Blakebrook Quarry

Biodiversity Offset Strategy

Revision 4

for Lismore City Council

February 2019

Final

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Date:	*11 February 2019*
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Date:	*11 February 2019*

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Biodiversity Offset Strategy

Revision 4.0

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0436793

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Rev	Date	Description	By	Review	Approved
1.0	September 2018	Draft Biodiversity Offset Strategy	ERM Australia	David Nicholson	Paul Douglass
			Lismore City Council	Dave Edwards & Fiona Dawson	Eleisha Went & Phil Klepzig
			OEH	Dimitri Young	-
2.0	November 2018	Draft Biodiversity Offset Strategy incorporating comments from OEH and Lismore City Council.	ERM Australia	Joanne Woodhouse	Paul Douglass
			Lismore City Council	Eleisha Went	Phil Klepzig
			DPE	-	-
3.0	December 2018	Final Draft Biodiversity Offset Strategy for submission to DPE.	ERM Australia	Joanne Woodhouse	Paul Douglass
			Lismore City Council	Eleisha Went	Phil Klepzig
			DPE		
4.0	February 2019	Final Biodiversity Offset Strategy incorporating comments from DPE and input from Lismore City Council.	ERM Australia	Joanne Woodhouse	Paul Douglass
			Lismore City Council	Eleisha Went	Eleisha Went
			DPE		

This Biodiversity Offset Strategy, and any subsequent revisions must be approved by the relevant Lismore City Council manager/representative. Initial approval of the strategy must also be obtained from the Secretary (or delegate), NSW Department of Planning and Environment in accordance with the Minister's Conditions of Approval. Subsequent revisions do not require Secretary (or delegate) approval; however, a copy of the revised strategy will be submitted for information.

CONTENTS

ABBREVIATIONS

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Abbreviation	Meaning
BOS	Biodiversity Offset Strategy
BRMP	Biodiversity and Rehabilitation Management Plan (EMS-MP4)
CoA	Conditions of Approval
DECCW	NSW Department of Environment, Climate Change and Water
DP	Deposited Plan
DVPA	Dedicated Vegetation Protection Area
DPE	Department of Planning and Environment
EAR	Environmental Assessment Report
EIS	Environmental Impact Statement
EM Strategy	Environmental Management Strategy
EMP	Environmental Management Plan
EMS	Environmental Management System
ERM	Environmental Resources Management
FBA	Framework for Biodiversity Assessment
LBMP	Landscape and Biodiversity Management Plan
LCC	Lismore City Council
LEP	Local Environmental Plan
LGA	Local Government Area
LHPA	Livestock Health and Pest Authority
OEH	NSW Office of the Environment and Heritage
SSD	State Significant Development
SSI	State Significant Infrastructure
TEC	Threatened Ecological Community

1 INTRODUCTION

The purpose of this Biodiversity Offset Strategy (BOS) is to establish a commitment to offsetting the residual impact on threatened species and ecological communities resulting from quarrying activities at Blakebrook Quarry. It has been prepared by Environmental Resources Management Australia Pty Ltd (ERM), on behalf of Lismore City Council in order to meet the biodiversity offset requirements pursuant to Condition 25 of the Minister's Conditions of Approval (CoA).

The final Notice of Modification to application No.: 07-0020, dated 18th September 2017, under Section 75W of the *Environmental Planning & Assessment Act 1979*, provides a number of Environmental Performance Conditions under Schedule 3. With specific reference to Biodiversity Offsetting, Condition 5 states:

The proponent must:

(a) implement the Biodiversity Offset Strategy (refer Table 1.1);
(b) ensure that adequate resources are dedicated towards the implementation of this strategy;
(c) provide appropriate long term security for the offset area; and
(d) provide a timetable for the implementation of the offset strategy prior to 30 June 2010, or as otherwise agreed by the Secretary.

to the satisfaction of the Secretary.

Table 1.1 Biodiversity Offset Strategy State requirements

Offset Areas	*Minimum size*
On-site offset (Protection Zone)	*17.6 hectares*
Off-site offset (within Lismore local government area, and not already within a conservation area)	*45 hectares*
Total	***62.6 hectares***

Note: Mechanisms to provide appropriate long-term security to the land within the Biodiversity Offset Strategy in accordance with the NSW Biodiversity Offset Policy for Major Projects 2014, include a BioBanking Agreement, Voluntary Conservation Agreement or an alternative mechanism that provides for a similar conservation outcome.

1.1 BIODIVERSITY OFFSET OBJECTIVES

The objectives of the biodiversity offset strategy are:

1. to offset loss of biodiversity from the development to meet the approval requirements; and

2. to acquire and manage like for like native vegetation for the purpose of conserving biodiversity and to develop a relatively weed free, functional ecosystem which maintains and enhances fauna populations.

This report should be read in conjunction with Blakebrook Quarry Environmental Management System (EMS), the Biodiversity and Rehabilitation Management Plan (available from: www.lismore.nsw.gov.au) and Blakebrook Quarry Bush Regeneration Plan (Dawson 2018; refer *Annex B*).

1.2 POLICY FRAMEWORK

As detailed in the Environmental Impact Statement (EIS) and the CoA, a number of documents were reviewed to identify the need for biodiversity offsets for this project. In October 2014, the NSW Biodiversity Offsets Policy for Major Projects (Offsets Policy 2014) was implemented and became mandatory for all state significant development (SSD) and state significant infrastructure (SSI) projects. The Offset Policy 2014 reduced the number of offset principles and introduced the use of a new assessment methodology, the framework for biodiversity assessment (FBA). While Lismore City Council (LCC) is committed to providing offsets in accordance with its current approval conditions, consideration to the principles outlined in the Offset Policy is also provided below:

Before offsets are considered, impacts must first be avoided and unavoidable impacts minimised through mitigation measures. Only then should offsets be considered for the remaining impacts.	
Avoid	In consideration of the overall project objectives, the design process involved considerable design refinements to ensure protection of identified ecological values including Koala Habitat, Threatened Ecological Communities (TEC) and threatened species. Known occurrences of Arrow-head Vine (*Tinospora tinosporoides*), Thorny Pea (*Desmodium acanthocladum*) and the Lowland Rainforest an endangered ecological community (EEC) have been conserved and improved on-site and key habitat features for identified threatened fauna species and fauna movement corridors have also been targeted for protection during project design.
Minimise	A comprehensive ecological survey has been undertaken at the Blakebook Quarry (CEG 2008) and at the selected offset sites (Dawson 2018, refer to *Annex B*) to inform the development of management and mitigation measures.
Offset requirements should be based on a reliable and transparent assessment of losses and gains.	
Offsets are based on a quantitative assessment of the loss in biodiversity from the approved clearing. The methodology includes a direct 'like for like' comparison against the area of impact; and the types of ecological communities and habitat affected.	
Offsets must be targeted to the biodiversity values being lost or to higher conservation priorities.	
The first priority for investigation and selection of the offset sites was land located within the Lismore LGA, containing moderate to good condition habitat	

representative of the ecological value, threatened species habitats and EEC affected. The selected offset sites are considered to be of greater value as: – they protect land with high conservation significance; – management actions have greater benefits for biodiversity; – the offset areas are not isolated or fragmented; and – the management for biodiversity will be in perpetuity ie. secured by rezoning the land to a suitable Environmental Protection Zone.
Offsets must be additional to other legal requirements
The acquired biodiversity offset sites are being managed as biodiversity offsets only. They are not being used to satisfy other approvals such as pollution or noise control.
Offsets must be enduring, enforceable and auditable.
The long term management of the offset sites will be monitored to determine that the actions are leading to positive biodiversity outcomes. The ongoing monitoring and audit of this strategy will be undertaken in accordance with the Blakebrook Quarry Environmental Management System (EMS).
Supplementary measures can be used in lieu of offsets.
The entire 45ha required as off-site offset has been acquired by LCC and supplementary measures are not required.

1.3 CONSULTATION AND ENDORSEMENT

Consultation with OEH has been undertaken since 2014 in regards to the selection of suitable offset sites and to discuss the most suitable options for the long term security of the sites (refer to *Section 4.2*).

A draft copy of the Biodiversity Offset Strategy has been provided to Office of the Environment and Heritage (OEH) for their review and comment. Comments were received on 24 October 2018 and all of the suggested changes have been incorporated into the final report. A copy of the Agency correspondence is included within *Annex E*.

A copy of the Biodiversity Offset Strategy has also be provided to the NSW Department of Planning and Environment (DPE) for their review and comment. Comments were received on 15 January 2019 and all of the suggested changes have been incorporated into the final report (Rev 4). A copy of the Agency correspondence is included within *Annex E* and a response to the issues raised is provided in *Table 1.2* below.

Table 1.2 Response to DPE Comments

DPE Comments dated 15 January 2019	Response
See Section 3 and Section 4 – Append or hyperlink any referenced documents e.g. Bush Regeneration Plan. So that the Biodiversity Offset Strategy may be read as a standalone document.	A copy of the Blakebrook Quarry Bush Regeneration Plan (Dawson 2018) is provided in *Annex B*. A copy of the Biodiversity and Rehabilitation Management Plan is available for download: www.lismore.nsw.gov.au.
See Section 4.2 – Please provide further details of what the on-site induction will entail or alternatively append the induction.	Section 4.3 has been updated to include some examples of the information that would be included in the site induction.
See Section 5.1 – Further details are required on how adequate resources will be ensured.	The Blakebrook Quarry Bush Regeneration Plan (Dawson 2018) and the Indicative Management Actions provided in *Annex C* provide a breakdown of the forecast expenditure. Resourcing will be subject to budget allocation by Council as part of the annual operational budget cycle.
See Section 5 – Include the final decision for the long-term security of the offset made in consultation with OEH.	Rezoning the land to a suitable Environmental Protection Zone was selected as the preferred option and confirmed by OEH to 'satisfactorily secure the land for conservation' (see *Annex E*). LCC have commenced the process to rezone the land to E2 Environmental Conservation under the Lismore City Council local environmental plans (LEP). This zone is for areas with high ecological, scientific, cultural or aesthetic values outside national parks and nature reserves. The zone provides the highest level of protection, management and restoration for such lands whilst allowing uses compatible with those values.
Please include a timetable detailing the implementation of the offset strategy.	An indicative timetable has been provided as *Annex D*.

2 QUARRY OPERATIONS

2.1 DESCRIPTION

The original Blakebrook Quarry development consent limited production to 182,000 tonnes per annum plus a 2.5% production increase over 25 years to a maximum 337,500 tonnes per annum. The approved production rate as of 2008 is in the order of 243,000 tonnes per annum. Production at the quarry has remained at or below the allowable rate over the life of the current consent. The quarry has also maintained compliance with all other relevant conditions of consent over the current life of the quarry.

Blakebrook Quarry has an identified resource of approximately 13.6 million tonnes which based on an extraction rate of 600,000 tonnes per annum, would allow for quarrying for approximately 22 years. The maximum proposed extraction rate is not expected be achieved in all years of quarrying. Project approval was therefore sought for an area sufficient for 30 years of quarrying with maximum extraction rate of 600,000 tonnes per annum, continuing in the existing main pit (herein also referred to as the 'North Pit') and a new smaller pit (herein also referred to as the 'South Pit') located to the south of the existing pit.

In August 2017, Lismore City Council submitted a Modification Application to the DPE seeking to mine the first 10 metres of the cap rock in the South Pit at Blakebrook Quarry. The South Pit was previously unable to be mined until late 2018, at the completion of the detailed groundwater assessment. On 18 September 2017, approval was granted to Lismore City Council to undertake these works, in accordance with revised CoA.

2.2 OPERATIONAL OVERVIEW

Quarrying has initially commenced laterally in the existing main pit before extraction in the southern pit occurs, in order to ensure continued demands for the hard rock material can be met. Council has purchased mobile crushing and screening plant for operation in the quarry pits which will result in a significant reduction in plant noise.

It is expected that that over the initial 10 years of the 30 year life of the quarry that production will average in the order 200-300 tonnes per annum including extraction of high quality product from the southern pit. The production is expected to increase beyond 10 years to the maximum 600,000 tonnes per annum.

3 BIODIVERSITY OFFSET STRATEGY

There are minimal risks associated with achieving the biodiversity offsetting objectives because offset land has already been acquired by LCC and is already being managed for this purpose in accordance with the Biodiversity and Rehabilitation Management Plan and Blakebrook Quarry Bush Regeneration Plan (Dawson 2018), or any further reiterations of these plans.

A copy of the Blakebrook Quarry Bush Regeneration Plan (Dawson 2018) is provided in Annex B. A copy of the Biodiversity and Rehabilitation Management Plan is available for download: www.lismore.nsw.gov.au

3.1 BIODIVERSITY OFFSETS REQUIRED

A detailed Ecological Site Assessment was prepared by Conacher Environmental Group (CEG) in 2008 to inform the Environmental Assessment Report (EAR) and subsequent project approval. The assessment included desktop assessment, targeted flora and fauna surveys and included a comprehensive ecological impact assessment and characterisation of the site.

Vegetation within the site is typical of remnant vegetation associated with the upper slopes and plateaus of the local area, being highly fragmented as a result of historical clearing associated with logging and agricultural practices (CEG, 2008). The following five vegetation communities have been identified on-site:

- Tall Open Forest (Pink Bloodwood (*Corymbia intermedia*), White Mahogany (*Eucalyptus acmenoides*), Tallowwood (*Eucalyptus microcorys*) and Brush Box (*Lophostemon confertus*));
- Tall Open Forest/Woodland (Broad-leaved Apple (*Angophora subvelutina*), Forest Red Gum (*Eucalyptus tereticornis*) and Swamp Turpentine (*Lophostemon suaveolens*));
- Closed Forest;
- Regrowth Scrub; and
- Disturbed Grassland (CEG, 2008).

These vegetation communities are described in greater detail in Annex B of the Biodiversity and Rehabilitation Management Plan (2018). The Open Forest, Woodland and Closed Forest communities within the site are part of a relatively large, high quality remnant that provides connectivity to the landscape to the east (koala habitat) and extends to the north, south (CEG, 2008).

The Closed Forest vegetation community qualifies as the Endangered Ecological Community (EEC) Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions (Lowland Rainforest EEC) (CEG, 2008). This community comprises subtropical rainforest and some related, structurally

complex forms of dry rainforest associated with high nutrient geological substrates (notably basalts and fine-grained sedimentary rocks) on coastal plains, plateaus, footslopes and foothills of the NSW North Coast and Sydney Basin Bioregions (DECCW, 2008a).

The site also provides a range of potential fauna habitat for locally occurring fauna species associated with the Open Forest, Closed Forest and Woodland vegetation variants (CEG, 2008), with three threatened flora species and eight threatened fauna species recorded on the Quarry site.

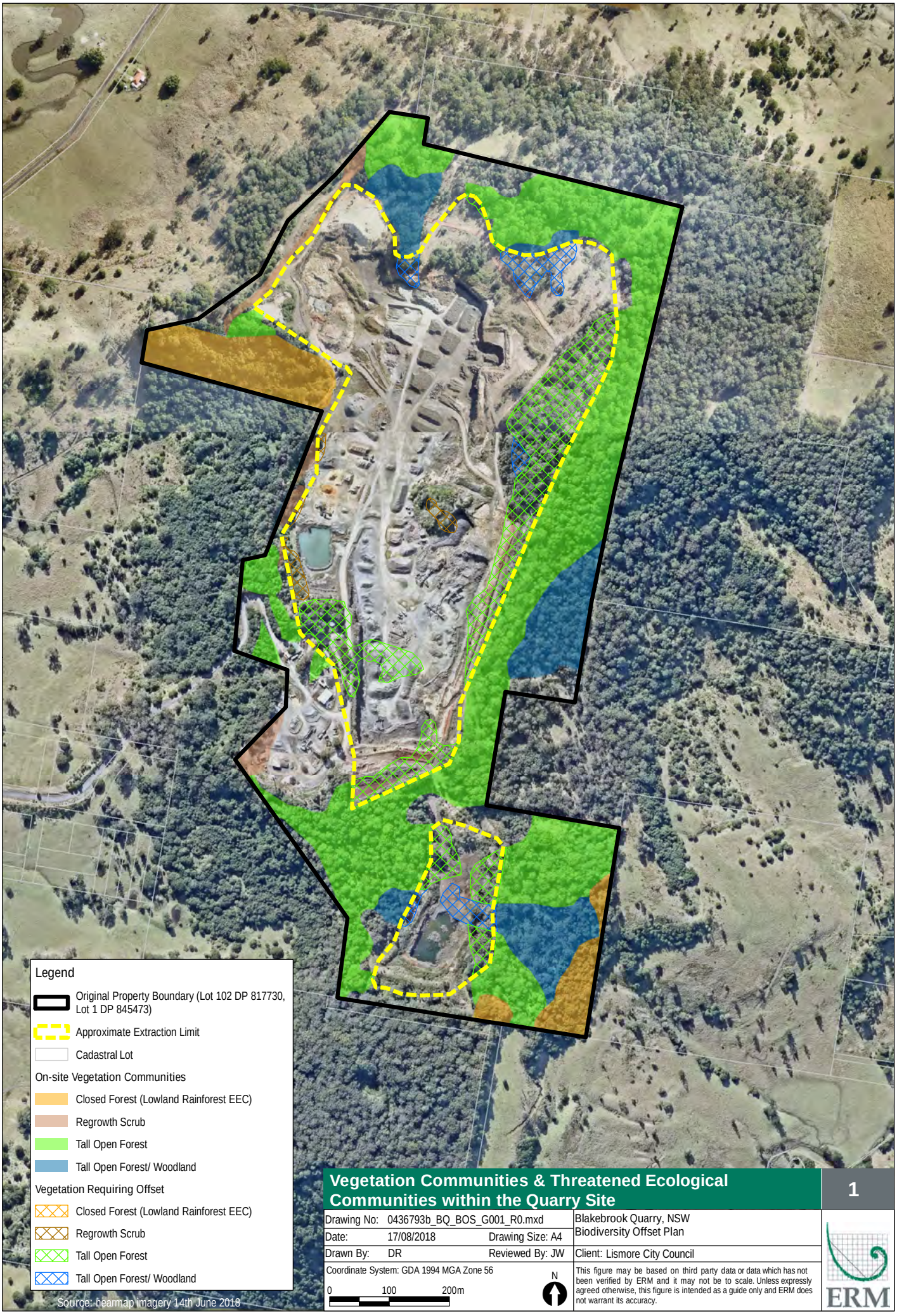
A summary of the environmental impacts resulting from the quarry expansion is provided below. Further details including an assessment of these impacts in accordance with relevant State and Commonwealth legislation is provided in Annex F of the Blakebrook Quarry Expansion: Ecological Site Assessment Report (CEG, 2008).

