome (#3).

The Australian Government aims to ensure that offsets deliver a conservation outcome that would not otherwise be achieved. For example, funding open ended research programs which deliver little or no on-ground benefit for the matter impacted are not considered to deliver a conservation outcome. Also, the purchase of existing unprotected habitat only provides a real conservation outcome if that habitat becomes protected in perpetuity and actively managed for long term conservation purposes.

How addressed by the Proponent

The offset area proposed for the LOM Project provides a 4:1 offset ratio of offset : cleared vegetation, which will managed to provide an increase in biodiversity values (i.e. through restoration of canopy, shrubs and groundcovers components) to provide a net improvement over time. This is accompanied by a Landscape Management Plan that will ensure the rehabilitation of >400 ha of native woodlands within the lands offset for conservation. The detail of the BOS is outlined in **Section 8**.

NSW

Offsets must be enduring & they must offset the impact of the development for the period that the impact occurs (#7).

As impacts on biodiversity are likely to be permanent, the offset should also be permanent and secured by a conservation agreement or reservation and management for biodiversity. Where land is donated to a public authority or a private conservation organisation and managed as a biodiversity offset, it should be accompanied by resources for its management. Offsetting should only proceed if an appropriate legal mechanism or instrument is used to secure the required actions.

How addressed by the Proponent

The LOM Project BOS proposes the protection of 840 ha of native vegetation in perpetuity. This will be secured under an appropriate instrument such as s88 of the *Conveyancing Act 1919*, a Conservation agreement under the *National Parks and Wildlife Act 1974*, or other.

NSW

Offsets should be agreed prior to the impact occurring (#8).

Offsets should minimise ecological risks from time-lags. The feasibility and in-principle agreements to the necessary offset actions should be demonstrated prior to the approval of the impact. Legal commitments to the offset actions should be entered into prior to the commencement of works under approval.

How addressed by the Proponent

The LOM Project BOS has been included as part of the Environmental Assessment for Part 3A developments. Preliminary consultation has been undertaken with State and Commonwealth departments.

All of the land that forms the BOA is already owned by the Proponent, and as such the BOS can be implemented upon Project approval.

NSW

Offsets must be quantifiable & the impacts and benefits must be reliably estimated (#9).

Offsets should be based on quantitative assessment of the loss in biodiversity from the clearing or other development and the gain in biodiversity from the offset. The methodology must be based on the best available science, be reliable and used for calculating both the loss from the development and the gain from the offset. The methodology should include:

- *the area of impact*
- *the types of ecological communities and habitat/species affected*
- *connectivity with other areas of habitat/corridors*
- *the condition of habitat*
- *the conservation status and/or scarcity/rarity of ecological communities*
- *management actions*
- *level of security afforded to the offset site.*

The best available information/data should be used when assessing impacts of biodiversity loss and gains from offsets. Offsets will be of greater value where:

- *they protect land with high conservation significance*
- *management actions have greater benefits for biodiversity*
- *the offset areas are not isolated or fragmented*
- *the management for biodiversity is in perpetuity (e.g. secured through a conservation agreement).*
- *Management actions must be deliverable and enforceable*

How addressed by the Proponent

The LOM Project BOS was developed with reference to the Biobanking Methodology, which provides a transparent, consistent and scientifically-based set of rules to assess biodiversity values and calculate sufficient offsets to impacts so as to 'improve or maintain' environmental outcomes. This strategy was also developed in consultation with DECCW and DSEWPAC. It provides for both 'like for like' vegetation and the eco-tonal influence of vegetation types that will not be impacted upon but provide the necessary integration from valley to ridgeline.

NSW

Offsets must be targeted (#10).

They must offset impacts on the basis of like-for-like or better conservation outcome. Offsets should be targeted according to biodiversity priorities in the area, based on the conservation status of the ecological community, the presence of threatened species or their habitat, connectivity and the potential to enhance condition by management actions and the removal of threats. Only ecological communities that are equal or greater in conservation status to the type of ecological community lost can be used for offsets. One type of environmental benefit cannot be traded for another: for example, biodiversity offsets may also result in improvements in water quality or salinity but these benefits do not reduce the biodiversity offset requirements.