Table 3.1 Vegetation Communities requiring offset

Vegetation Formation*	Vegetation Type	EPBC Status	BC Act Status	Identified in Project site	Area to be cleared
Tall Open Forest	North Coast Wet Sclerophyll Forest	-	-	25.7 ha	8 ha
Tall Open Forest/Woodland	Wet sclerophyll forests (Grassy subformation)	-	-	9.1 ha	1.3 ha
Closed Forest	Subtropical Rainforests Lowland Rainforest in the NSW North Coast and Sydney bioregions	EEC	CE	1.9 ha	0 ha
Sub-Total (native)				36.7 ha	9.3 ha
Regrowth Scrub	Cleared	-	-	2.1 ha	0.3 ha
Disturbed Grassland	Cleared	-	-	21.2 ha	16.5 ha
Total				96.7 ha	35.4 ha

E – Endangered CE = Critically Endangered

**Detailed descriptions of the vegetation communities are provided in Annex A.*



Vegetation Communities & Threatened Ecological Communities within the Quarry Site

1

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Date:	17/08/2018	Drawing Size: A4	
Drawn By:	DR	Reviewed By: JW	Client: Lismore City Council

Coordinate System: GDA 1994 MGA Zone 56

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This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

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Table 3.2 ***Threatened Species and their habitats***

Species Name (scientific name)	EPBC Status	BC Act Status	Habitat available	Habitat to be removed
Arrowhead Vine *(Tinospora tinosporoides)*	-	Vulnerable	1.9 ha	0 ha
Thorny Pea (*Desmodium acanthocladum*)	Vulnerable	Vulnerable	36.7	9.3 ha
Fragrant Myrtle (Gossia fragrantissima)	Vulnerable	Vulnerable	1.9 ha	0 ha
Glossy Black-Cockatoo (*Calyptorhynchus lathami)*	-	Vulnerable	34.8 ha	9.3 ha
Masked Owl (*Tyto novaehollandiae*)	-	Vulnerable	58.1 ha	26.1 ha
Squirrel Glider (*Petaurus norfolcensis*)	-	Vulnerable	34.8 ha	9.3 ha
Koala (*Phascolarctos cinereus*)	Vulnerable	Vulnerable	36.7 ha	9.3 ha
Grey-headed Flying-fox (*Pteropus poliocephalus*)	Vulnerable	Vulnerable	38.8 ha	9.6 ha
Little Bentwing-bat (*Miniopterus australis*)	-	Vulnerable	60 ha	26.1 ha
Eastern Bentwing-bat (*Miniopterus schreibersii*)	-	Vulnerable	60 ha	26.1 ha
Eastern False Pipistrelle (*Falsistrellus tasmaniensis*).	-	Vulnerable	60 ha	26.1 ha

Note: Black Flying-fox (Pteropus alecto) was removed from the Schedules of the Threatened Species Act in August 2008 and is no longer listed as threatened in NSW and is not considered in this Biodiversity Offset Strategy.

In accordance with the development approval conditions and as outlined in *Table 3.2* and depicted in *Figure 1*, the project will clear 26.1 ha of vegetation, including 9.3 hectares of native vegetation and 16.6 ha of scrub and grassland. To offset this clearing, the project has committed to conserve 62.6 ha of vegetation in perpetuity, including the regeneration of 17.6 ha of vegetation in and around the quarry pits (refer *Table 3.3*).

Table 3.3 ***Biodiversity Offset Commitments***

Offset Areas	Minimum size
On-site offset Dedicated Vegetation Protection Area (DVPA) – refer to *Section 3.2*	17.6 ha
Off-site offset - refer to *Section 3.3*	45 ha

3.2 ESTABLISHED ON-SITE DEDICATED VEGETATION PROTECTION AREA

In accordance with the project approval, a Dedicated Vegetation Protection Area (DVPA) has been established on-site to offset predicted ecological impacts. The DVPA is shown on *Figure 2* and covers an area of approximately 34 ha. This DVPA is managed in accordance with the Biodiversity and Rehabilitation Management Plan (www.lismore.nsw.gov.au) and Blakebrook Quarry Bush Regeneration Plan (*Annex B*).

As outlined within the Biodiversity and Rehabilitation Management Plan, the DVPA has been divided into three zones. These zones outline key management strategies and have been referred to in this Biodiversity Offset Strategy to confirm dedication of a 17.6 ha on-site offset area as required in the CoA:

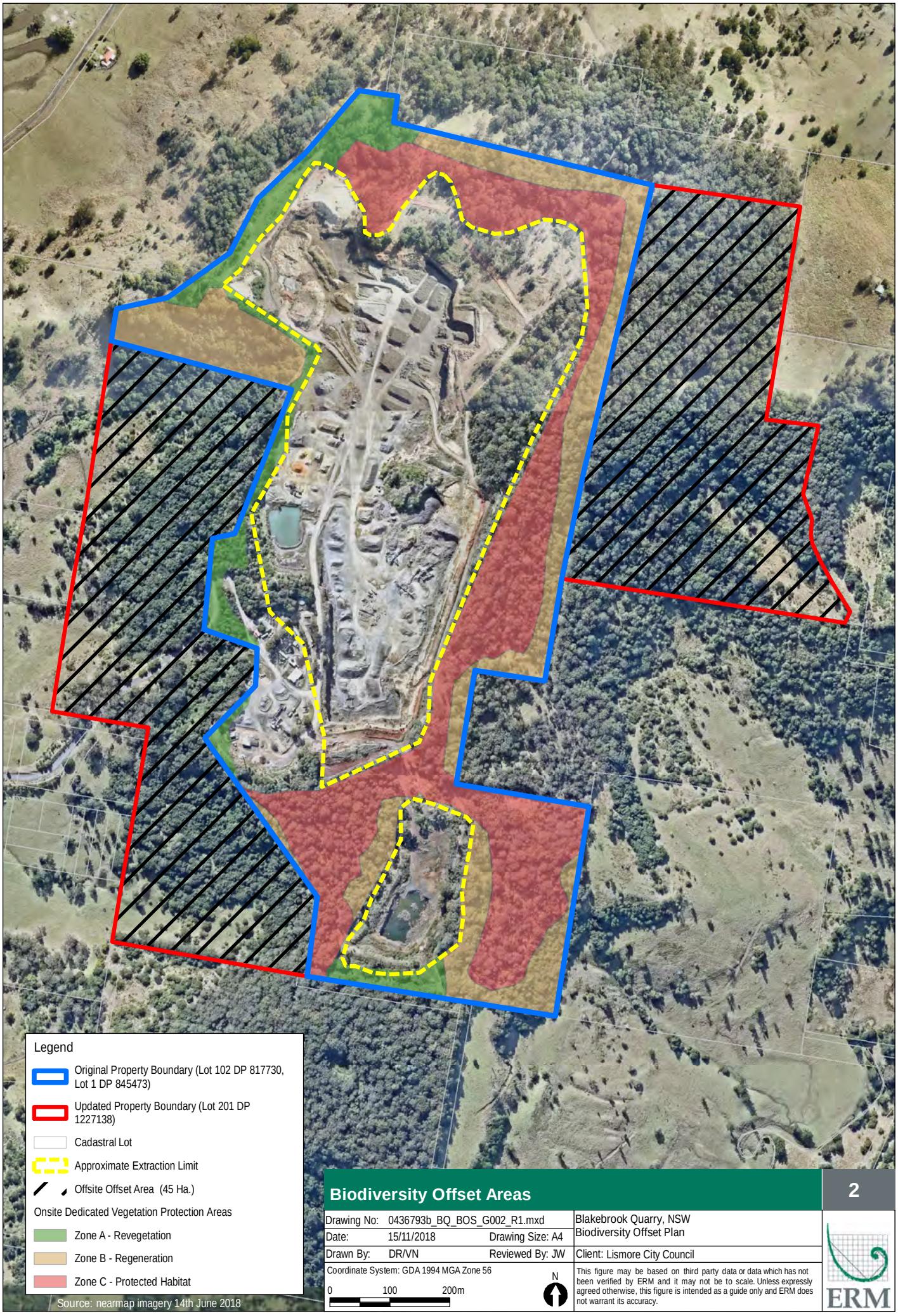
- **Zone A – Revegetation Zone:** this zone is highly degraded due to past clearing which has resulted in a loss of topsoil, native vegetation and fauna habitat availability;
- **Zone B – Regeneration Zone:** areas identified within this zone have a high degree of weed invasion and are located at the edges of vegetation communities and the site boundary; and
- **Zone C – Protected Habitat Zone:** covers approximately 17.6ha comprising less disturbed bushland areas within the site that require weed removal (CEG, 2008). This zone meets the requirements and is actively managed as the On-site Offset as required in *Table 4.1* of the CoA.

A breakdown of the DVPA according to the three zones and vegetation communities is provided in ***Table 3.4***.

Table 3.4 Management Zones within the DVPA

Vegetation Community	Zone A*- Revegetation Zone (ha)	Zone B* – Regeneration Zone (ha)	Zone C *– Dedicated Vegetation Protection Area (ha)	Total Area (ha)
Tall Open Forest	1.54	4.86	11.84	18.24
Tall Open Forest/Woodland	0.03	3.63	3.93	7.59
Closed Forest (Lowland Rainforest EEC)	0.02	1.78	0.05	1.85
Disturbed Land	2.53	1.1	1.82	5.45
Regrowth Scrub	0.86	0	0	0.86
Total	4.98 ha	11.37 ha	17.64 ha	33.99 ha

** It is noted that these zones have been referred to in this Biodiversity Offset Strategy to confirm dedication of a 17.6 ha on-site offset area as required in the CoA. Refer to the Blakebrook Quarry Bush Regeneration Plan (Dawson 2018) for the identification of specific work zones and management actions. It is also noted that although a minimum of 17.6ha (Zone C of the DVPA) is required to be enhanced to meet the CoA; ~34ha is included in the Bush Regeneration Plan and is under active management.*



Biodiversity Offset Areas

2

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Date:	15/11/2018	Drawing Size: A4	
Drawn By:	DR/VN	Reviewed By: JW	Client: Lismore City Council

Coordinate System: GDA 1994 MGA Zone 56

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3.3 BIODIVERSITY OFFSET SITE SELECTION (45 HECTARES)

In addition to the 34ha (which includes the 17.6ha on-site offset area) that is already being protected and enhanced on-site, an additional 45ha has been purchased by Lismore City Council as part of this Biodiversity Offset Strategy. This area has been chosen to offset predicted ecological impacts, and has been developed in accordance with NSW Biodiversity Offsets Policy and the requirements of the CoA (refer to *Table 3.5*).

In order to improve or maintain existing biodiversity values within the local area, the following criteria was used when selecting appropriate areas to offset predicted impacts associated with on-site quarrying activities:

Table 3.5 Offsite Site Selection Criteria

Criteria		Assessment
The offset area must be at least 45ha in size.	✓	Total property acquisition is 45ha.
The offset area must be located off-site although must occur elsewhere within the LCC LGA;	✓	The offset site is located in a rural area of Blakebrook in the central part of the Lismore LGA. The offset site directly adjoins Blakebrook Quarry to the east and west in a locality otherwise dominated by rural land use such as beef production or large forested acreage living.
The offset area cannot be funded by another offset scheme or contained within an existing conservation area protected on private land (unless additional security or management actions are implemented) or managed by government (eg National Park, reserve, public open space etc);	✓	The offset sites have already been purchased by LCC and are not funded by another offset scheme or contained within an existing conservation area.
The offset area will need to have similar ecological characteristics including vegetation structure, ecosystem function and compositional as that being removed.	✓	The offset area is located adjacent to the quarry site, has similar (like for like) vegetation structure, ecosystem function and compositional as that being removed.
The biodiversity value of the offset area will need to be such that enhancement and conservation works result in a net improvement in biodiversity values within the local area.	✓	The offset areas offer additional ecological benefits, above those required in the CoA, and provides for the long term protection and conservation of 24 ha Lowland Rainforest EEC. The offset areas also provides for the long term protection and conservation of Arrowhead Vine (*Tinospora tinosporoides*), Fragrant Myrtle (Gossia fragrantissima) and Thorny Pea (*Desmodium acanthocladum*) which are being actively monitored within the offset area.

Based on these criteria, the following offsite sites have been purchased by LCC and are located adjacent to the Blakebrook Quarry within the Lismore City Council LGA. The total offset area is 45 hectares which includes extensive areas of mature native vegetation.

The Deposited Plan formalising the amendments to property boundaries (transferring the 45 ha of environmental offsets to the quarry site) was registered by NSW Land and Property Information on 05/01/2017. Purchase of the land was completed on 31/01/2017 and the title transfer documentation has been lodged with the LPI. The quarry, including the 45ha offset sites is now located on Lot 201 DP 1227138, Parish of Blakebrook, County of Rous.

3.4 VEGETATION TYPES

A detailed assessment of the vegetation communities has been undertaken by Dawson (2018). In summary, the vegetation within the offset sites is typical of remnant vegetation associated with the upper slopes and plateaus of the local area, including the Blakebrook Quarry Project site. As identified in *Figure 3,* the same (like for like) five vegetation communities have been identified as follows:

- 25 ha of Tall Open Forest (Pink Bloodwood (*Corymbia intermedia*), White Mahogany (*Eucalyptus acmenoides*), Tallowwood (*Eucalyptus microcorys*) and Brush Box (*Lophostemon confertus*));
- 3.6 ha of Tall Open Forest/Woodland (Broad-leaved Apple (*Angophora subvelutina*), Forest Red Gum (*Eucalyptus tereticornis*) and Swamp Turpentine (*Lophostemon suaveolens*));
- 24 ha of Closed Forest;
- 18.5 ha of Regrowth Scrub; and
- Disturbed Grassland.

Detailed descriptions of the vegetation communities are provided in *Annex A* and *Annex B*.

3.5 THREATENED SPECIES HABITATS

The offset sites also provide a range of potential fauna habitat for locally occurring fauna species associated with the Open Forest, Closed Forest and Woodland vegetation variants, with two threatened flora species and one threatened fauna species recorded within the offset site (refer to *Table 3.6*).

Koala activity at the Blakebrook quarry site was monitored over a five-year period from 2012 – 2016 (Biolink 2016). Monitoring was based on 17 permanent monitoring points (PMPs) that were established in 2012 and at which koala activity was measured. Four additional ancillary sites within the biodiversity offset sites were established during the 2016 monitoring event. The recording of a koala in one of these ancillary sites, when adjusted for the increase in both survey effort and study area size, confirmed the persistence of a small population of approximately six koalas. Biolink (2016) recommended ongoing

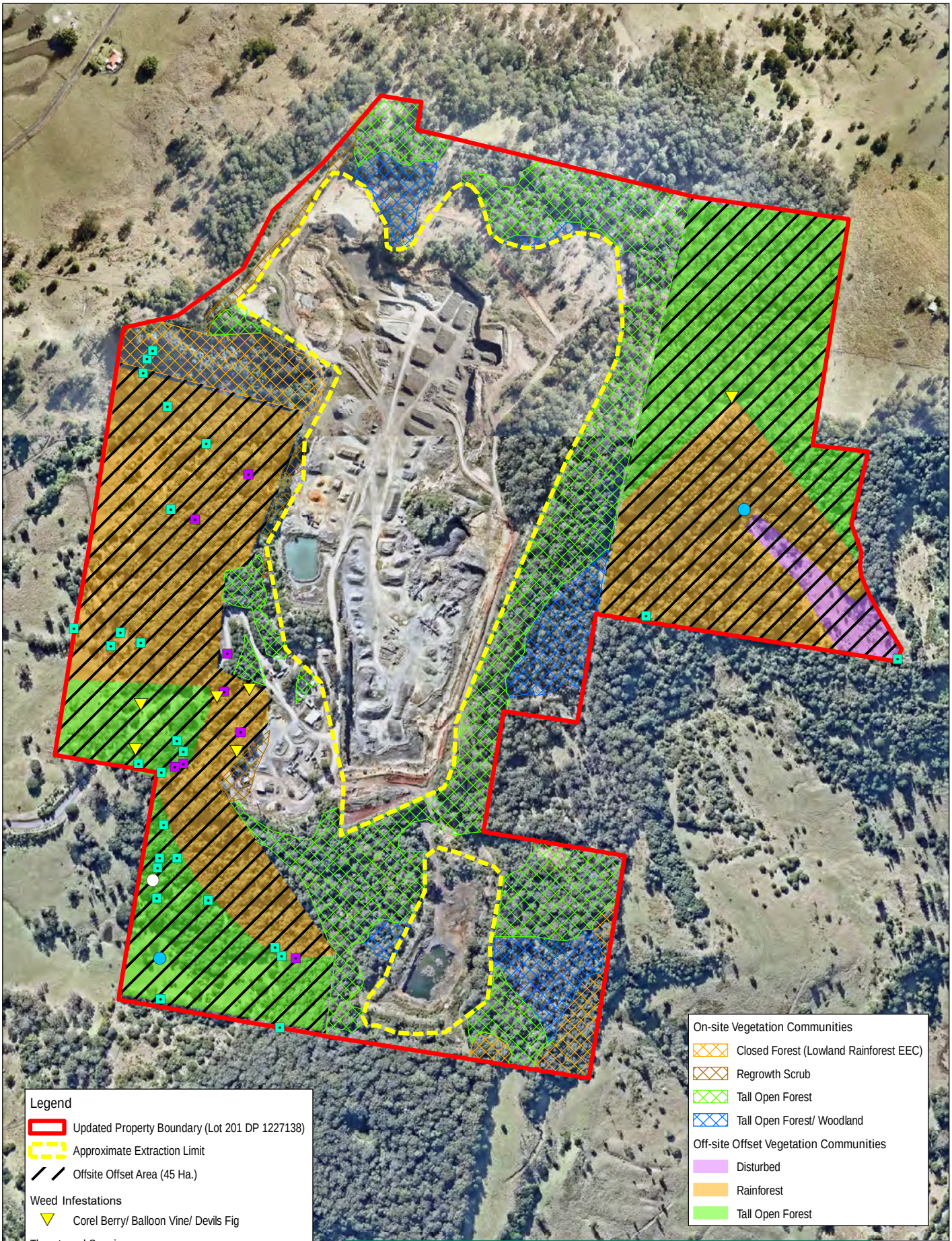
habitat rehabilitation works that include increasing the densities of the naturally occurring preferred koala food tree species Tallowwood and Forest Red Gum, as well as measures to improve habitat/landscape connectivity over the longer-term as useful ongoing koala management measures.

Although it is recognised that the Blakebrook quarry site is located outside of the application area of the Comprehensive Koala Plan of Management for south-east Lismore (LCC 2013), the general objectives of the plan - to allow for safe koala movement across the landscape; and to create, manage and/or restore koala habitat linkages and corridors have also been considered.

The remaining threatened species have been recorded within the adjacent habitats and are being assumed to utilise the offset sites and management measures applied accordingly.

Table 3.6 Offsite Acquisitions, Threatened Species Habitats

Species Name (scientific name)	Recorded with Offset Sites (Dawson 2018)	Impact area	Offset area
Arrowhead Vine *(Tinospora tinosporoides)*	✓	0 ha	24 ha
Thorny Pea (*Desmodium acanthocladum*)	✓	9.3 ha	43.3 ha
Fragrant Myrtle (*Gossia fragrantissima*)	✓	0 ha	24 ha
Glossy Black-Cockatoo (*Calyptorhynchus lathami)*	-	9.3 ha	19.3 ha
Masked Owl (*Tyto novaehollandiae*)	-	26.1 ha	21 ha
Squirrel Glider (*Petaurus norfolcensis*)	-	9.3 ha	19.3 ha
Koala (*Phascolarctos cinereus*)	✓	9.3 ha	43.3 ha
Grey-headed Flying-fox (*Pteropus poliocephalus*)	-	9.6 ha	43.3 ha
Little Bentwing-bat (*Miniopterus australis*)	-	26.1 ha	45 ha
Eastern Bentwing-bat (*Miniopterus schreibersii*)	-	26.1 ha	45 ha
Eastern False Pipistrelle (*Falsistrellus tasmaniensis*).	-	26.1 ha	45 ha



Vegetation Communities & Threatened Ecological Communities within the Offset Area

3

Drawing No:	0436793b_BQ_BOS_G003_R0.mxd		Blakebrook Quarry, NSW Biodiversity Offset Plan
Date:	17/08/2018	Drawing Size: A4	
Drawn By:	DR	Reviewed By: JW	Client: Client Name

Coordinate System: GDA 1994 MGA Zone 56

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4 MANAGEMENT ACTIONS FOR THE OFFSET AREA

Management of the offset sites will be undertaken in accordance with the Blakebrook Quarry Bush Regeneration Plan to develop a relatively weed free, functional ecosystem which maintains and enhances fauna populations. Relatively weed free has been interpreted as <5% exotics remaining in all strata within the action plans and performance indicators for on-ground works.

With specific reference to the off-site offset areas, the site has been divided into work zones to ensure prioritised, comprehensive and systematic regeneration (assisted) and weed control. Zones have been grouped into South, West and East for logistical and mapping purposes, with each zone prefixed by location (for example, w1 = work zone 1, within the western portion of the offset site). This allocation of management zones has been used within this offset strategy to ensure consistency with the Blakebrook Quarry Bush Regeneration Plan (*Annex B*). These zones are depicted in Figure 4.

Management classes for costing in each zone related to weed severity are based on Appendix 4 of the Lismore City Council Urban Green Corridors Plan (2017) as reported by Dawson (2018) and summarised in *Annex C*.

The use of assisted natural regeneration is the preferred approach where the site exhibits sufficient in-situ resilience (native seed bank in the soil or on-site flora) or migratory resilience (wind, birds etc). Revegetation may be required where the seed bank has been depleted and/or genetic diversity requires supplementation (SERA, 2017 as cited by Dawson 2018).

In accordance with the Blakebrook Quarry Bush Regeneration Plan and with consideration of the objectives of the Comprehensive Koala Plan of Management for south-east Lismore (LCC 2013), the objectives of the long-term management actions are to:

- Enhance koala habitat by targeting rainforest pioneers which shade out eucalypt recruitment and by removing weeds in mid and ground stratum which prevent germination of natives, particularly Eucalypts (Zones e1, e2, w1 and s1);
- Restore EEC and protect threatened species by removing cattle and weeds in mid and ground stratum which prevent germination of natives (Zones e3, w2, w3, w4 and s2).
- Protect and expand Thorny Pea (Zones e3, w1, w2, w3, s1 and s2).
- Protect and expand Fragrant Myrtle (Zone w1).
- Protect and expand Arrowhead Vine (Zone w2, w3 and s2).
- create, manage and/or restore koala habitat linkages and corridors within site & landscape by replacing Rhodes Grass with Forest Red Gum plantings in stages (Zone e4).

- Expand koala habitat and allow for safe koala movement across the landscape by excluding cattle and allowing Forest Red Gum and other natives to regenerate naturally. Erosion and water quality also improve (Zones w1 and s1).

- Expand and link koala habitat on lower slopes to Zone w1 and allow for safe koala movement across the landscape by removing cattle and weeds (Zone w2).

- Eliminate weed infestations and prevent dispersal to other zones (Zone w3).

Ecological restoration and enhancing habitat value is the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed and will include:

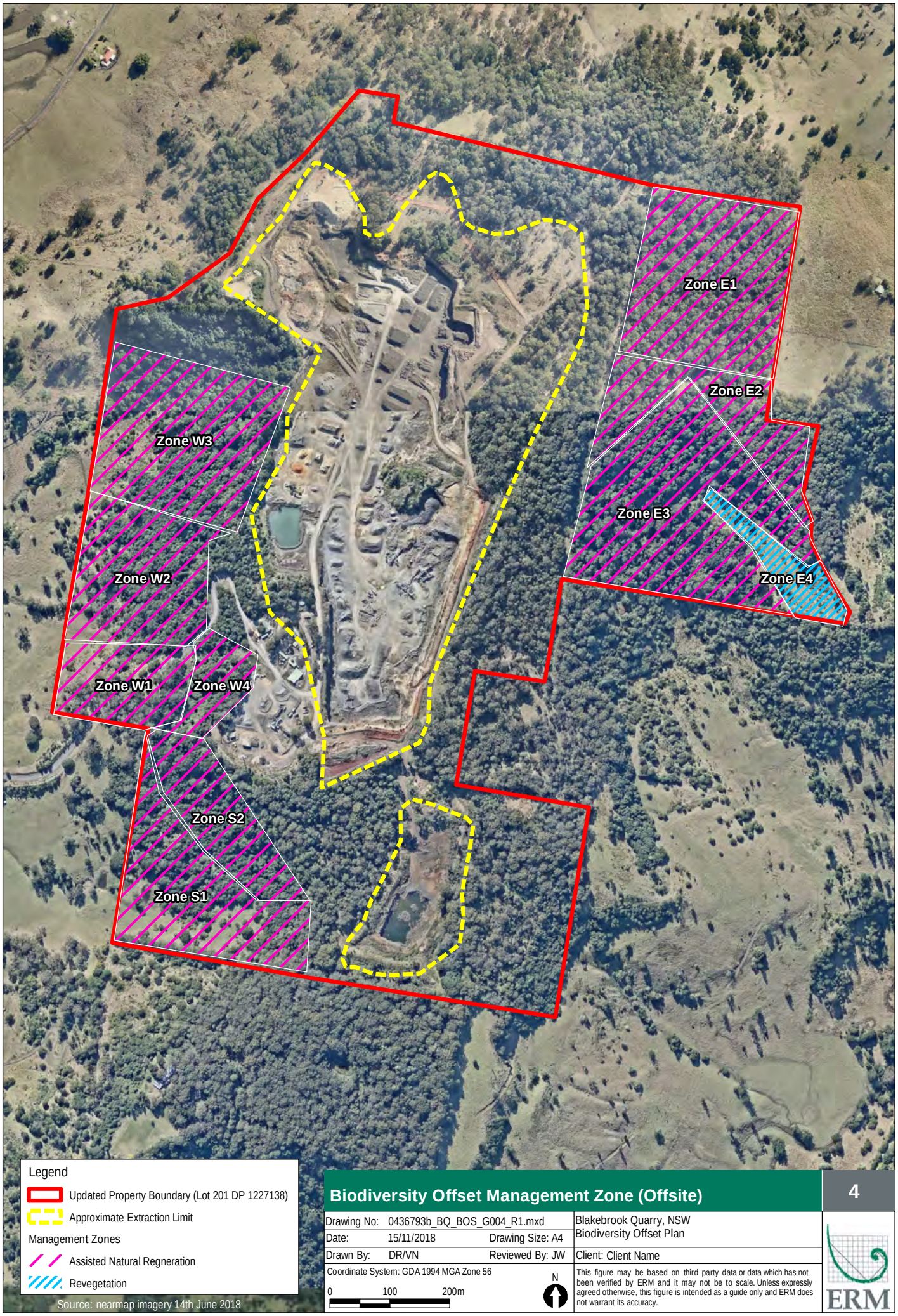
4.1 WEED REMOVAL

The implementation of a methodical and thorough weed management program is vital to controlling weed infestations and encouraging native plant growth. All weed removal must be conducted by appropriately trained and licensed personnel experienced in weed removal and the use of herbicides. Use of herbicide near waterways must be conducted in accordance with the Safe and Effective Herbicide Use: A handbook for near-water applications (EPA, 2017).

As a general rule, weed removal will be undertaken in a methodical manner and will commence on one side of the zone and progress systematically towards the end ensuring follow-up is timely and thorough until the weed seed bank is depleted. When working along waterways, weed removal will commence upstream and progressively work downstream. This helps to prevent the reinvasion of areas with weed seeds and propagules that may be contained in upstream water.

Where possible, weed removal will be conducted in a manner that minimises soil disturbance, erosion and the risk of native fauna habitat removal. Minimising disturbance to the soil reduces opportunities for weeds to re-establish as many species maintain a large seed bank in the soil and soil disturbance can provide optimal conditions for weed regeneration. Minimising soil disturbance can also reduce overall weed management costs.

Where planting of native species is required, weed removal will commence immediately in order to provide native seedlings with a competitive advantage against invading weed species.



Legend

- Updated Property Boundary (Lot 201 DP 1227138)
- Approximate Extraction Limit

Management Zones

- Assisted Natural Regneration
- Revegetation

Source: nearmap imagery 14th June 2018

Biodiversity Offset Management Zone (Offsite)

4

Drawing No:	0436793b_BQ_BOS_G004_R1.mxd		Blakebrook Quarry, NSW Biodiversity Offset Plan
Date:	15/11/2018	Drawing Size: A4	
Drawn By:	DR/VN	Reviewed By: JW	Client: Client Name

Coordinate System: GDA 1994 MGA Zone 56

0 100 200m

N

ERM

4.2 SEDIMENT AND EROSION CONTROL MEASURES

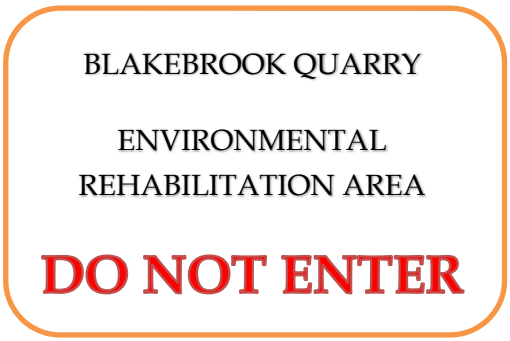
Sediment and erosion control measures that will be used at the offset sites, depending on level of erosion risk and suitability, include prioritising revegetation of areas at high risk of erosion as soon as practicable according to the progressive rehabilitation approach detailed in the Biodiversity & Rehabilitation Management Plan.

4.3 PROTECTION OF NATIVE VEGETATION

All activity within the offset areas has the potential to introduce or spread weed seeds, propagules and pathogens such as *Phytophthora cinnamomi* (an introduced soil-borne pathogen with the ability to kill native plants by attacking root systems and inhibiting the movement of water and nutrients within the plant). Where access permits, signage indicating that rehabilitation works are in progress will be erected to discourage disturbance to these areas. On-site personnel will be inducted on their responsibilities in relation to avoiding restoration and biodiversity offset areas and personnel with access to rehabilitation areas will be provided with information regarding appropriate hygiene practices (eg cleaning of shoes and machinery) to prevent the spread of weeds and pathogens. An example of the information that will presented in the induction include:

No-Go Areas

- No Go areas are clearly delineated on site with signs and fencing
- Areas that may be protected include remnant vegetation, biodiversity offset areas, project boundaries etc
- All works and access paths must stay within established areas
- If you must enter an Environmental No-Go Area always seek approval from the Environmental Manager first.



Vegetation Protection

- Do not park vehicles, plant/machinery, stockpile machinery or stack equipment against trees or under their branches.

Noxious Weeds

- Weeds occur within the Quarry site, including the rehabilitation and offset sites.
- Seeds can be spread by vehicles, machinery or people

		
Lantana (Lantana camara)	*Crofton Weed (Ageratina adenophora)*	*Mistflower (Ageratina riparia)*

Equipment should be cleaned down when moving between properties or known weed infested area. Soil, soil slurry or vegetation material is to be removed. Dry conditions will require a brushdown to remove dirt clods or vegetation. Dust does not have to be cleaned from the vehicle.

4.4 PEST FAUNA SPECIES MANAGEMENT

The following pest fauna species have been observed within the adjacent Project area and are assumed to also be present with the offset area:

- Cane Toad *(Rhinella marina);*
- Rabbit *(Oryctolagus cuniculus)*;
- Dog *(Canis lupus);* and
- Fox *(Vulpes vulpes)* (CEG, 2008).

None of these species are likely to constitute a threat to the conservation and management of the offset site although it is recognised that pest fauna species can cause problems in natural landscapes such as soil erosion, degradation of

native flora and fauna habitat, competition for resources, predation; distribution of disease and weeds; and increased management costs. It is important that all food waste is disposed of in covered waste bins.

Fringing vegetation along the edges of dams should be encouraged where possible (specially targeted dams within zones e1/e2/e3/e4 and s1) to prevent access by Cane Toads.

Dogs (both wild and domestic) are recognised as a threat to the local Koala population. Records maintained by Friends of the Koala and reported by LCC (2013) indicate that 15.5% of mortalities were caused by (or euthanised due to) vehicle strike and 8.3 % were caused by (or euthanised due to) dog attack between 2007 and 2011. A wild dog baiting program has been undertaken at the quarry site over a number of years (*pers com*). This program will continue in consultation with the Local Land Services and with reference to the *NSW Wild Dog Management Strategy 2017–2021.*

The management of pest fauna species is governed by the *Rural Lands Protection Act 1989* and the *National Parks and Wildlife Act 1974*. The Livestock Health and Pest Authority (LHPA) (formerly the Rural Lands Protection Board) and local Council are the control authorities for feral and domestic animals. These agencies, in coordination with the Office of the Environment and Heritage (OEH) (formerly Department of Environment, Climate Change and Water (DECCW)) are able to provide a wide range of technical advice on control and management strategies. Further information and control strategies for each of the four invasive fauna species observed during site surveys provided in the Biodiversity & Rehabilitation Management Plan. Ongoing pest control is required for five years to maintain target pest fauna populations. A licensed pest removal contractor will be engaged to complete these works.

4.5 ENHANCEMENT OF FAUNA HABITAT AND FAUNA MOVEMENT CORRIDORS

The management and assisted rehabilitation of the offset sites as detailed in the Bush Regeneration Plan will ensure that the long term viability of the identified fauna corridors are enhanced and protected.

Where planting of native species is required species will be selected that:

- emulate vegetation that naturally occurs in the area;
- provide a structurally diverse community (ie comprise tree, shrub and groundcover species);
- provide potential foraging, sheltering and breeding habitat for native fauna, particularly threatened fauna species;
- to ensure that there is no net loss of preferred or core koala habitat in the area and allow for safe koala movement across the landscape incorporate

preferred Koala feed tree species (*Eucalyptus tereticornis* or *Eucalyptus microcorys*);

- maintain and enhance habitat for Glossy-Black Cockatoo by encouraging conditions for Forest Oak feed trees to proliferate in the small tree layer by controlling fire regimes and invasion by native mesic and weed species;

- maintain denning habitat for Squirrel Glider by protecting senescing eucalypts and other hollow bearing trees by managing risks associated with wildfire;

- maintain denning habitat for threatened microbats by protecting trees with fissures and decorticating bark trees by managing risks associated with wildfire; and

- are suitable for local environmental conditions.

Species listed in ***Table 4.1*** occur naturally within the offset (and impact) sites and are recommended for consideration within the revegetation works, subject to availability.

Table 4.1 Recommended Revegetation Species List

Scientific Name	Common Name	Growth Habitat	Planting Method	Notes
Upper Stratum				
Acacia irrorata	Green Wattle	Shrub or tree to 10m	Direct drilling/tubestock	fast growing shade species
Acronychia oblongifolia	Common Acronychia	Shrub or tree to 30m	Tubestock	foraging resource for frugivores (eg birds and bats)
Allocasuarina torulosa	Forest Oak	Tree to 20m	Direct drilling/tubestock	Foraging resources for Glossy-black Cockatoo
Alphitonia excelsa	Red Ash	Small or medium tree to 10m	Tubestock	Foraging resources for frugivores (eg birds and bats)
Corymbia gummifera	Red Bloodwood	Tree to 30m	Direct drilling/tubestock	Foraging habitat; Hallow producing
Eucalyptus microcorys	Tallowwood	Tree to 40m	Direct drilling/tubestock	Koala feed tree
Eucalyptus tereticornis	Forest Red Gum	Tree to 50m	Direct drilling/tubestock	Koala feed tree; Hollow producing;
Glochidion ferdinandi	Cheese Tree	Small or medium tree to 15m	Tubestock	Foraging resources for frugivores (eg birds and bats)
Lophostemon confertus	Brush Box	Tree to 40m	Direct drilling/tubestock	Refuge/foraging habitat
Lophostemon suaveolens	Swamp Turpentine	Tree to 30m	Direct drilling/tubestock	Refuge/foraging habitat
Melaleuca quinquenervia	Broad-leaved Paperbark	Medium tree to 15m	Direct drilling/tubestock	Ideal canopy tree in water-logged soils or wet environments

Scientific Name	Common Name	Growth Habitat	Planting Method	Notes
Melia azedarach	White Cedar	Small or medium tree to 10m	Tubestock	Foraging resources for frugivores (eg birds and bats)
Mid Stratum				
Acacia falcata	-	Shrub or small tree to 5m	Direct drilling/tubestock	Fast growing shade species
Breynia oblongifolia	Coffee Bush	Shrub to 3m	Direct drilling/tubestock	Refuge/foraging habitat
Hibiscus heterophyllus	Native Rosella	Shrub or small tree to 8m	tubestock	Nectar producing
Homalanthus populifolius	Bleeding Heart	Shrub or small tree to 6m	Direct drilling/tubestock	Pioneer species
Indigofera australis	Australian Indigo	Shrub to 3m	Direct drilling/tubestock	Refuge/foraging habitat
Rhodamnia rubescens	Scrub Turpentine	Shrub or tree to 25m	tubestock	Foraging resources for frugivores (eg birds and bats)
Sambucus australasica	Native Elderberry	Shrub to 4m	Direct drilling/tubestock	Refuge/foraging habitat
Trema tomentosa	Native Peach	Shrub or small tree to 6m	Direct drilling/tubestock	Ideal replacement plant for Lantana, provides similar habitat
Groundcover				
Adiantum aethiopicum	Common Maidenhair	Fern	tubestock	Ideal in moist conditions
Centella asiatica	Indian Pennywort	Herb	tubestock	Soil stabilisation
Cymbopogon refractus	Barbed Wire Grass	Grass	Direct drilling/tubestock	Soil stabilisation
Doodia aspera	Prickly Rasp Fern	Fern	tubestock	Ideal in moist situations
Echinopogon ovatus	Forest Hedgehog Grass	Grass	Direct drilling/tubestock	Soil stabilisation
Fimbristylis dichotoma	Common Fringe-sedge	Sedge	tubestock	Ideal in moist situations
Geitonoplesium cymosum	Scrambling Lily	Climber	tubestock	Biodiversity function
Gymnostachys anceps	Settler's Twine	Herb	Direct drilling/tubestock	Soil stabilisation
Imperata cylindrica	Blady Grass	Grass	Direct drilling/tubestock	Soil stabilisation
Lepidosperma laterale	Variable Sword-sedge	Sedge	tubestock	Ideal in moist situations
Lomandra filiformis	Wattle Mat-rush	Tufted herb	Direct drilling/tubestock	Soil stabilisation
Lomandra longifolia	Spiny-headed Mat-rush	Tufted herb	Direct drilling/tubestock	Soil stabilisation
Pratia purpurascens	Whiteroot	Herb	tubestock	Soil stabilisation
Themeda australis	Kangaroo Grass	grass	Direct drilling/tubestock	Soil stabilisation

Source: CEG, 2008 and the Biodiversity & Rehabilitation Management Plan

Planting density depends on the growth form and rate of various species and the nature of the root system. In areas where broad-scale planting is required, seedlings will be planted at a ratio to achieve quick vegetative cover to maximise soil stability and prevent weed invasion. Planting densities may also be increased in areas where there is a high risk of soil erosion (eg on slopes and the edge of waterways).

4.6 FENCING AND STOCK EXCLUSION.

The offset areas will be protected by existing fences that exclude stock from the Blakebrook Quarry and it is not anticipated that a fence will be required along the internal boundaries of the offset area. It is proposed to fence off the external perimeter of the sites and provide signage to indicate the area is being actively managed as a biodiversity offset site. These access restrictions will be maintained throughout the operational life of the quarry, and in perpetuity. The condition of existing fences and gates will be monitored as part of the ongoing monitoring program and failed or damaged fencing or gates to be replaced as soon as practical following detection.