Commonwealth Equivalent

Environmental offsets should be targeted to the matter protected by the EPBC Act that is being impacted (#1)

Environmental offsets may be appropriate when they:

- *are necessary or convenient to protect or repair impacts to a protected matter – i.e. a matter of national environmental significance or the environment more broadly for actions involving the Commonwealth;*
- *relate specifically to the matter (for example, species) being impacted; and*
- *seek to ensure that the health, diversity and productivity of the environment are maintained or enhanced.*

Offsets are not appropriate where the impacts of a development are considered to be minor in nature; or could reasonably be avoided or mitigated.

How addressed by the Proponent

The LOM Project BOS proposes the inclusion of almost 600 ha of 'like for like' vegetation in varying condition states, along with the additional benefits of securing eco-tonal influence of shrubby woodland and rainforest vegetation types to compliment the grassy woodlands vegetation types.

NSW

Offsets must be located appropriately (#11).

Wherever possible, offsets should be located in areas that have the same or similar ecological characteristics as the area affected by the development.

Commonwealth Equivalent

Environmental offsets should be located within the same general area as the development activity (#6).

Environmental offsets should generally be located in the vicinity (e.g. same bioregion or subregion) of the development site to ensure that one area of importance to a protected matter (e.g. a Ramsar listed area or part of a species' range) does not become severely degraded. This may be less relevant for those indirect offsets that are not location-based.

The Australian Government recognises that it may not always be desirable or possible to locate offsets in the vicinity of a development site. In some cases, greater conservation outcomes may be delivered by locating offsets elsewhere.

How addressed by the Proponent

The LOM Project BOS proposed the inclusion of 840 ha of vegetation into conservation covenant in the immediate vicinity of the impact area. This is complimented by an additional >500 ha of rehabilitation of native woodlands after the impact creating a corridor of almost 1,600 ha between two sub-regional biodiversity corridors.

NSW

Offsets must be supplementary (#12).

They must be beyond existing requirements and not already funded under another scheme. Areas that have received incentive funds cannot be used for offsets. Existing protected areas on private land cannot be used for offsets unless additional security or management actions are implemented. Areas already managed by the government, such as national parks, flora reserves and public open space cannot be used as offsets.

Commonwealth Equivalent

A flexible approach should be taken to the design and use of environmental offsets to achieve long-term and certain conservation outcomes which are cost effective for Proponents (#2).

Offsets are not intended to replace avoidance and mitigation which are expected to be the primary strategies for managing the potential impacts of development proposals. The Australian Government will not consider any proposal for environmental offsets unless the intended measures to avoid and/or mitigate the anticipated impacts are presented at the same time.

However, consideration should be given to how offsets can combine with avoidance and mitigation measures to achieve the best outcomes for the matters protected and the proponent. This means that if it can be demonstrated that better conservation outcomes would be achieved by the use of an environmental offset rather than measures to avoid and/or mitigate certain impacts, then the Australian Government will be prepared to consider such an approach.

In assessing the merits of avoidance, mitigation and offsets there needs to be clear information about the scale and intensity of impacts of the development and the relative benefits to be gained through various actions.

How addressed by the Proponent

The Proponent has acquired a number of neighbouring properties in the vicinity of the impact for inclusion in the LOM Project BOS. These lands are currently managed as grazing and cropping lands, with no conservation security provided to any of the vegetation present.

NSW

Offsets and their actions must be enforceable through development consent conditions, licence conditions, conservation agreements or a contract (#13).

Offsets must be audited to ensure that the actions have been carried out, and monitored to determine that the actions are leading to positive biodiversity outcomes.

Commonwealth

Environmental offsets should be enforceable, monitored and audited.

To ensure the success of environmental offsets, it is important that they are enforceable, monitored and audited. Proponents, or their contractors, must report on the success of the offset so that conditions of approval can be varied if the offset is not delivering the desired outcome and future offset packages can have greater chance of success.

The Australian Government will measure the success of environmental offsets by:

- *requiring environmental offsets or offset packages to include clearly articulated measures of success that are linked to the purpose of the offsets and provide clear benchmarks about their success or failure;*
- *monitoring the performance of agreed offsets as part of the monitoring, compliance and audit program for all projects considered under the EPBC Act; and*
- *seeking feedback at regular intervals from parties affected by and/or interested in environmental offsets to inform offset policy and future offset negotiations with proponents and state, territory or local governments.*

How addressed by the Proponent

The Proponent has proposed to include approximately 840 ha of vegetation identified in the conservation corridor into covenant, and has further proposed to monitor the progress of this corridor for a 20 year period post mining.