In accordance with the LCC (2013), fences that do not impede safe koala movement and suitable for use at this site include:

- fences where the bottom of the fence is a minimum of 300 mm above the ground to allow koalas (and other native wildlife) to freely move underneath;
- fences that are easy for koalas to climb (e.g. sturdy chain mesh fences not topped by barbed wire, or solid style fences with a timber 'post and bridge' system over the fence at regular intervals of less than 20 metres; or
- open post and rail fences.

Where fencing is proposed, the final design will be also be subject to the adjacent property owners requirements to secure livestock.

4.7 MANAGEMENT OF FIRE.

It is noted that under section 63 of the NSW Rural Fires Act 1997, owners and occupiers of land have a duty to take practicable steps to prevent the occurrence of bushfires on, and to minimise the danger of the spread of bushfires on or from that land. The offset areas are located within bushfire prone land as mapped within the RSF bush fire prone land online mapping tool and the recommendations detailed in this BOS are intended to assist LCC to minimise the physical and environmental impact of fires. Even after these recommendations are implemented a residual bushfire risk will remain.

Fire is a natural and complex process that plays a significant role in maintaining the diversity and abundance of some native animals and plants. It is important to remember that while some species are killed by fire, other species are dependent on fire for reproduction and/or habitat requirements. Fire also opens up the canopy, allowing sunlight to reach the ground. The ash bed left behind after a fire contains nutrients, which encourage seedling growth. Fire may also eliminate insects and fungal diseases which might otherwise slow seedling growth. *Table 4.2* lists those threatened species that have been recorded within the Blakebrook Quarry Project site (and Offset areas), and the species' vulnerability to bushfire.

Table 4.2 Threatened Species and their Vulnerability to Bushfire

Species Name)	Vulnerability to Bushfire	Recommended hazard reduction burning
Arrowhead Vine *(Tinospora tinosporoides)*	Inappropriate fire regimes are a threat to this species.	• Hazard reduction burns to be excluded from the areas of Closed Forest.
Thorny Pea (*Desmodium acanthocladum*)	Inappropriate fire regimes are a threat to this species.	• Hazard reduction burns to be excluded from the areas of Closed Forest.
Glossy Black-Cockatoo (*Calyptorhynchus lathami)*	Bushfires that occur during the nesting season in late summer and autumn can cause nests to be abandoned or destroyed.	• Low intensity fires within the areas of open forest and woodland to be undertaken in a mosaic pattern at no greater than once every 10 years. • Avoid burning areas of regenerating Forest Oak feed trees. • No fire around known roost sites and protect hollows.
Masked Owl (*Tyto novaehollandiae*)	No burning around known nesting sites at any time.	• Low intensity fires within the areas of open forest and woodland to be undertaken in a mosaic pattern at no greater than once every 10 years. • No fire around known roost sites and protect hollows.
Squirrel Glider (*Petaurus norfolcensis*)	High frequency fuel reduction burning can result in loss of hollows. Major wildfire events can impact on fragmented populations. Many of the preferred	• Low intensity fires within the areas of open forest and woodland to be undertaken in a mosaic pattern at no greater than once every 10 years. • No fire around known roost sites and protect hollows.

Species Name)	Vulnerability to Bushfire	Recommended hazard reduction burning
	squirrel glider food plants also require a specific fire regime to enable seeding and reproduction. Optimum habitat suitability generally does not occur until the understorey has been left unburnt for 10 or more years.	• occur in early Autumn (not late winter when females have pouch young). • Be conducted so as to maintain connectivity and glider movement.
Koala (*Phascolarctos cinereus*)	Intense fire that scorches or kills the tree canopy is a key threat to this species. Low intensity fire only.	• Low intensity fires within the areas of open forest and woodland to be undertaken in a mosaic pattern at no greater than once every 10 years.
Grey-headed Flying-fox (*Pteropus poliocephalus*)	Avoid known roost sites.	• Hazard reduction burns to be excluded from the areas of Closed Forest. • Low intensity fires within the areas of open forest and woodland to be undertaken in a mosaic pattern at no greater frequency than once every 10 years. • No fire around known roost sites.
Little Bentwing-bat (*Miniopterus australis*)	Frequent, high intensity fires may cause the degradation of foraging habitats although mobile species such as bats are less likely to be impacted by bushfire as they are able to escape the direct impacts of flame and smoke.	• Low intensity fires within the areas of open forest and woodland to be undertaken in a mosaic pattern at no greater than once every 10 years. • No fire around known roost sites and protect hollows.
Eastern Bentwing-bat (*Miniopterus schreibersii*)		
Eastern False Pipistrelle (*Falsistrellus tasmaniensis*).		
Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions (Lowland Rainforest EEC)	Unlike most other vegetation types in Australia, rainforest is not adapted to fire. Inappropriate fire regimes associated with burning off and hazard reduction pose a threat to the margins of rainforest stands and the entirety of small stands in fragmented landscapes.	• Hazard reduction burns to be excluded from the areas of Closed Forest.

Currently little research exists into the effects of wildfires on bats, however, in NSW (and elsewhere) bats tend to like open environments and are likely to respond positively to the post-fire pulse of productivity driving insect abundance up. In terms of shelter and roost sites, tree hollows do not form within the span of any currently acceptable fire rotation (Irvin et al, 2003). The protection of hollows during any fire hazard reduction activities within the site is vital for the long term protection of hollow dependant fauna, including microchiropteran bats, the Glossy Black-Cockatoo, forest owls and arboreal mammals.

Given the fragmented nature of koala habitat in the Lismore LGA fire is not reported by LCC (2013) as a significant issue, however high-intensity wildfires do pose a threat to koalas, particularly where refuge habitat is not available. High-intensity fires burn the canopy and can cause the death or injury of koalas and a reduction in the availability of foraging habitat (Lunney et al. 2004, as cited in DECC 2008). In addition, fastmoving fires fanned by strong winds reduce the ability of koalas to escape to refuge areas. When preparing for any low intensity hazard reduction burn within the offset area, it is important that the fire planner is aware of the local koala populations. It must also be recognised that if a large scale controlled or prescribed burn is to proceed it is likely to have an impact on individual koalas in that location. However, the habitat of koalas recovers quickly and koalas reoccupy burnt habitat within months – the issue is one of management of koalas not of habitat (D. Lunney, DECC, pers. comm., as cited in DECC 2008).

The key principles and recommendations for bushfire management with the offset sites are:

- any wildfire/bushfire should be extinguished as soon as possible unless a conscious decision is made not to extinguish the fire immediately and resources are available to manage the event to the desired end point (such as to burn safely out to formed containment lines);

- cooperation among land managers/owners and NSW RFS is important for successful bushfire suppression and maintenance of any perimeter fire trails. Unimpeded access in the event of a fire is critical during suppression activities. The RFS must be aware of any locked gates or notified in the event that any key access roads or perimeter tracks are no longer accessible;

- applying fire which varies in frequency, duration, intensity and seasonality will maximise biodiversity. Through a program of appropriately prescribed burns, ecosystem resilience to unplanned fire and other threats can be improved within the offset sites and low intensity fires within the areas of open forest and woodland are to be undertaken in a mosaic pattern at no greater than once every 10 years;

- woody weed control will reduce fire fuel load and therefore risk of fire.

- hazard reduction burns to be excluded from the areas of Closed Forest;

- consideration of alternative means of reducing fuel loads within the offset areas may include intermittent grazing within selected areas of the site to maintain a mosaic of reduced fuel loads;

- post-fire maintenance must include weed control; and

- monitoring the impacts of all fires, whether planned or unplanned, allows land managers to evaluate and modify fire management practices.

4.8 ABORIGINAL HERITAGE VALUES.

The Biodiversity Offset Strategy does not authorise any person to harm, damage or desecrate an Aboriginal Object or Aboriginal Place in, on or under the Offset Areas. An unexpected (chance) finds procedure should be included within the site induction procedures for any locations subject to soil disturbance activities. In the event that site workers identify any potential Aboriginal heritage sites, the unexpected finds procedure outlined within the Blakebrook Quarry Heritage Management Plan (2018) will also apply to the offset areas as follows:

1. STOP WORK IMMEDIATELY. Any person that observes or uncovers potential Aboriginal heritage objects during the works must notify machinery operators immediately. All activities and/or works in the immediate area must cease (DO NOT collect samples to show someone);

2. NOTIFY. Notify the site supervisor immediately. The site supervisor will contact, notify and consult with LCC, OEH and an appropriately qualified heritage professional (archaeologist). Consultation with the LCC Aboriginal Advisory Group and Ngulingah Local Aboriginal Land Council will also be undertaken as required;

3. AVOID DISTURBANCE of the area at and adjacent to the cultural finds;

4. PROTECT THE SITE. Any sand/soils removed must be identified and set aside for assessment. The disturbed area needs to be cordoned off as an exclusion zone so that no further disturbance occurs (include a minimum 10m wide buffer area);

5. ASSESS THE FIND. The archaeologist will investigate the nature; extent and location of the find. If the find is suspected to be Human Remains the site supervisor will contact the Police who may then take control of the site and any further investigation;

6. RECORD/SALVAGE THE FIND. The archaeologist will, in consultation with the site supervisor and OEH, arrange recording of the objects and if required salvage.; and

7. RESUME WORK. Subject to the archaeologist's assessment, work may be able to recommence under the terms once the site is assessed and appropriately salvaged. Alternatively, where possible, work methods or location may be altered to minimise further harm to the find, or objects associated with the find. AHIMS sites cards and/or Aboriginal Site Impact Recording (ASIR) form will be completed and submitted to the AHIMS Registrar as soon as practicable.

5 LONG TERM SECURITY FOR THE OFFSET

An offset area must be legally protected and managed in perpetuity, as the impact of the development is permanent. Offset areas should not be amenable to being offset again in the future. The following options were investigated in consultation with OEH to meet this requirement:

i. Biodiversity Stewardship Agreement under the new Biodiversity Offsets Scheme (noting that this offset strategy has been prepared based on the existing CoA and there is no formal requirement to establish any agreement under the new Biodiversity Conservation Act 2016);

ii. Identification of the land as a Natural Area and/or Council Reserve;

iii. Dedication of the land as Nature Reserve, National Park or State Conservation Area;

iv. Formal Categorisation of the land as Community Council Land (not operational);

v. Rezoning the land to a suitable Environmental Protection Zone; or

vi. Fulfilling the requirement for Community classified Council land and Council Reserves by way of requiring a Plan of Management to be prepared and implemented.

Rezoning the land to a suitable Environmental Protection Zone was selected as the preferred option and confirmed by OEH as a means to 'satisfactorily secure the land for conservation' (see correspondence in *Annex E*).

LCC have commenced the process to rezone the land to E2 Environmental Conservation under the Lismore City Council local environmental plans (LEP). This zone is for areas with high ecological, scientific, cultural or aesthetic values outside national parks and nature reserves. The zone provides the highest level of protection, management and restoration for such lands whilst allowing uses compatible with those values.

The use of the E2 zone is consistent with the Recommendations of the Northern Councils E Zone Review (DPE 2017) as the primary use of the land is considered to be environmental conservation and the land has attributes which meet the criteria for an E2 zone. Based on the above justification LCC are proposing to rezone the offset area to E2 Environmental Conservation through an LEP amendment which is likely to take up to twelve months to complete (as amendments are scheduled annually and require councillor approval).

5.1 RISKS TO SUCCESSFUL IMPLEMENTATION

Risks to the successful implementation of the Biodiversity Offset Strategy are detailed in ***Table 5.1***. In summary, there are minimal risks associated with achieving the biodiversity offsetting objectives because offset land has been acquired and is already being managed for this purpose.

Table 5.1 Risks to the successful implementation of the Biodiversity Offset Strategy

Risk/consideration	Detail	Action/Control
Resource restrictions	Failure to ensure adequate resources are dedicated to implementation of the Biodiversity Offset Strategy	Lismore City Council must ensure adequate resources are available to achieve the Strategy objectives and detailed management actions as outlined within the Blakebrook Quarry Bush Regeneration Plan (Dawson 2018).
Seed and tubestock supply	Seed and tubestock supply can be affected by: - Access to viable seed - Technical issues such as disease or equipment failure - Inability to collect seeds from the site	Seed or tubestock to be sourced from local stock. Certification must be obtained from the nursery. Seedlings will be ordered at least six to twelve months prior to scheduled planting to ensure enough time for seed collection, propagation and hardening-off.
Plant survival rate during establishment and vegetation decline at mature stage	Plant survival in revegetated areas may not be satisfactory due to: - Lack of appropriate maintenance - Poor species selection - Weed invasion - Fire	The progressive approach will allow for rehabilitation methods to be tested and consequently improved to ensure rehabilitation methods are effective. Weed control as outlined in the Blakebrook Quarry Bush Regeneration Plan (Dawson 2018).

5.2 MAINTENANCE AND MONITORING

Maintenance and monitoring are integral components of the rehabilitation process (including assisted regeneration) providing documentation of rehabilitation activities, identifying trends and revealing the need for any improvements to strategies and assessing the success of the rehabilitation (Commonwealth, 2016). The maintenance and monitoring schedule for Offset sites is integrated into the wider schedule for rehabilitation works for the Project. This schedule is provided in Chapter 9 and 11 of the Blakebrook Quarry Biodiversity and Rehabilitation Management Plan.

A suitably qualified and experienced professional will be engaged to carry out ongoing maintenance and monitoring. This will involve activities such as bushland rehabilitation, pest control and weed removal. To minimise disturbance to offset areas, it is proposed to fence off the perimeter of the sites and provide signage to indicate the area is being actively managed as a biodiversity offset site. On-site staff and contractors will be inducted on their responsibilities in relation to avoiding these areas.

Recording of Maintenance Undertaken. All maintenance will be undertaken in accordance with Chapter 9 of the Blakebrook Quarry Biodiversity and Rehabilitation Management Plan and will be recorded in accordance with the requirements of the Blakebrook Quarry EMS.

Reporting Against Performance Criteria. Reporting will detail the effectiveness of the measures outlined in Chapter 6 – Performance Criteria and Indicators of the Blakebrook Quarry Biodiversity and Rehabilitation Management Plan and progress against the performance and completion criteria in Section 9.4 of the Biodiversity and Rehabilitation Management Plan. Relevant performance indicators for each of the management zones are provided in *Annex C* of this BOS. Reporting details are outlined in Section 9.52 and Chapter 13 of the Biodiversity and Rehabilitation Management Plan.

All external reporting required by the CoA or other obligation for Blakebrook Quarry will be approved by the Manager Commercial Services. This includes management and monitoring documentation associated with this BOS.

6 REFERENCES

Biolink. (2016) Koala Population Monitoring (Year 5) Blakebrook Quarry, Lismore LGA.

CEG (2008) Blakebook Quarry: Ecological Site Assessment. Report prepared by Conacher Environmental Group

Dawson (2018) Blakebrook Quarry Bush Regeneration Plan (Lot 201 DP 1227138), Updated to incorporate the 45ha off-site Biodiversity Offset Area. Report being prepared for Lismore City Council.

DECC (2008) **Approved Recovery Plan for the Koala (*Phascolarctos cinerus*)**, Department of Environment and Climate Change

EPA (2017) **Safe and Effective herbicide use. A handbook for near-water applications**. EPA South Australia.

ERM (2018) **Blakebrook Quarry Biodiversity & Rehabilitation Management Plan**. Report prepared by ERM for Lismore City Council (dated 3 August 2018, reference 0436793).

Lismore City Council (2013) **Comprehensive Koala Plan of Management for south-east Lismore**. Lismore City Council, Lismore, NSW.

OEH (2014a) **NSW Biodiversity Offsets Policy for Major Projects**. NSW Government, Office of the Environment and Heritage.

OEH (2014b) **Framework for Biodiversity Assessment**. NSW Government, Office of the Environment and Heritage.

Annex A

Vegetation Communities within Development Footprint (CEG 2008)

TALL OPEN FOREST	
BC Act Status: Not listed	EPBC Act Status: Not Listed
Area available with Project Site: 25.7 ha	Area impacted/requiring offset: 8 ha

Vegetation Formation (Keith 2006)

Structure

- Trees: to 35m high with 45-50% Projected Foliage Cover (PFC)
- Shrubs: to 4m high with 55-60% PFC
- Groundcover: to 1.5m high with variable 40-65% PFC

Location and Distribution

This vegetation community occurs throughout the eastern portion of the site and occupies the majority of the remaining vegetated areas on the plateau.

Variation

There are a number of minor variations within the canopy of this community, particularly in regards to structure and species dominance. One of the more significant variations is the association dominated by Brush Box (*Lophostemon confertus*) and a variety of mesophilic rainforest species in the far southwest of the site. This variation gradually grades into the Closed Forest community that occupies the very steep gullies and slopes.

Disturbance

This community has been disturbed by extensive weed invasion in the shrub and ground layers, a history of rural activities, massive earth movement, numerous vehicle tracks, selective clearing and stockpiles of quarry waste.

Weed Invasion

This community exhibits extensive weed invasion in both the shrub and ground layers. Large areas of Lantana (*Lantana camara*) and to a lesser extent Large-leaved Privet (*Ligustrum lucidum*) dominate the shrub layers, while a variety of exotic herbs and pasture grasses, including Coolatai Grass (*Hyparrhenia hirta*), dominate the ground layer.

Threatened Species Habitat

Glossy Black-Cockatoo (*Calyptorhynchus lathami*)

Masked Owl (*Tyto novaehollandiae*)

Squirrel Glider (*Petaurus norfolcensis*)

Koala (*Phascolarctos cinereus*)

Grey-headed Flying-fox (*Pteropus poliocephalus*)

Black Flying-fox (*Pteropus alecto*)

Little Bentwing-bat (*Miniopterus australis*)

Eastern Bentwing-bat (*Miniopterus schreibersii*)

Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)

TALL OPEN FOREST		
Dominant Species		
Trees		
LAURACEAE	*Cinnamomum camphora**	Camphor Laurel
MYRTACEAE	*Corymbia intermedia*	Pink Bloodwood
MYRTACEAE	*Eucalyptus acmenoides*	White Mahogany
MYRTACEAE	*Eucalyptus microcorys*	Tallowwood
MYRTACEAE	*Lophostemon confertus*	Brush Box
Shrubs		
ASTERACEAE	*Ozothamnus diosmifolius*	White Dogwood
CASUARINACEAE	*Allocasuarina littoralis*	Black She-oak
EUPHORBIACEAE	*Acalypha capillipes*	-
EUPHORBIACEAE	*Macaranga tanarius*	Blush Macaranga
FABACEAE (MIMOSOIDEAE)	*Acacia* spp.	Wattle
VERBENACEAE	*Lantana camara**	Lantana
Groundcover		
BLECHNACEAE	*Doodia aspera*	Prickly Rasp Fern
CONVOLVULACEAE	*Dichondra repens*	Kidney Weed
DENNSTAEDTIACEAE	*Pteridium esculentum*	Bracken
FABACEAE (FABOIDEAE)	*Desmodium* spp.	-
LOMANDRACEAE	*Lomandra* spp.	Mat-rush
LUZURIAGACEAE	*Eustrephus latifolius*	Wombat Berry
LUZURIAGACEAE	*Geitonoplesium cymosum*	Scrambling Lily
POACEAE	*Chloris gayana**	Rhodes Grass
POACEAE	*Eragrostis brownii*	Brown's Lovegrass
POACEAE	*Hyparrhenia hirta**	Coolatai Grass
POACEAE	*Imperata cylindrica*	Blady Grass
POACEAE	*Paspalum dilatatum**	Paspalum
POACEAE	*Themeda australis*	Kangaroo Grass

*denotes introduced species Community description from CEG (2008)

TALL OPEN FOREST/WOODLAND

BC Act Status: Not listed	EPBC Act Status: Not Listed
Area available with Project Site: 9.1 ha	Area impacted/requiring offset: 1.3 ha

Vegetation Formation (Keith 2006)

Structure

- Canopy Trees: to 20-30m high with 25-55% PFC
- Shrubs: to 2m high with variable 5-35% PFC
- Groundcover: to 1.5m high with 75-95% PFC

Location and Distribution

This community occupies a number of small areas associated with impeded drainage in the north, east and south of the site.

Variation

Previous clearing and associated disturbances have led to an altered structure and age class of the canopy within some areas of this community.

Disturbance

This community has been disturbed by extensive weed invasion in the shrub and ground layers, a history of rural activities, massive earth movement, numerous vehicle tracks, selective clearing and stockpiles of quarry waste.

Weed Invasion

This community exhibits extensive weed invasion in both the shrub and ground layers. Large areas of Lantana dominate the limited shrub layer, while a variety of exotic herbs and pasture grasses, including Coolatai Grass, dominate the ground layer.

Threatened Species Habitat

Koala (*Phascolarctos cinereus*)

Glossy Black-Cockatoo (*Calyptorhynchus lathami*)

Masked Owl (*Tyto novaehollandiae*)

Squirrel Glider (*Petaurus norfolcensis*)

Grey-headed Flying-fox (*Pteropus poliocephalus*)

Black Flying-fox (*Pteropus alecto*)

Little Bentwing-bat (*Miniopterus australis*)

Eastern Bentwing-bat (*Miniopterus schreibersii*)

Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)

Dominant Species

Trees

MYRTACEAE	*Angophora subvelutina*	Broad-leaved Apple
MYRTACEAE	*Eucalyptus tereticornis*	Forest Red Gum
MYRTACEAE	*Lophostemon suaveolens*	Swamp Turpentine
MYRTACEAE	*Melaleuca quinquenervia*	Broad-leaved Paperbark

TALL OPEN FOREST/WOODLAND		
Shrubs		
MYRTACEAE	*Callistemon salignus*	Willow Bottlebrush
RHAMNACEAE	*Alphitonia excelsa*	Red Ash
VERBENACEAE	*Lantana camara*	Lantana
Groundcover		
ASTERACEAE	*Ageratina adenophora**	Crofton Weed
POACEAE	*Chloris gayana**	Rhodes Grass
POACEAE	*Hyparrhenia hirta**	Coolatai Grass
POACEAE	*Imperata cylindrica*	Blady Grass
POACEAE	*Paspalum dilatatum**	Paspalum
POACEAE	*Pennisetum alopecuroides*	Swamp Foxtail

*denotes introduced species Community description from CEG (2008)

CLOSED FOREST	
BC Act Status: Endangered	EPBC Act Status: Critically Endangered
Area available with Project Site: 1.9 hectares	Area impacted/requiring offset: None

Vegetation Formation (Keith 2006)

Structure

- Canopy Trees: 15-25m high with 35-65% PFC
- Sub-canopy Trees: 10-15m high with 65-80% PFC
- Shrubs: to 4m high with variable 5-50% PFC
- Groundcover: to 1m high with variable 15-40% PFC

Location and Distribution

This community occurs along the south eastern and western boundaries of the site on the very steep basalt derived slopes. A small regrowth remnant of this community is also located along the southern boundary of the site, associated with a single large Fig tree.

Variation

There are a number of variations within this community associated with topography and wind exposure. Transitional areas adjoining Open Forest communities are dominated by Large-leaved Privet and Lantana. The upper slopes of the eastern remnants contain a high proportion of characteristic dry rainforest species.

Disturbance

The main disturbance to this community has been a result of previous clearing and weed invasion.

Weed Invasion

Weed invasion is moderate to high in the shrub and ground layers of ecotone areas between adjoining communities and low within the core of the eastern remnant portion.

Threatened Species Habitat

Arrowhead Vine (*Tinospora tinosporoides*)

Koala (*Phascolarctos cinereus*)

Grey-headed Flying-fox (*Pteropus poliocephalus*)

Black Flying-fox (*Pteropus alecto*)

Little Bentwing-bat (*Miniopterus australis*)

Eastern Bentwing-bat (*Miniopterus schreibersii*)

Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)

Dominant Species		
Trees		
MORACEAE	*Ficus obliqua*	Small-leaved Fig
MYRTACEAE	*Lophostemon confertus*	Brush Box

CLOSED FOREST		
Sub-canopy Trees		
ARALIACEAE	*Polyscias* spp.	-
EBENACEAE	*Diospyros australis*	Black Plum
PUTRANJIVACEAE	*Drypetes deplanchei*	Yellow Tulipwood
RHAMNACEAE	*Alphitonia excelsa*	Red Ash
SAPINDACEAE	*Guioa semiglauca*	-
STERCULIACEAE	*Brachychiton populneus*	Kurrajong
Shrubs		
APOCYNACEAE	*Alyxia ruscifolia*	Prickly Alyxia
LAURACEAE	*Neolitsea dealbata*	Hairy-leaved Bolly Gum
MALVACEAE	*Hibiscus heterophyllus*	Native Rosella
MORACEAE	*Ficus fraseri*	Sandpaper Fig
MORACEAE	*Streblus brunonianus*	Whalebone Tree
OLEACEAE	*Ligustrum lucidum**	Large-leaved Privet
SAPINDACEAE	*Alectryon tomentosus*	
VERBENACEAE	*Lantana camara**	Lantana
Groundcover		
ADIANTACEAE	*Adiantum hispidulum*	Rough Maidenhair
ARECACEAE	*Calamus muelleri*	Southern Lawyer Cane
ASPLENIACEAE	*Asplenium australasicum*	Bird's Nest Fern
ASTELIACEAE	*Cordyline rubra*	Palm-lily
POACEAE	*Oplismenus imbecillis*	Basket Grass
VITACEAE	*Cissus antarctica*	Water Vine

*denotes introduced species Community description from CEG (2008)

Regrowth Scrub	
BC Act Status: Not listed	EPBC Act Status: Not Listed
Area available with Project Site: 2.1 ha	Area impacted/requiring offset: 0.2 ha

Vegetation Formation (Keith 2006)

Structure

- Shrubs – to 4m high with variable 5-80% PFC
- Groundcover – to 1.5m high with a variable 15-80% PFC

Location and Distribution

This community is scattered throughout disturbed areas of the site.

Variation

There is little variation within this community.

Disturbance

This community has a high level of disturbance resulting from extensive weed invasion, clearing, earth movement, quarrying, stockpiling of quarry material and waste, construction of roads and alterations to the natural drainage.

Weed Invasion

This community exhibits extensive weed invasion in both the shrub and ground layers.

Threatened Species Habitat

Grey-headed Flying-fox (*Pteropus poliocephalus*)

Black Flying-fox (*Pteropus alecto*)

Little Bentwing-bat (*Miniopterus australis*)

Eastern Bentwing-bat (*Miniopterus schreibersii*)

Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)

Dominant Species

Trees

None

Shrubs

EUPHORBIACEAE	*Macaranga tanarius*	Blush Macaranga
FABACEAE (MIMOSOIDEAE)	*Acacia falcata*	-
LAURACEAE	*Cinnamomum camphora**	Camphor Laurel
OLEACEAE	*Ligustrum lucidum**	Large-leaved Privet
VERBENACEAE	*Lantana camara**	Lantana

Groundcover

BLECHNACEAE	*Doodia aspera*	Prickly Rasp Fern
CONVOLVULACEAE	*Dichondra repens*	Kidney Weed
DENNSTAEDTIACEAE	*Pteridium esculentum*	Bracken

Regrowth Scrub		
FABACEAE (FABOIDEAE)	*Desmodium spp*	-
LOMANDRACEAE	*Lomandra* spp.	Mat-rush
LUZURIAGACEAE	*Eustrephus latifolius*	Wombat Berry
LUZURIAGACEAE	*Geitonoplesium cymosum*	Scrambling Lily
BLECHNACEAE	*Doodia aspera*	Prickly Rasp Fern
POACEAE	*Chloris gayana**	Rhodes Grass
POACEAE	*Eragrostis brownii*	Brown's Lovegrass
POACEAE	*Hyparrhenia hirta**	Coolatai Grass
POACEAE	*Imperata cylindrica*	Blady Grass
POACEAE	*Paspalum dilatatum**	Paspalum
POACEAE	*Themeda australis*	Kangaroo Grass

*denotes introduced species Community description from CEG (2008)

DISTURBED GRASSLAND

BC Act Status: Not listed	EPBC Act Status: Not Listed
Area available with Project Site: 21.2 ha	Area impacted/requiring offset: 1.3 ha

Vegetation Formation (Keith 2006)

Cleared

Structure

- Shrubs - to 6m high with 5-15% PFC
- Groundcover – to 1.5m high with variable 40-95% PFC

Location and Distribution

This vegetation community occurs throughout the central and southern portions of the site, associated with areas of high disturbance.

Variation

This community contains a number of considerable variations largely associated with the degree of disturbance. The southern and northern portions of this community are dominated by a dense cover of exotic and native grasses, herbs, and to a lesser extent, shrubs. The central portion of this community associated with the quarry is largely devoid of any vegetation and contains only scattered patches of exotic grasses and herbs. Within the central portion of this community, there are a number of artificial dams and permanent water bodies. These water bodies contain a variety of exotic aquatic and semi-aquatic herbs around their perimeters.

Disturbance

This community has a high level disturbance resulting from extensive weed invasion, clearing, earth movement, quarrying, stockpiling of quarry material and waste, construction of roads and alterations to the natural drainage.

Weed Invasion

This community exhibits extensive weed invasion in both the shrub and ground layers.

Threatened Species Habitat

Little Bentwing-bat (*Miniopterus australis*)

Eastern Bentwing-bat (*Miniopterus schreibersii*)

Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)

Dominant Species

Trees

None

Shrubs

VERBENACEAE	*Lantana camara**	Lantana

Groundcover

BLECHNACEAE	*Doodia aspera*	Prickly Rasp Fern
CONVOLVULACEAE	*Dichondra repens*	Kidney Weed
DENNSTAEDTIACEAE	*Pteridium esculentum*	Bracken
FABACEAE (FABOIDEAE)	*Desmodium* spp.	-

DISTURBED GRASSLAND		
LOMANDRACEAE	*Lomandra* spp.	Mat-rush
LUZURIAGACEAE	*Eustrephus latifolius*	Wombat Berry
LUZURIAGACEAE	*Geitonoplesium cymosum*	Scrambling Lily
POACEAE	*Chloris gayana**	Rhodes Grass
POACEAE	*Eragrostis brownii*	Brown's Lovegrass
POACEAE	*Hyparrhenia hirta**	Coolatai Grass
POACEAE	*Imperata cylindrica*	Blady Grass
POACEAE	*Paspalum dilatatum**	Paspalum
POACEAE	*Themeda australis*	Kangaroo Grass

*denotes introduced species Community description from CEG (2008)

Annex B

Blakebrook Quarry Bush Regeneration Plan (Lot 201 DP 1227138) (Dawson 2018)

Blakebrook Quarry Bush Regeneration Plan (Lot 201 DP 1227138)

Version 4 final

Updated to incorporate the 45ha off-site Biodiversity Offset Area

Prepared by:

Fiona Dawson
BEnvSc (SCU); BCom (AKU); CLM Cert 3&4
Friends of the Koala (Honorary Life Membership)
Under contract to Lismore City Council, Sep 2018

Lismore City Council acknowledges the people of the Bundjalung nation, traditional custodians of the land on which we work.

Prepared by Fiona Dawson under contract for Lismore City Council

Contents

Introduction

This operational Bush Regeneration Plan (BRP) updates the 2012 BRP, Annex E of the Blakebrook Quarry Biodiversity & Rehabilitation Management Plan (BRMP) (ERM, 2018a) by incorporating an additional 45ha of land acquired as an off-site Biodiversity Offset Strategy in January 2017 (Fig.1). Blakebrook Quarry is now located on Lot 201 DP 1227138, Parish of Blakebrook, County of Rous.

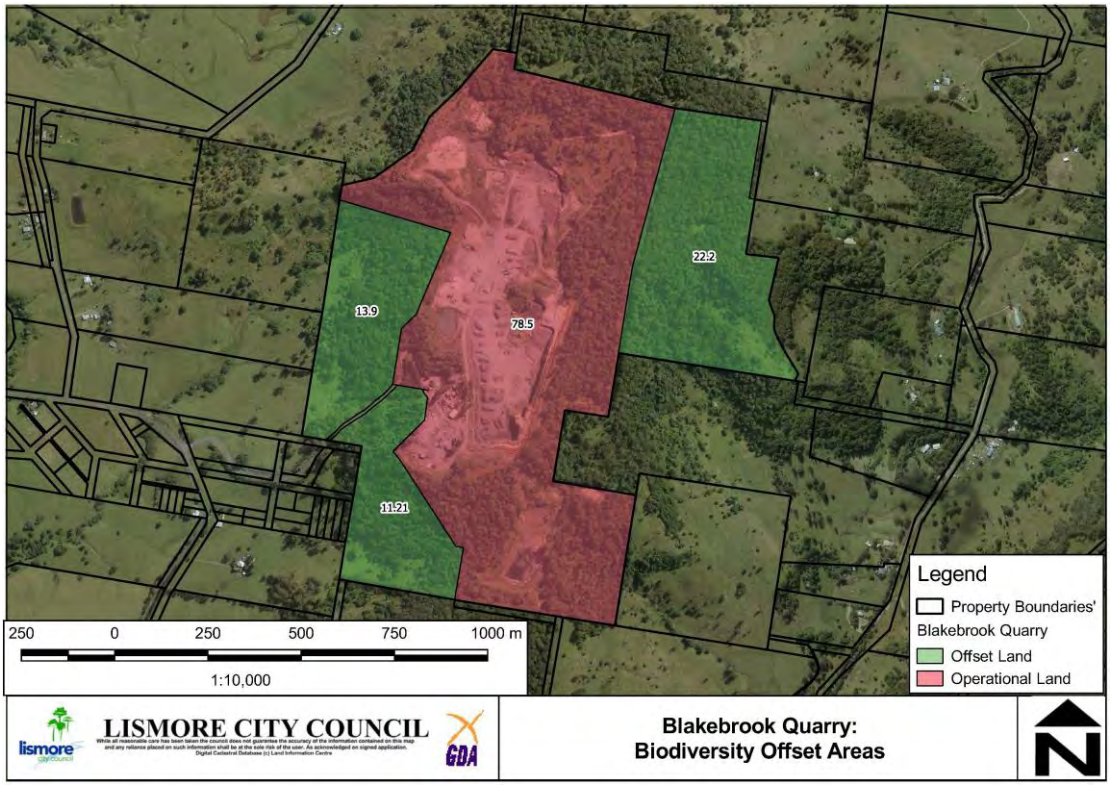


Figure 1 Map of off-site offset (45ha) acquisitions indicated in green (source: Lismore City Council, Sep 2018)

Strategy and Overview Map

This BRP should be read in conjunction with the BRMP (ERM, 2018a) and the Biodiversity Offset Strategy (BOS) (ERM, 2018b). This BRP was prepared by referring to relevant documents encompassed within the BRMP including the Koala Plan of Management (CEG,2006) and Ecological Site Assessment (in particular the Vegetation Community Descriptions) (CEG,2008).

As with the original BRP, this document is intended to guide Council staff and contractors undertaking on-ground bush regeneration works and is subject to the overarching strategy encompassed within the BRMP and BOS, the objective of which is to develop a relatively weed free, functional ecosystem which maintains and enhances fauna populations (ERM, 2018a, 2018b). Relatively weed free has been interpreted as <5% exotics remaining in all strata within the Action Plans and performance indicators for on-ground works, unless there is justification for reducing this target, such as in low priority zones.

Ecological restoration is the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed (SERA, 2017) and includes the following relevant best practice principles:

- The use of work zones to ensure prioritised, comprehensive and systematic weed control (CBRS,2012). The area divided into work zones is 79.4ha comprising 34.4ha on-site and 45ha off-site. Work zones have been grouped into South, West, East and North for logistical and mapping purposes, with each zone prefixed by location (w1 for West block zone 1 etc). The 19 zones are as follows:

Zones in off-site area	Area (ha)
e 1	7.8
e 2	3.5
e 3	8
e 4	1.7
s 1	5.7
s 2	2.4
w 1	2.3
w 2	5.4
w 3	6.5
w 4	1.7
subtotal	45
Zones in on-site area	
e 5 (formerly zone 7,8,9)	10.4
n 1 (formerly zone 3)	1
n 2 (formerly zone 4,5)	2
n 3 (formerly zone 6,19)	2.9
w 5 (formerly zone 2)	3
w 6 (formerly zone 1,18)	1.4
s 3 (formerly zone 13,15,16,17)	5
s 4 (formerly zone 11,14,12)	7.3
s 5 (formerly zone 10)	1.4
subtotal	34.4
Total	79.4

Management classes for costing of each zone are based on weed severity classes defined in Appendix 4 of the Lismore City Council Urban Green Corridors Plan (2017) and prioritised according to proximity to completed or currently worked zones, presence of koala habitat, value for money and presence of threatened species/endangered ecological communities - see Indicative Costing.

- The use of assisted natural regeneration as the preferred approach where the site exhibits sufficient in-situ resilience (native seed bank in the soil or on-site flora) or migratory resilience (wind, birds etc). Revegetation may be required where the seed bank has been depleted and/or genetic diversity requires supplementation (SERA, 2017).

- Effective weed control which requires long-term management based on a coordinated and consistent approach (Lismore City Council, 2015). Responsibility for post implementation maintenance by the management body is assumed to prevent the site regressing into a degraded state in the future (SERA, 2017). Weed control includes an awareness that weeds may provide valuable habitat or food for some fauna (for example, small birds such as wren species use thickets of lantana for cover). To avoid adversely affecting fauna, the removal of weed species can be buffered by matching ongoing weed control and restoration with the germination and growth of native plants (CBRS,2012). Staged weed control may also assist where erosion is a problem, for example, by avoiding the removal of exotic trees from a bank with little or no native vegetation until native vegetation is established (CBRS,2012b).

- The use of professional bush regenerators with knowledge of best practise weed control as detailed in the Subtropical Rainforest Restoration Manual (Big Scrub Landcare) and SE Qld Ecological Restoration Framework. Weed control timing details are not included in the Action Plans as it is assumed that professional bush regenerators plan work days in accordance with weather, seasons and specific weed requirements. Misidentification of Threatened Species can have legal as well as

environmental damage consequences thus a NPWS s132C licence may be required for undertaking weed control in threatened species habitat. Bush regenerators should refer to the Checklist in Appendix 1. Appropriate qualifications, chemical card, white card, insurances, completion of Daily Work Records and the use of herbicides registered for use in and around waterways is also assumed (BSRLCG, 2005).

- Koala focus: - this Plan has been prepared with a focus on koala habitat. The rehabilitation and protection of vegetation within the site is expected to result in the long-term viability of the local koala population (CEG,2006). The final Koala Monitoring Report recommends prioritising areas that support koala food trees and which can be expanded with plantings, in addition to ongoing monitoring of koala sightings by quarry staff and a formal biennial sampling program (Biolink, 2016). Koala habitat at Blakebrook Quarry corresponds with the Tall Open Forest, Tall Open Forest/Woodland communities (CEG,2006) as described in Annex B of the BRMP (ERM, 2018a). It is expected that the removal of woody weeds on site will reduce the risk of fire, which although required to prevent ongoing biodiversity loss (Baker & Catterall, 2015), is also a factor associated with the decline of the koala and is listed as a threatening process (McAlpine et al., 2015). The removal of some natives, particularly rainforest pioneers, will be undertaken as part of the bush regeneration activities to preserve Open Forest/Woodland species such as grasses and eucalypts. Eucalypt germination rates should increase following the removal of excess shade created by lack of fire and subsequent rainforest tree recruitment.
- Monitoring – refer to the Blakebrook Quarry Bush Regeneration Plan Monitoring Addendum.