Appendix K: Environmental history of the responsible party

The following table is drawn from the EPBC Act Referral submitted to DSEWPAC, June (2010).

	Yes	No
• **Does the party taking the action have a satisfactory record of responsible environmental management? (Provide details)**	✓	
An independent audit of the compliance of the mine operations with the Conditions of Consent of DA 172-7-2004 (which incorporates the majority of the requirements of EPL 12290 and ML1563) was completed by URS in October 2008 (URS, 2008). This audit identified that the mine was compliant with 84 of the 99 conditions. Notably, of the 15 conditions against which the mine has been non-compliant, actions undertaken by the Applicant since a 100% interest was acquired by Whitehaven (December 2007) has resulted in this number reducing to seven. It is also relevant to note that two of the current non-compliances were identified by URS to be of an administrative nature, e.g. the late provision of a report, and these have been recorded as "compliant with intent of requirement". It is also noteworthy that an Annual Environmental Management Report (AEMR) is produced for the site each year and referred to several agencies for review, comment and follow up inspection. The AEMR outlines environmental performance over the reporting year.		

	Yes	No
• **Has the party taking the action ever been subject to any proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources? (If yes, provide details)**	✓	
• Since the commencement of operations, there has been several wet weather discharge events from the mine associated with surface water flows during significant rainfall. In the last 12 months two surface water discharges occurred for which discharge criteria at the discharge point were within compliance limits (GeoTerra, 2010). There was an event when a discharge of mine void water occurred on 14 July 2007. This discharge occurred without any notification, and without any prior analysis to determine the quality of the water discharged, with water flowing to Quipolly Creek to the south of the mine. This discharge occurred prior to Whitehaven Coal Limited having full ownership and management control of the site. The incident was investigated and prosecuted by DECCW in the Land and Environment Court. It was found that no environmental harm occurred from this event and it was not foreseeable, but that Werris Creek Coal, as the EPL Licence holder was responsible and subsequently fined $49,000. The fine monies were paid to help fund the Quipolly Dam revegetation project being undertaken by Liverpool Plains Shire Council.		
• **If the party taking the action is a corporation, will the action be taken in accordance with the corporation's environmental policy and planning framework? (If yes, provide details of environmental policy and planning framework)**	✓	
The Proponent currently operates the Werris Creek Coal Mine in accordance with 11 separate management plans and monitoring programs, each of which has been reviewed and approved by the Director-General of the NSW Department of Planning. All activities associated with the LOM Project would be undertaken in accordance with a project approval granted by the NSW Minister for Planning.		
• **Has the party taking the action previously referred an action under the EPBC Act, or been responsible for undertaking an action referred under the EPBC Act?**	✓	
• **Provide name of proposal and EPBC reference number (if known)** EPBC 2010/5502		

This page has intentionally been left blank

ecological AUSTRALIA

HEAD OFFICE
Suite 4, Level 1
2-4 Merton Street
Sutherland NSW 2232
T 02 8536 8600
F 02 9542 5622

SYDNEY
Suite 604, Level 6
267 Castlereagh Street
Sydney NSW 2000
T 02 9993 0566
F 02 9993 0573

ST GEORGES BASIN
8/128 Island Point Road
St Georges Basin NSW 2540
T 02 4443 5555
F 02 4443 6655

CANBERRA
Level 2
11 London Circuit
Canberra ACT 2601
T 02 6103 0145
F 02 6103 0148

HUNTER
Suite 17, Level 4
19 Bolton Street
Newcastle NSW 2300
T 02 4910 0125
F 02 4910 0126

NAROOMA
5/20 Canty Street
Narooma NSW 2546
T 02 4476 1151
F 02 4476 1161

COFFS HARBOUR
35 Orlando Street
Coffs Harbour Jetty NSW 2450
T 02 6651 5484
F 02 6651 6890

ARMIDALE
92 Taylor Street
Armidale NSW 2350
T 02 8081 2681
F 02 6772 1279

BRISBANE
93 Boundary St
West End QLD 4101
T 1300 646 131

WESTERN AUSTRALIA
108 Stirling Street
Perth WA 6000
T 08 9227 1070
F 08 9227 1078

WOLLONGONG
Level 2
25 Atchison Street
Wollongong NSW 2500
T 02 8536 8615
F 02 4254 6699