An overview map of the work zones follows in Figure 2.

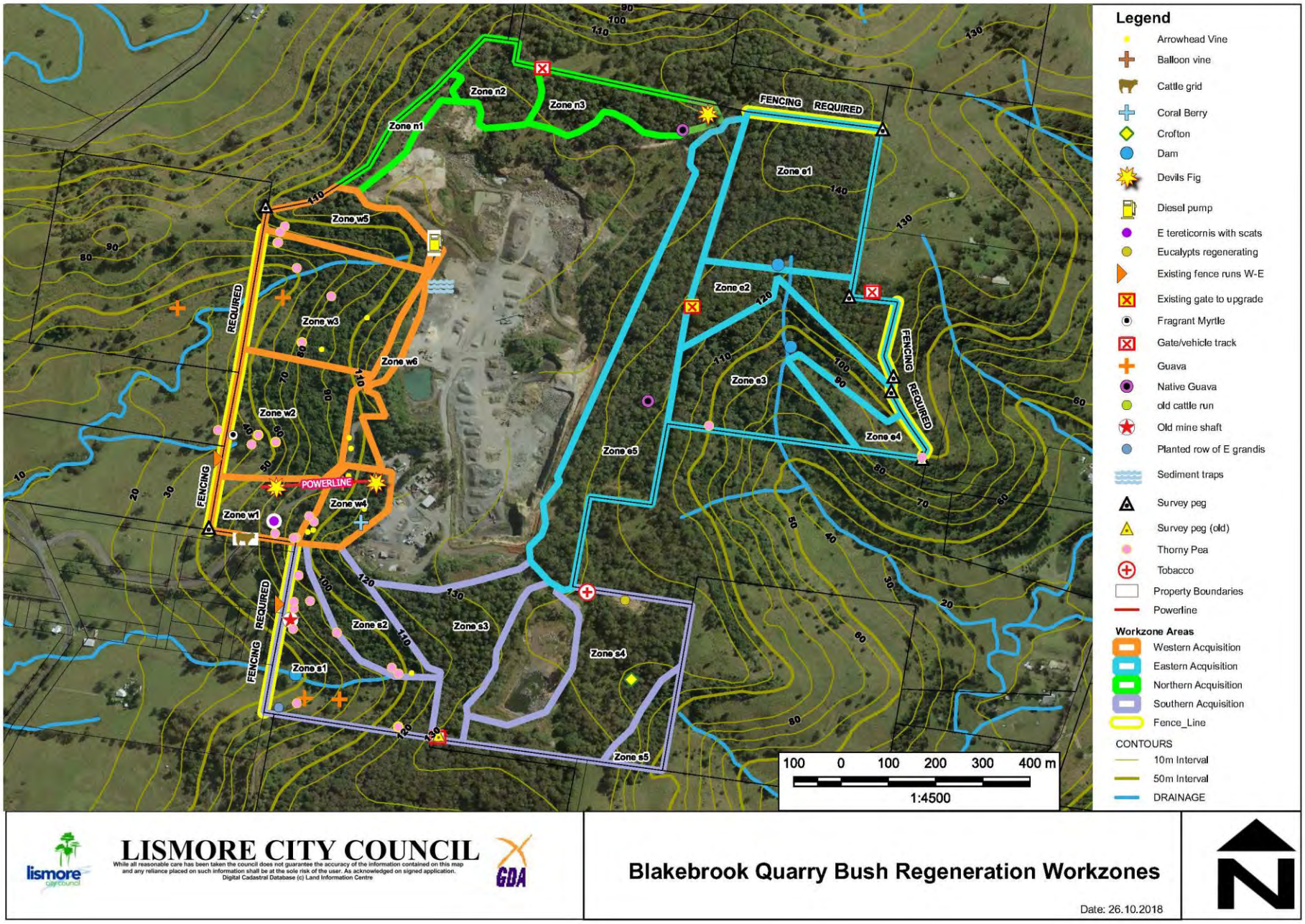


Figure 2 Overview map of combined off-site (45ha) and on-site (34.4ha) offset work zones (source: Lismore City Council)

Indicative Costing and Work zone Maps

A summary of prioritized work zones and indicative costs over a 10 and 20-year period follows in Table 1 which is based on the following assumptions:

- Table 1 costings are based on Appendix 4 of the Lismore City Council Urban Green Corridors Plan (2017) (see Appendix 2) which is related to the weed severity in each zone. This provides a $/ha cost for primary and follow-up work. Maintenance is an additional cost also sourced from Appendix 2 and is based on the relevant number of years following the commencement of the zone. Maintenance is required on an ongoing basis to prevent regression of the site (SERA, 2017) and has been reduced to 50% of the cost in Appendix 4 to better reflect actual site conditions.

- It is assumed that within year 1 to 10, the high and medium priority zones are restored with priority based primarily on presence of koala habitat, proximity to completed or currently worked zones, value for money and presence of threatened species or endangered ecological communities. The remaining zones are generally not classified as koala habitat and assumed to be treated in year 11 to 20. Based on these criteria, the zones in year 1 to 10 are recommended to be treated in the following order:

Zone	Priority criteria *CKH (Core Koala Habitat), TS (Threatened Species), EEC (Endangered Ecological Community)*
n3, e5	Completed or current CKH work zone
n2	CKH, proximity to treated zones will minimise future maintenance costs
w4	prevent dispersal of exotic vines, TS, EEC, highly visible
e1, e2	CKH, proximity to treated zones will minimise future maintenance costs
s3, s4	CKH, reduced cost as fencing already installed
w1, s1	CKH, fencing required, TS

- Costs are estimates only and are based on council supplied figures. Fencing costs are $16/m supplied and installed plus gate $120. Labour costs are $45/hr and include materials and monitoring costs. Table 1 includes an additional allowance for CPI increases over year 1 to 10 of 10% and year 11 to 20 of 20%. Resourcing will be subject to budget allocation by Council as part of the annual operational budget cycle.

- In line with the Biodiversity & Rehabilitation Management Plan Review (ERM, 2018a), a review of the status of the site after 10 years is assumed, including a review of labour costs.

- Total area is 79.4ha comprising on-site zones (34.4ha) and off-site zones (45ha).

Table 1 Prioritised work zones indicative costing over 10 years (year 1 to 10) and 20 years (year 11 to 20)

P (primary), FU (follow-up), C (current or completed), H (high), M (medium), L (low), ANR (assisted natural regeneration), Reveg (planting), M (maintain)
CKH (core koala habitat), DG (disturbed grassland), CF (closed forest)

Offset	Zone	Veg	Priority	Mgt Class	Strategy	Completed (excl maint.)	To Do (pre maint.)	Start year	$/ha pre maint. (P/FU)	Area (ha)	$/zone pre maint. (P/FU)	Fencing	Total $ pre maint.	Maint # years	Maint. $ (10 years)	Total $ Zone (10 years)	Note
Completed/current, high and medium priority zones year 1 to 10																	
Onsite	n3	CKH	C	-	ANR	P, FU	-		$ -	2.9	$ -		$ -	10	$ 15,660	$ 15,660	
Onsite	e5	CKH	C	Mod	ANR	60% P, FU	-		$ -	6.2	$ -		$ -	10	$ 33,696	$ 33,696	
Onsite	e5	CKH	C	Mod	ANR		40% P, FU	1	$ 14,040	4.2	$ 58,406		$ 58,406	9	$ 20,218	$ 78,624	
Onsite	n2	CKH	H	Mod	ANR		P, FU	2	$ 14,040	2.0	$ 28,080		$ 28,080	8	$ 8,640	$ 36,720	
Offsite	w4	DG/CF	H	High	ANR		P, FU	2	$ 28,080	1.7	$ 47,736		$ 47,736	8	$ 7,344	$ 55,080	
Offsite	e1	CKH	H	Low	ANR		P, FU	3	$ 5,400	7.8	$ 42,120	$ 3,320	$ 45,440	7	$ 29,484	$ 74,924	200m fencing/gate
Offsite	e2	CKH	H	Mod	ANR		P, FU	5	$ 14,040	3.5	$ 49,140	$ 5,720	$ 54,860	5	$ 9,450	$ 64,310	350m fencing/gate
Onsite	s3	CKH	H	Low	ANR		P, FU	6	$ 5,400	5.0	$ 27,000		$ 27,000	4	$ 10,800	$ 37,800	
Onsite	s4	CKH	H	Mod	ANR		P, FU	6	$ 14,040	7.3	$ 102,492		$ 102,492	3	$ 11,826	$ 114,318	
Offsite	w1	CKH	M	Mod	ANR		P, FU	8	$ 14,040	2.3	$ 32,292	$ 2,520	$ 34,812	2	$ 2,484	$ 37,296	150m fencing/gate
Offsite	s1	CKH	M	Mod	ANR		P, FU	9	$ 14,040	5.7	$ 80,028	$ 6,136	$ 86,164	0	$ -	$ 86,164	360m fencing/gate/mine shaft
	CPI increase 10% over years 1 to 10															$ 63,459	
	Monitoring costs																incl.within regen costs
Total High and Medium priority zones									$ 123,120	48.6	$ 467,294	$17,696	$ 484,990		$ 149,602	$ 698,051	
Total pa																$ 69,805	
Regen budget (total costs less fencing)																$ 680,355	
Regen budget pa																$ 68,036	
Crew of 4 @ $47/per hr x 45 visits pa																*$ 67,680*	
Crew of 4 @ $50/per hr x 42 visits pa																*$ 67,200*	

Offset	Zone	Veg	Priority	Mgt Class	Strategy	Completed (excl maint.)	To Do (pre maint.)	Start year	$/ha pre maint. (P/FU)	Area (ha)	$/zone pre maint. (P/FU)	Fencing	Total $ pre maint.	Maint # years	Maint. $ (10 years)	Total $ Zone (10 years)	Note
Low priority zones year 11 to 20 (subject to 10 year review)																	
Year 1 to 10 zones maintenance										48.6				10	$ 262,440	$ 262,440	
Onsite	n1	DG	L	Low	ANR		P, FU	11	$ 5,400	1.0	$ 5,400		$ 5,400	9	$ 4,860	$ 10,260	
Offsite	e4	DG	L	Low	ANR		P, FU	11	$ 5,400	1.7	$ 9,180		$ 9,180	9	$ 8,262	$ 17,442	includes planting maintenance
Offsite	e4	DG	L	n/a	Reveg		planting (1ha)	11	$ 1,500		$ 1,500		$ 1,500	9	$ -	$ 1,500	100 x $15 per tree
Offsite	e3	CF	L	Mod	ANR		P, FU	12	$ 14,040	8.0	$ 112,320		$ 112,320	8	$ 34,560	$ 146,880	
Onsite	w6	Reveg	L	Mod	M		P, FU	14	$ 14,040	1.4	$ 19,656		$ 19,656	6	$ 4,536	$ 24,192	
Offsite	s2	CF	L	Mod	ANR		P, FU	14	$ 14,040	2.4	$ 33,696		$ 33,696	6	$ 7,776	$ 41,472	
Offsite	w2	CF	L	High	ANR		P, FU	15	$ 28,080	5.4	$ 151,632	$ 3,880	$ 155,512	5	$ 14,580	$ 170,092	235m fencing/gate
Offsite	w3	CF	L	High	ANR		P, FU	16	$ 28,080	6.5	$ 182,520	$ 5,160	$ 187,680	4	$ 14,040	$ 201,720	315m fencing/gate
Onsite	w5	CF	L	High	ANR		P, FU	18	$ 28,080	3.0	$ 84,240		$ 84,240	2	$ 3,240	$ 87,480	
Onsite	s5	CF	L	Low	ANR		P, FU	19	$ 5,400	1.4	$ 7,560		$ 7,560	1	$ 756	$ 8,316	
	CPI increase 20% over years 11 to 20															$ 194,359	
	Monitoring costs																incl.within regen costs
Total Low priority zones									$ 144,060	79.4	$ 607,704	$ 9,040	$ 616,744		$ 355,050	$ 1,166,153	
Total all zones									$ 267,180	128.0	$ 1,074,998	$ 26,736	$ 1,101,734		$ 502,222	$ 1,861,531	

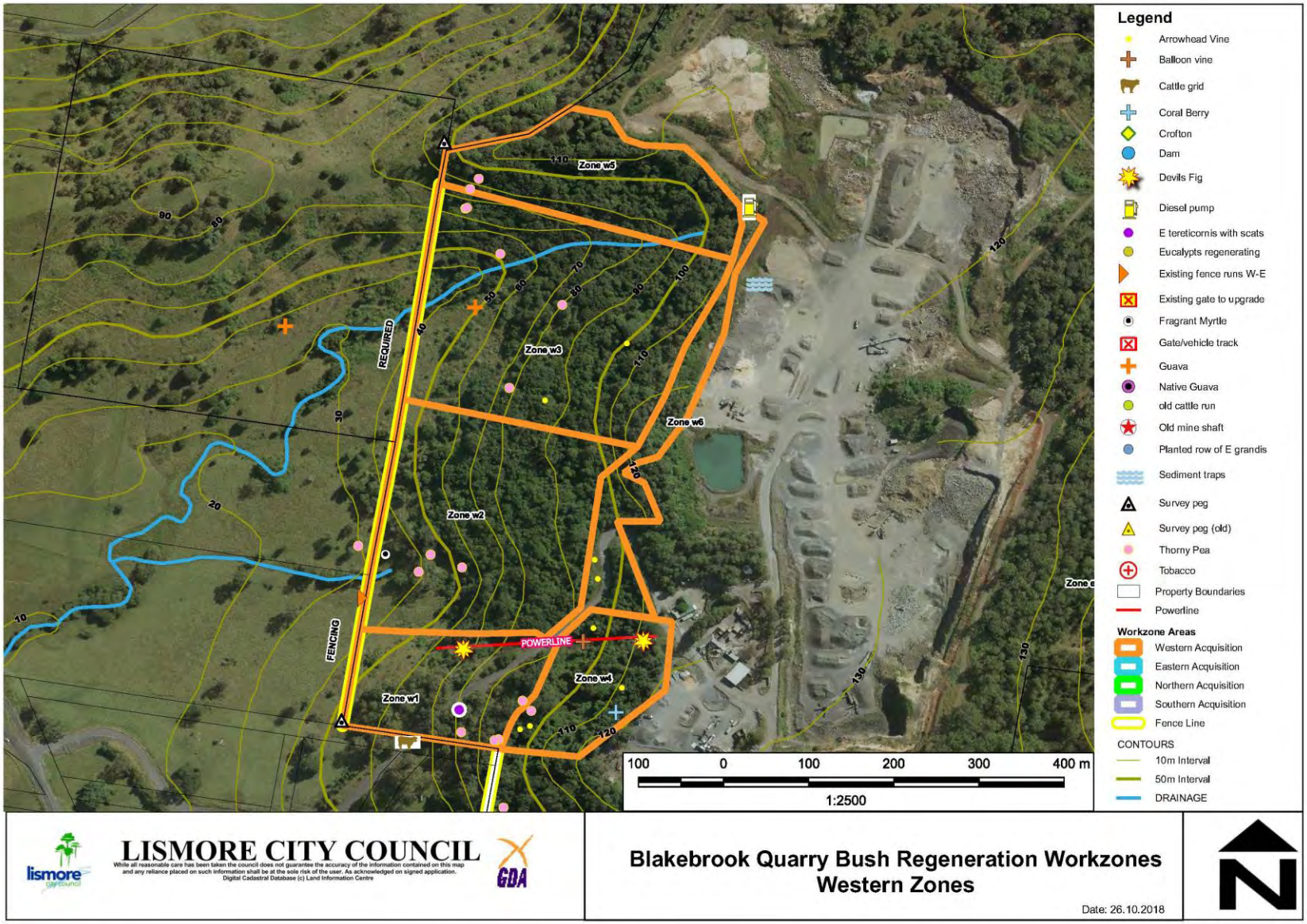


Figure 3 Map of combined off-site and on-site offset western work zones (source: Lismore City Council)

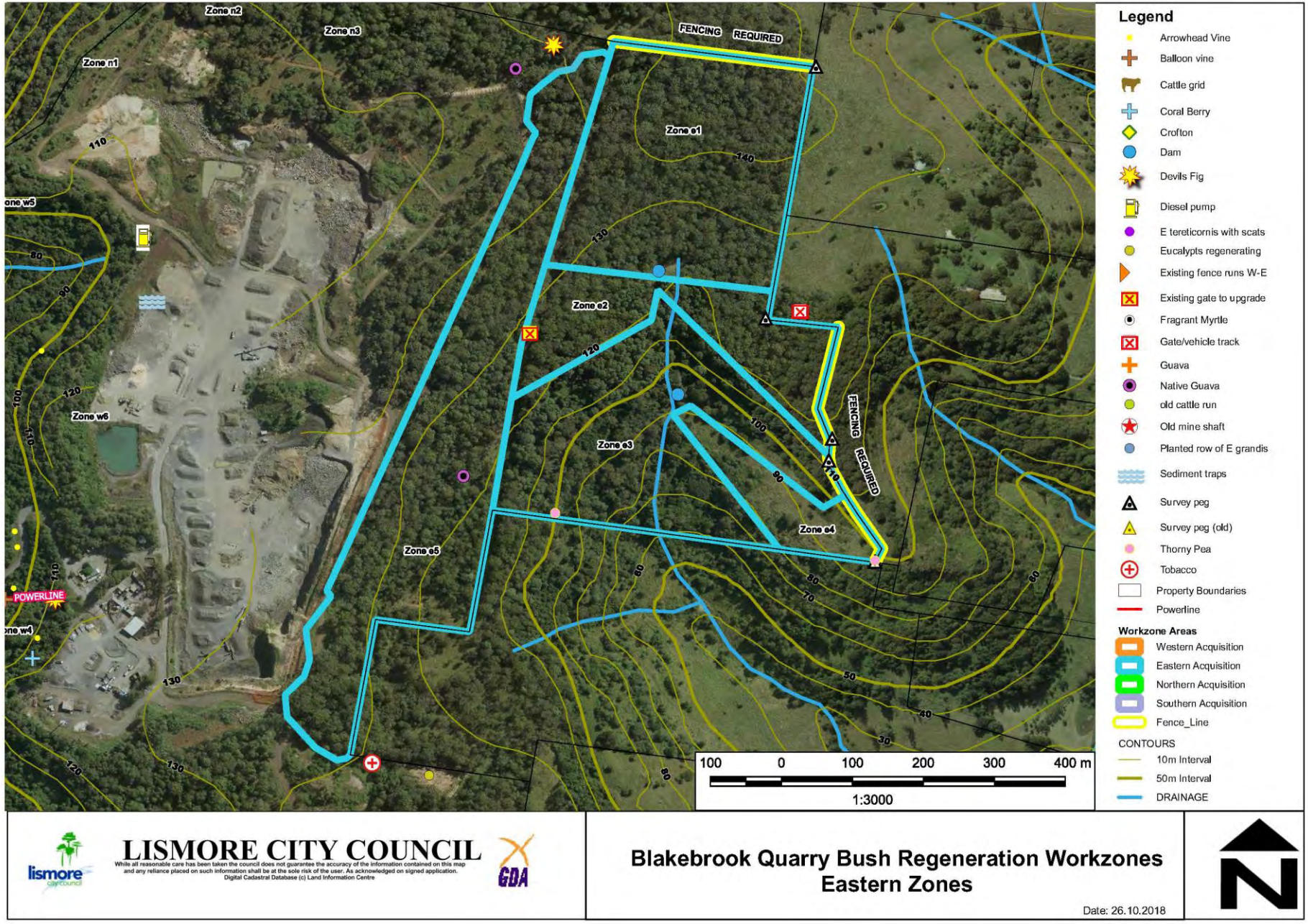


Figure 4 Map of combined off-site and on-site offset eastern work zones (source: Lismore City Council)

Figure 5 Map of combined off-site and on-site offset southern work zones (source: Lismore City Council)

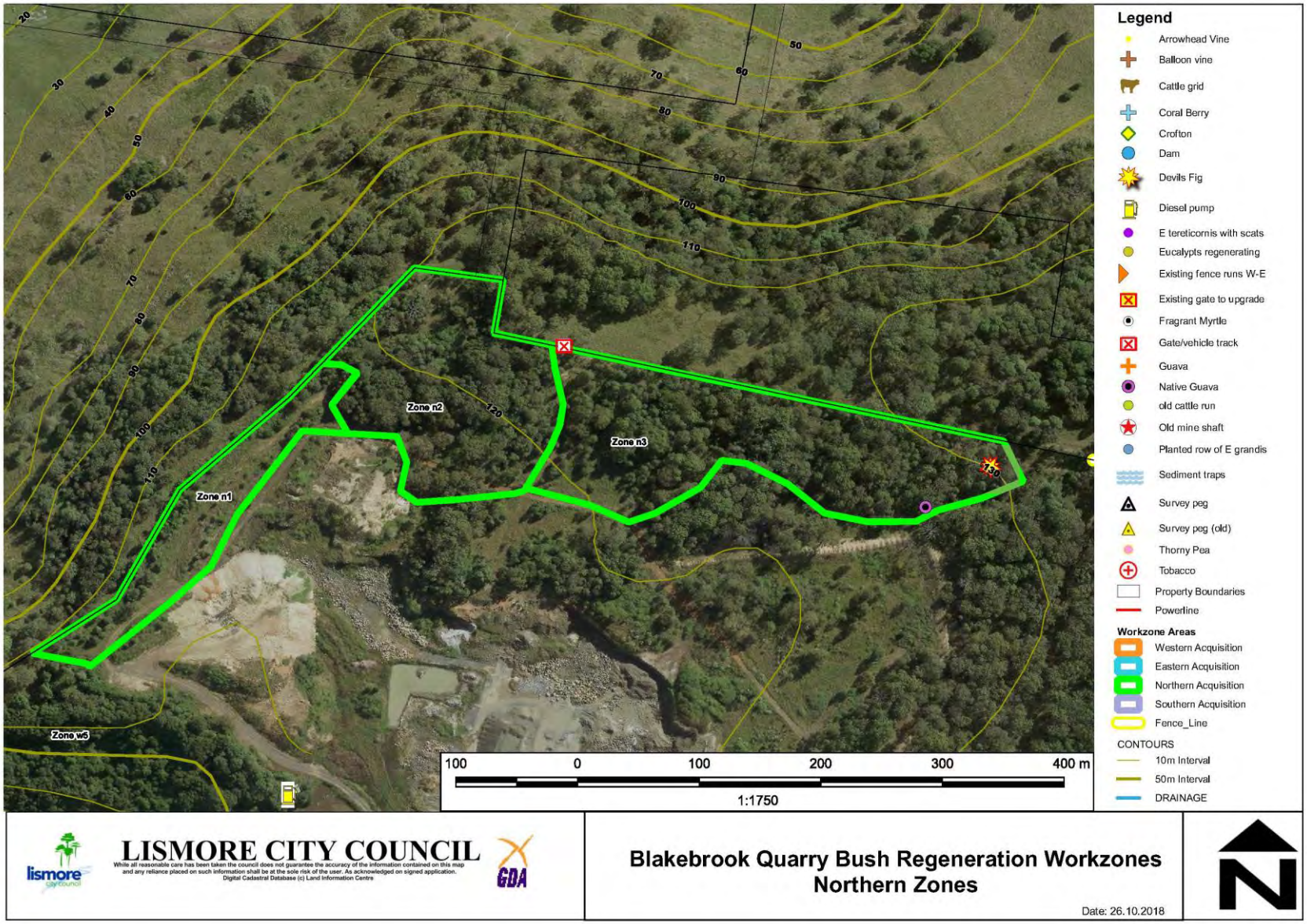


Figure 6 Map of combined off-site and on-site offset northern work zones (source: Lismore City Council)

Off-site: Work Zones and Action Plans (45ha)

Zone e1

Tall Open Forest, Core Koala Habitat, good condition, excellent access, connectivity

Location northern half of eastern acquisition above dam 1	**Topography** flat-gentle slope	
Aspect SW (western portion), E (eastern portion)	**Elevation** 145m – 150m	**Area** 7.8ha

Description	Tall Open Forest as described in the Blakebrook Quarry Ecological Site Assessment and considered Core Koala Habitat (CEG,2008). Also known as Wet Sclerophyll Forest (Keith, 2006). Contains primary koala food tree species Tallowwood (*E. microcorys*) and secondary food tree species White Mahogany (*E. acmenoides*), Blackbutt (*E. pilularis*), Brush Box (*Lophostemon confertus*) and Swamp Box (*L. suaveolens*) (FoK,n.d.).	
Upper stratum	Exotics	N/a
	Natives	Dominated by 30m tall eucalypts Tallowwood, White Mahogany, Blackbutt, Pink Bloodwood (*Corymbia intermedia*) and Brush Box. Cabbage Gum (*E. amplifolia*) is scattered throughout.
Mid stratum	Exotics	20% woody weeds dominated by scattered clumps of Lantana (*Lantana camara*), Large-leaf Privet (*Ligustrum lucidum*) and Camphor Laurel (*Cinnamomum camphora*) with minor amounts of Devil's Fig (*Solanum torvum*), Tobacco (*Solanum mauritianum*) and White Passionflower Vine (*Passiflora subpeltata*).
	Natives	Sweet Pittosporum (*Pittosporum undulatum*), Mock-olive (*Notelaea longifolia*), Red Kamala (*Mallotus philippensis*), Sally Wattle (*Acacia melanoxylon*), Red Ash (*Alphitonia excelsa*), Celery Wood (*Polyscias elegans*), White Aspen (*Acronychia oblongifolia*), Prickly Alyxia (*Alyxia ruscifolia*), Black Plum (*Diospyros australis*), Hairy Psychotria (*Psychotria loniceroides*), Forest Oak (*Allocasuarina torulosa*).
Ground stratum	Exotics	5-20% Lantana, Mistflower (*Ageratina riparia*), Paspalum (*Paspalum dilatatum*).
	Natives	Mat Rush (*Lomandra multiflora*), Blady Grass (*Imperata cylindrica*), Kangaroo Grass (*Themeda triandra*), Basket Grass (*Oplismenus* spp.), A Burrgrass (*Cenchrus robustus*), Brisbane Lily (*Proiphys cunninghamii*), Pink Hyacinth Orchid (*Dipodium punctatum*), Cockspur Flower (*Plectranthus parviflorus*), Rough Maidenhair Fern (*Adiantum hispidulum*), Prickly Rasp Fern (*Doodia aspera*), Dianella (*Dianella caerulea*), Settlers Flax (*Gymnostachys anceps***)**.

Access Excellent - an existing gate (requires replacement due to dilapidation) on the western boundary provides vehicle access to an inner perimeter track adjacent to the western, northern and eastern boundary. This perimeter track is 20-50m in width and has been well maintained by the previous owner.

Condition and costing The overall condition of this zone is good with an average of 20% weeds in the mid stratum, 5-20% in the ground stratum with no major infestations. The appropriate management class for costing as described in the Lismore City Council Urban Green Corridors Plan 2017 Appendix 4 is Low.

Fencing The western and eastern boundary is fenced. Installation of fencing (and gate for return of stray cattle/firefighting) on the northern boundary is required to exclude cattle (approx. 200m) which compact the soil and prevent natural regeneration of natives (CBRS,2012). This should be timed to occur just prior to regeneration works commencing as the cattle currently present will assist in preventing weed growth until works commence. Minor amounts of scattered Lantana north of this new fencing on the northern

boundary could be eliminated whilst working in this zone to prevent reinfestation of the site in future. The southern boundary is an arbitrary line through the dam.

Zone e1 Tall Open Forest with Eucalypt canopy, mid stratum of 20% exotics (scattered clumps of Lantana, Privet, Camphor) and ground stratum of Blady Grass with 5-20% exotics.

Strategy This area of Core Koala Habitat is a High priority. Zone e1 is in good condition, has excellent access and is located within a generally weed free landscape with potential connectivity to the east (CEG2006). Zone e1 is adjacent to zones which have been or are currently being regenerated (i.e. the northern and eastern Zones n3 and e5). Significant weed control cost savings can be achieved by commencing work asap. This will avoid the additional resources which will be required when maintenance by the previous owner ceases. Long-term maintenance costs should be minimal as potential for weed reinfestation from upslope and adjacent areas is low.

The objective is to enhance koala habitat via assisted natural regeneration by removing the weed canopy which prevents germination of koala food trees (Keith, 2006) and hinders access by koalas. Removal of targeted rainforest pioneers adjacent to eucalypts will improve light levels and eucalypt recruitment rates.

Action Plan Zone e1 (Assisted Natural Regeneration) Priority: High

Value	Objective	Performance Indicator	Actions	Area	Class & Indicative Cost/ha
Core Koala Habitat	Enhance koala habitat by removing weeds in mid and ground stratum which prevent germination of natives, particularly Eucalypts	All strata 95% natives, Eucalypt species germinating	• Establish monitoring photo points • Weed control (working in lines from west to east in a southerly direction): Primary: clear around natives, hand weed/cut & paint/overspray Lantana, cut & paint/drill Privet & Camphor, cut & paint/drill or spot spray Devil's Fig, Tobacco & exotic vines. Spot spray Mistflower & Paspalum but ensure fringing native vegetation around dam is encouraged to prevent cane toad access. Follow up: spot spray as required/to prevent seeding. Remove rainforest pioneers in patches/adjacent to eucalypts to improve eucalypt recruitment. • Monitor annually after primary weed control commences *Other actions required:* o Replace existing gate on western boundary for improved access o Install fencing and gate on northern boundary to exclude cattle (approx. 200m) just prior to commencement of work with wildlife friendly fencing o Control minor scattered Lantana north of new fence as gesture of good will or liaise with landowner to ensure controlled o Resolve adjoining landowner (Birney) cattle water access needs	7.8ha	$5,400/ha Low cost category

Zone e2

Tall Open Forest, Core Koala Habitat, poor condition, partial vehicle access

Location flat areas of eastern acquisition below Dam 1	**Topography** flat-gentle slope	**Area** 3.5ha
Aspect SE	**Elevation** 125-145m	

Description	Tall Open Forest as described in the Blakebrook Quarry Ecological Site Assessment and classified as Core Koala Habitat (CEG,2008). Also known as Wet Sclerophyll Forest (Keith, 2006). Contains primary koala food tree species Tallowwood (*E. microcorys*) and secondary food tree species White Mahogany (*E. acmenoides*), Blackbutt (*E. pilularis*), Brush Box (*Lophostemon confertus*) and Swamp Box (*L. suaveolens*) (FoK,n.d.). Larger trees than Zone e1, some hollow-bearing.	
Upper stratum	Exotics	N/a
	Natives	Dominated by 40m tall eucalypts Tallowwood, White Mahogany, Blackbutt, Pink Bloodwood (*Corymbia intermedia*) and Brush Box. Cabbage Gum (*E. amplifolia*) is scattered throughout.
Mid stratum	Exotics	50% woody weeds dominated by Lantana (*Lantana camara*) particularly on the eastern side, Large-leaf Privet (*Ligustrum lucidum*), Tobacco (*Solanum mauritianum*) and Camphor Laurel (*Cinnamomum camphora*).
	Natives	Guioa (*Guioa semiglauca*), Prickly Alyxia (*Alyxia ruscifolia*), Small-leaved Tuckeroo (*Cupaniopsis parvifolia*), Hairy Alectryon (*Alectryon tomentosus),* Black Plum (*Diospyros australis*), Red Kamala (*Mallotus philippensis*), Muttonwood (*Myrsine variabilis*), Cockspur Thorn (*Maclura cochinchinensis*).
Ground stratum	Exotics	>50% Lantana, Paspalum (*Paspalum dilatatum*).
	Natives	Mat Rush (*Lomandra multiflora*), Blady Grass (*Imperata cylindrica*), Kangaroo Grass (*Themeda triandra*), Basket Grass (*Oplismenus* spp.), A Burrgrass (*Cenchrus robustus*), Brisbane Lily (*Proiphys cunninghamii*), Pink Hyacinth Orchid (*Dipodium punctatum*), Cockspur Flower (*Plectranthus parviflorus*), Rough Maidenhair Fern (*Adiantum hispidulum*), Prickly Rasp Fern (*Doodia aspera*), Dianella (*Dianella caerulea*), Settlers Flax (*Gymnostachys anceps***)**.

Access Good. From the existing gate on the western boundary (to be replaced due to dilapidation), a track provides vehicle access to the dam and foot access to the rest of the zone east and south of the dam. On the eastern boundary is a vehicle track excluded from the acquisition as indicated by survey pegs, with access via neighbour (Stassi, 365 Booerie Creek Rd) granted if pre-arranged. This track becomes a rocky path along the top of a steep spur and ends in an open patch of Rhodes Grass above Zone e4.

Condition and costing Zone e2 is older than Zone e1 with larger eucalypts and hollows and is therefore higher quality habitat for fauna including koalas which prefer larger trees (Biolink, 2011). However, it also contains significantly more exotics particularly on the eastern side, with an average of 50% weeds in the mid and ground stratum dominated by Lantana. The inner perimeter has not been maintained resulting in weedy edges. The appropriate management class for assisted regeneration costing as described in the Lismore City Council Urban Green Corridors Plan 2017 Appendix 4 is Moderate.

Fencing The western boundary of Zone e2 is fenced. The northern boundary is an arbitrary line through the dam, while the southern boundary is defined by the steep rocky slopes of adjacent zone e3. Installation of fencing (and gate for return of stray cattle/firefighting) on the eastern boundary track is required to exclude cattle (approx. 350m) which compact the soil and prevent natural regeneration of natives (CBRS,2012). This should be timed to occur just prior to regeneration works commencing as the cattle currently present will assist in preventing weed growth until works commence. The Lantana dominating the eastern boundary track (external to Quarry property) could be eliminated whilst working in this zone to prevent reinfestation of the site in future.

Dam on northern boundary of Zone e2 with evidence of maintenance by previous owner

Zone e2 Looking south from dam. Tall Open Forest with Eucalypt canopy, mid and ground strata >50% Lantana.

Strategy This zone of Core Koala Habitat contains larger trees which koalas prefer (Biolink, 2011) with potential landscape connectivity (CEG,2006) and should therefore be a High priority. The adjacent property to the NE corner is Lantana dominated and will result in reinfestation of the zone if not addressed. The objective is to enhance koala habitat via assisted natural regeneration by removing the weed canopy which prevents germination of koala food trees and hinders access by koalas (Keith, 2006). Selected rainforest pioneers to be removed adjacent to eucalypts will improve light levels and eucalypt recruitment rates.

Action Plan Zone e2 (Assisted Natural Regeneration) Priority: High

Value	Objective	Performance Indicator	Actions	Area	Class & Indicative Cost/ha
Core Koala Habitat	Enhance koala habitat by removing weeds in mid and ground stratum which prevent germination of natives, particularly Eucalypts	All strata 95% natives, Eucalypt species germinating	• Establish monitoring photo points • Weed control (working in lines from west to east in a southerly direction): Primary: clear around natives, hand weed/cut & paint/overspray Lantana, cut & paint/drill Privet & Camphor, cut & paint/drill or spot spray Devil's Fig, Tobacco & exotic vines. Spot spray Mistflower & Paspalum, including around Dam 1 but ensure fringing native vegetation is encouraged to prevent cane toad access. Follow up: spot spray as required/to prevent seeding particularly Lantana. Remove rainforest pioneers in patches/adjacent to eucalypts to improve eucalypt recruitment. • Monitor annually after primary weed control commences *Other actions required/notes:* o Install fencing and gate on eastern boundary track to exclude cattle (approx. 350m) just prior to commencement of work with wildlife friendly fencing o Consent from eastern neighbour (Stassi, 365 Booerie Creek Rd) for occasional vehicle access to zone via vehicle track has been granted if pre-arranged o Off-site Lantana control to the east and north of the eastern boundary track (approx. 0.5ha) as resources allow	3.5ha	$14,040/ha Moderate cost category

Zone e3

Closed Forest, Endangered Ecological Community (EEC), Threatened Species (TS), poor condition & access, moderate-steep slopes

Location SE slopes of eastern acquisition	**Topography** mod to steep slopes (10-40°), rocky	
Aspect SE to SW	**Elevation** 65m to 120m	**Area** 8ha

Description	Closed Forest as described in the Blakebrook Quarry Ecological Site Assessment which occurs on the steeper slopes and is not suitable koala habitat (CEG,2008). Protected at State level as the EEC Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions which comprises subtropical rainforest and some related, structurally complex forms of dry rainforest associated with basalts on the North Coast foothills (ERM, 2018a). The TS Thorny Pea (*Desmodium acanthocladum*) was observed during the site assessment. A dam is located at the boundary of Zone e3/e4, adjacent to an ephemeral watercourse and is fringed by natives, particularly Sally Wattle (*Acacia melanoxylon*).	
Upper stratum	Exotics	N/a
	Natives	Upper slopes dominated by 30m tall Brush Box (*Lophostemon confertus*) with Hoop Pine (*Araucaria cunninghamii*) emergents. Lower slopes contain scattered Silky Oak (*Grevellia robusta*), Red Cedar (*Toona ciliata*) and White Cedar (*Melia azedarach*).
Mid stratum	Exotics	Dominated by Large-leaf Privet (*Ligustrum lucidum*) which varies from 20% to > 50% - 80% of the stratum (some large at 15-20m tall), scattered clumps of Lantana (*Lantana camara*) and vines Passionfruit (*Passiflora edulis*), Corky Passionflower (*P. suberosa*).
	Natives	Native Olives (*Notelaea johnsonii, N. longifolia, N. venosa)*, Flintwood (*Scolopia braunii*), Glossy Laurel (*Cryptocarya laevigata*), Native Holly (*Alchornea ilicifolia*), Black Plum (*Diospyros australis*), Cordylines (*C. petiolaris, C. rubra*), Sassafrass (*Doryphora sassafrass*), Veiny Wilkiea (*Wilkiea huegeliana*), epiphytes and vines Richmond Birdwing (*Pararistolochia praevenosa*), Water Vine (*Cissus hypoglauca*).
Ground stratum	Exotics	L/L Privet invasion varies from lack of understory due to cattle through to a carpet of seedlings, with 5-20% Lantana and Mistflower (*Ageratina riparia*).
	Natives	Native Ginger (*Alpinia caerulea*), Basket Grass (*Oplismenus* spp.), scattered patches of Rough Maidenhair Fern (*Adiantum hispidulum*) and Prickly Rasp Fern (*Doodia aspera*).

Access Poor. Generally difficult terrain of steep rocky slopes. Access on foot via either the western track gate to the western slopes or via spur track belonging to the adjacent property on the eastern boundary to the eastern slopes. Access from neighbour (Stassi, 365 Booerie Creek Rd) granted if pre-arranged.

Condition and costing Although this zone has good potential for restoration with diverse natives germinating, the overall condition is poor. Privet has dominated due to its ability to germinate in low light and varies from 20% to > 80% of the mid stratum, at times forming a closed mid canopy with some large/tall (20m) trees (average 50%). Similarly, the understory varies from 5-20% to a carpet of Privet seedlings. Lantana is present in generally minor quantities with scattered infestations of exotic vines. The appropriate management class for assisted regeneration costing as described in the Lismore City Council Urban Green Corridors Plan 2017 Appendix 4 is Moderate.

Fencing The western boundary is fenced. The southern boundary is fenced but ageing in parts with possible minor repairs required. The northern boundary is defined by steep rocky slopes and the eastern boundary will be fenced (see zone e2).

Zone e3 Closed Forest on moderate to steep slopes with mid stratum dominated by 80% L/L Privet.
Left: southern boundary fence water course looking north with mid stratum dominated by 20% to 50% L/L Privet.

Strategy This zone is an EEC with good potential for assisted natural regeneration with diverse natives germinating and TS observed during the site assessment. However, taking into consideration the condition of this zone including that of adjacent properties, access and slope, this zone should be a Low priority. Treatment of Privet will result in increased light levels and both natives and weeds which will require frequent and regular follow-up to prevent reinfestation. Work should commence after Zone e1 and e2 are treated, at the top of the slope working in lines across the contour moving in a downward direction to prevent reinfestation from upslope. Depending on weed control undertaken by the eastern and southern neighbours, maintenance into the future may be higher than that of zones surrounded by relatively weed free landscapes such as Zone e1.

Action Plan Zone e3 (Assisted Natural Regeneration) Priority: Low

Value	Objective	Performance Indicator	Actions	Area	Class & Indicative Cost/ha
EEC	Restore EEC by removing cattle and weeds in mid and ground stratum which prevent germination of natives. Erosion and water quality also improve.	All strata 80% natives	o Establish monitoring photo points and flag known TS o Weed control (working in lines from west to east from top of slope downwards): Primary: Flag and hand weed/cut & paint a buffer zone around TS Clear around natives, cut & paint/drill Privet, hand weed/cut & paint/overspray Lantana, hand pull/cut & scrape or spot spray exotic vines. Spot spray Mistflower & Paspalum including perimeter of Dam 2 but ensure fringing native vegetation is encouraged to prevent cane toad access. Follow up: spot spray as required/to prevent seeding particularly Privet seedling carpet - ensure this is regular and frequent due to increased light levels o Monitor annually after primary weed control commences *Other actions required/notes:* o Consent from eastern neighbour (Stassi, 365 Booerie Creek Rd) for occasional vehicle access to zone via vehicle track has been granted if pre-arranged o Monitor stock incursions and condition of fence on southern (485m) boundary and repair as required o Liaise with neighbouring property owners Stassi (365 Booerie Creek Rd) and Redford (289 Booerie Creek Rd) to conduct integrated weed control to prevent high maintenance costs into the future	8ha	$14,040/ha Moderate cost category
TS	Protect and expand Thorny Pea	TS patches maintained and expanded			

Zone e4

Disturbed Grassland, flat-gentle slope, poor access & condition, revegetation to expand koala habitat

Location SE corner of eastern acquisition	**Topography** flat-gentle slope	
Aspect W/SW	**Elevation** 85m – 95m	**Area** 1.7ha

Description	Disturbed Grassland (ex-cattle pasture) as described in the Blakebrook Quarry Ecological Site Assessment (CEG,2008). Comprises approx. 1m tall Rhodes Grass (*Chloris gayana*) with scattered clumps of exotics and natives totalling 1.7ha. Evidence of impeded drainage with wetland flora species and standing water.	
Upper stratum	Exotics	N/a
	Natives	Scattered Cabbage Gum (*E. amplifolia*) and Hoop Pine (*Araucaria cunninghamii*) on the lower slopes.
Mid stratum	Exotics	20% scattered clumps of Lantana (*Lantana camara*), Large-leaf Privet (*Ligustrum lucidum*) and Camphor Laurel (*Cinnamomum camphora*) with minor amounts of Devil's Fig (*Solanum torvum*) and Senna (*Senna septemtrionalis*).
	Natives	Scattered clumps dominated by 10-15m Sally Wattle (*Acacia melanoxylon*), Red Kamala (*Mallotus philippensis*), Silky Oak (*Grevellia* robusta), White Cedar (*Melia azedarach*) and Cockspur Thorn vine (*Maclura cochinchinensis*).
Ground stratum	Exotics	80% Rhodes Grass, 20% Lantana, Crofton (*Ageratina adenophora*).
	Natives	Swamp Foxtail (*Pennisetum alopecuroides*), Smartweed (*Persicaria* spp.).

Access Partial – by foot from Dam 2 or by vehicle if conditions are dry via the eastern boundary track as access from the owner (Stassi, 365 Booerie Creek Rd) has been granted if pre-arranged.

Condition and costing The overall condition of this zone is very poor. It is highly degraded due to domination by exotic Rhodes Grass although scattered clumps of natives with 20% exotics also occur. The overgrown Rhodes Grass indicates that cattle no longer use this pasture. However, this zone is relatively easy to treat, therefore the appropriate management class for assisted regeneration costing as described in the Lismore City Council Urban Green Corridors Plan 2017 Appendix 4 is Low.

Fencing The southern boundary is fenced with the remaining boundaries formed by the tree line/eastern boundary spur track which will be fenced (see zone e2).

Strategy The priority for Zone e4 is Low due to the higher costs associated with reconstructing koala habitat in the long term through a combination of assisted natural regeneration and in-fill planting.

This zone of Rhodes Grass shows evidence of impeded drainage with Swamp Foxtail and other wetland species. The ERM (2018) BRMP Annex A KPoM recommends revegetating degraded and disturbed areas with preferred koala food species found on site such as Forest Red Gum (*E. tereticornis*) (CEG,2006), a species associated with impeded drainage at this site (CEG,2008). In addition Fig 3 of the KPoM recommends connectivity to the surrounding landscape from the eastern side of the quarry as areas adjacent to the east are likely to contain Core Koala Habitat (CEG,2006). The Biolink Koala Monitoring Report recommends koala food tree plantings to fill in gaps and expand koala food resources while also improving habitat connectivity and safe koala movement both within the site and at the broader landscape scale (Biolink, 2016).

Therefore, a combination of assisted natural regeneration and revegetation with a focus on Forest Red Gum, taking into consideration the species selection, provenance and planting guidelines outlined in 7.5.1/Table 7.4/8.2.4 of ERM (2018) is recommended providing that vehicle access via the eastern boundary track is pre-arranged with the owner.

Zone e4 Looking SE from Dam 2. Disturbed Grassland (cattle pasture) of Rhodes Grass with mid story scattered clumps of natives and 20% exotics (Lantana, Privet, Camphor). Evidence of impeded drainage (Swamp Foxtail, Smartweed), therefore Forest Red Gum would be an appropriate species to revegetate and expand koala habitat. The slope on the left-hand side ascends to the eastern boundary spur track.

Action Plan Zone e4 (Combination of revegetation and assisted natural regeneration) Priority: Low

Value	**Objective**	**Performance Indicator**	**Actions** *(assuming access via eastern track is pre-arranged)*	**Area**	**Class & Indicative Cost/ha**
Revegetated koala habitat	Enhance koala habitat & connectivity within site & landscape by replacing Rhodes Grass with Forest Red Gum in-fill plantings	85% success rate of planted trees	• Establish monitoring photo points. Ensure tube stock with appropriate provenance is available for an autumn planting • Spot spray paddock weeds but ensure fringing native vegetation is encouraged around standing water to prevent cane toad access, drill Privet & Camphor in clumps & southern fence line • Planting preparation (working in stages from SE corner): blanket spray Rhodes Grass & scattered Crofton, Devils Fig to prepare for planting but ensure fringing native vegetation is encouraged around standing water to prevent cane toad access. Consider use of slashing. Follow up prior to planting • Plant @ 4-5m spacings in clumps or as scattered in-fills after brush cutting dead Rhodes Grass (water available from dam 2) • Maintain plantings and zone with follow up spot spray as required/to prevent seeding. Over time, understory will develop • Monitor annually after primary weed control commences • Remove guards when appropriate during follow up *Other actions required/notes:* o Consent from eastern neighbour (Stassi, 365 Booerie Creek Rd) for occasional vehicle access to zone via vehicle track has been granted if pre-arranged o Prior to planting, consider slashing planting area under access permission from neighbour (as above) or blanket spray	1.7ha 1ha planting In-fills (within the 1.7ha above)	$5,400/ha Low cost category $1,500 (approx. 100 trees @ $15 per tree)

Zone w1

Tall Open Forest/Woodland, Core Koala Habitat, good access, moderate condition overall

Location southern portion of western acquisition (both sides of quarry access road)		**Topography** gentle slope west of the access road above cattle pastures to moderately steep on the east (10-30°)	
Aspect W to NW		**Elevation** 30m – 90m	**Area** 2.3ha
Description	Tall Open Forest/Woodland as described in the Blakebrook Quarry Ecological Site Assessment associated with impeded drainage and considered Core Koala Habitat (CEG,2008). Contains primary koala food tree Forest Red Gum (*E. tereticornis*) and secondary food trees Swamp Box (*Lophostemon suaveolens*) and Flooded Gum (*E. grandis*) (FoK,n.d.). Koala scats observed at the base of roadside Forest Red Gums. The Threatened Species Thorny Pea (*Desmodium acanthocladum*) is present. The lower western plains comprise relatively weed free cattle pasture dominated by Swamp Foxtail (*Pennisetum alopecuroides*) or Blady Grass (*Imperata cylindrica*) with evidence of slumping along the toe of the slope.		
Upper stratum	Exotics	N/a	
	Natives	Dominated by 35-40m tall Forest Red Gum with scattered Swamp Box, Willow Bottlebrush (*Callistemon salignus*) and Hoop Pine (*Araucaria cunninghamii*) in the moister areas.	
Mid stratum	Exotics	Ranges from 50% Lantana (*Lantana camara*), 5-15m tall Camphor Laurel (*Cinnamomum camphora*), Large-Leaf Privet (*Ligustrum lucidum*), Devil's Fig (*Solanum torvum*) and Tobacco (*Solanum mauritianum*) in scattered clumps west of the access road to 30% east of the access road with 80% Camphor along the southern edge. Devil's Fig dominates below the powerlines.	
	Natives	Dominated by rainforest pioneers/secondary species such as Red Kamala (*Mallotus philippensis*), Sally Wattle (*Acacia melanoxylon*), Rough-leaved Elm (*Aphananthe philippinensis*), Foambark (*Jagera pseudorhus*) and Macaranga (*Macaranga tanarius*).	
Ground stratum	Exotics	Range from 70% Crofton (*Ageratina adenophora*) and Lantana in scattered clumps on the western and eastern side of the access road to sparse on the eastern side's steep slope.	
	Natives	On both sides of the access road, Forest Red Gum is regenerating amongst Kangaroo Grass (*Themeda triandra*), A Burrgrass (*Cenchrus robustus*), Blady Grass and Swamp Foxtail which dominates the low-lying areas but also occurs on the moister areas of the eastern slopes. The steep slopes east of the Quarry access road are sparse.	

Access By foot from the parking area at the cattle grid. Obtain consent for vehicle access to lower pastures from owner (McNamara, 18 Keerrong Rd).

Condition and costing Taking into consideration the varying degrees of weed invasion in this zone, the overall condition is moderate (weeds make up 20-50% of the site in any strata) and the appropriate management class for assisted regeneration costing as described in the Lismore City Council Urban Green Corridors Plan 2017 Appendix 4 is Moderate.

Fencing The southern boundary is fenced on both sides of the quarry access road. The eastern and northern boundaries are arbitrary. The eastern boundary is formed by a rocky plateau at the top of the slope with associated change in vegetation type to closed forest and the northern boundary by power lines. The western boundary is not fenced but is required to exclude cattle which compact the soil and prevent natural regeneration of natives (CBRS,2012b). Fencing should be timed to occur just prior to regeneration works commencing as the cattle currently present will assist in preventing weed growth until works commence. Scattered Camphor and Crofton west of this new fencing could be eliminated whilst

working in this zone to prevent future reinfestation or liaise with landowner to ensure controlled. An existing fence running west-east approx. 150m from the SW corner may be useful to section off cattle in stages.

Zone w1 west of the quarry access road looking east from cattle pastures downslope. Upper stratum dominated by Forest Red Gum (FRG), mid stratum of 20-50% exotics and regenerating FRG in Blady and Kangaroo Grass

Strategy Zone w1 is a Medium priority. The pasture areas are relatively weed free and comprise native grasses with regenerating Forest Red Gum, thus an opportunity to expand koala habitat without planting by fencing the western boundary to exclude the cattle currently present exists. However, the mid and ground strata on the mid and steep slopes contain 50 - 80% exotics. Other zones of koala habitat take priority when in proximity to completed zones (e1, e2) or with existing fencing and therefore reduced costs (s3, s4). Commencing works in Zone w1 will complement works to follow in w2 as removal of cattle will enable the regeneration process to continue to the water course in Zone w2 where Forest Red Gum and Swamp Box occur. Existing koala habitat can be enhanced by removing the weed canopy which prevents germination of koala food trees (Keith, 2006) and hinders access by koalas.

Zone w1 Looking north from west of the quarry road. Mid stratum of 80% Lantana, Camphor and Privet

Action Plan Zone w1 (Assisted Natural Regeneration) Priority: Medium

Value	Objective	Performance Indicator	Actions	Area	Class & Indicative Cost/ha
Core Koala Habitat TS	Enhance existing koala habitat by removing weeds in mid and ground stratum which prevent germination of natives, particularly Eucalypts. Expand koala habitat by excluding cattle and allowing Forest Red Gum and other natives to regenerate naturally. Protect and expand Thorny Pea.	All strata 95% natives, Eucalypt species germinating Cattle pasture replaced with natives particularly Forest Red Gum TS patches maintained and expanded	• Establish monitoring photo points and flag known TS. • Weed control (commencing from plateau at top of slope on eastern side of quarry access road working in lines from north to south in a westerly direction across road and downslope. Install fencing before crossing road): Primary: Flag and hand weed/cut & paint a buffer zone around TS. Clear around other natives (in particular skirting around FRG to allow access for koalas) to prepare for drilling with generator for larger camphor & privet. Hand weed/cut & paint/overspray Lantana, cut & paint/drill smaller Privet & Camphor, cut & paint/drill or spot spray Devil's Fig, Tobacco & Crofton. Spot spray weeds in cattle pasture area particularly those adjacent to regenerating FRG. Consider staking/guarding some of the FRG seedlings to assist with monitoring progress and prevent possible wallaby damage. Follow up: spot spray as required/to prevent seeding. Remove rainforest pioneers in patches/adjacent to eucalypts to improve eucalypt recruitment. • Monitor annually after primary weed control commences *Other actions required:* o Identify eastern and northern boundaries with flagging tape o Ensure area below powerlines slashed (Devil's Fig infestation) o Prior to works commencing on western side of quarry road, install wildlife friendly fencing and gate on western boundary to exclude cattle (approx. 150m) using existing fencing running W-E to section off o Obtain consent for vehicle access to lower pastures from owner (McNamara, 18 Keerrong Rd) o Off-site weed control west of boundary fencing as resources allow	2.3ha	$14,040/ha Moderate cost category

Zone w2

Closed Forest on steep rocky slopes above Open Forest/Woodland, poor condition & access although Threatened Species (TS)/potential Endangered Ecological Community (EEC) present

Location mid-slopes of western acquisition	**Topography** mod to very steep rocky slopes (10-40°) above flatter Open Forest/Woodland, watercourse in the south	
Aspect W	**Elevation** 40m to 120m	**Area** 5.4ha

Description	Steep to very steep rocky, eroded upper slopes of Closed Forest as described in the Blakebrook Quarry Ecological Site Assessment which may qualify as the EEC Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions (ERM, 2018a). Lower slopes comprise patches of koala habitat Open Forest/Woodland particularly adjacent to the ephemeral watercourse and cattle pasture dominated by Swamp Foxtail (*Pennisetum alopecuroides*). Evidence of erosion on steeper slopes and slumping along toe of slope. The TS Thorny Pea (*Desmodium acanthocladum*) is present while Fragrant Myrtle (*Gossia fragrantissima*) was observed in an earlier assessment in 2007.	
Upper stratum	Exotics	Steep slopes closed by 80-90% 10-20m tall Large-leaf Privet (*Ligustrum lucidum*) and Camphor Laurel (*Cinnamomum camphora*).
	Natives	Upper slopes contain scattered Silky Oak (*Grevellia robusta*), Guioa (*Guioa semiglauca*), Red Kamala (*Mallotus philippensis*), Red Ash (*Alphitonia excelsa*), Foambark (*Jagera pseudorhus*) with emergent Figs (*Ficus* spp.). Lower slopes contain Forest Red Gum (*E. tereticornis*) particularly along the watercourse, Swamp Box (*Lophostemon suaveolens*), Willow Bottlebrush (*Callistemon salignus*) and emergent Hoop Pines (*Araucaria cunninghamii*).
Mid stratum	Exotics	Rocky slopes 80% Large-leaf Privet with scattered open patches of Lantana (*Lantana camara*). Lower slopes contain 20% Lantana, Camphor Laurel and Devil's Fig (*Solanum torvum*) increasing to 50% along the watercourse. Minor amounts of Climbing Asparagus Vine (*Asparagus plumosus*).
	Natives	Steep slopes contain scattered Silky Oak, Guioa, Red Kamala, Red Ash and Foambark (*Jagera pseudorhus*) with numerous vines including the TS Arrowhead Vine (*Tinospora tinosporoides*). Thorny Pea patches comprise 50% of the stratum along the lower parts of the watercourse while pockets of the upper watercourse contain Native Frangipani (*Hymenosporum flavum*), Tree fern (*Cyathea* spp.), Cordyline (*Cordyline* spp.), Twin-leaf Coogera (*Arytera distylis*), Pepperberry (*Cryptocarya obovata*) and Cunjevoi (*Alocasia brisbanensis*).
Ground stratum	Exotics	Range from 70% Crofton (*Ageratina adenophora*) and Lantana along the watercourse to sparse Privet understory on the steep rocky slopes.
	Natives	Basket Grass (*Oplismenus* spp.) and scattered patches of Rough Maidenhair Fern (*Adiantum hispidulum*) and Prickly Rasp Fern (*Doodia aspera*) on the steeper rocky slopes or rocks/leaf litter only. Swamp Foxtail (*Pennisetum alopecuroides*), Kangaroo Grass (*Themeda triandra*) and Blady Grass (*Imperata cylindrica*) on the lower slopes.

Access Poor. Generally difficult terrain of cliffs, steep rocky slopes and very large boulders on the eastern boundary prevents easy access from the quarry. Foot access is possible from the sharp corner at the entry to the weigh bridge but hazardous due to steep slope, therefore access on foot via Zone w1 post weed control or obtain consent for vehicle access to lower pastures from owner (McNamara, 18 Keerrong Rd).

Condition and costing This zone comprises approx. 20 to 70% exotics in the lower slopes and watercourse. Regeneration works are severely constrained by restricted access on the steep upper rocky slopes which are degraded by 80% Privet and/or Camphor in the mid and upper stratum. The appropriate management class for assisted regeneration costing as described in the Lismore City Council Urban Green Corridors Plan 2017 Appendix 4 is High.

Fencing The eastern boundary is formed by very steep rocky slopes below the quarry access road. The northern and southern boundaries are arbitrary and require flagging. The western boundary shared by Zone w1 and w3 is not fenced or contains parts of an old fence line (total boundary approx. 700m of which this zone requires 235m) but is required to prevent cattle accessing the zone. Fencing should be timed to occur just prior to regeneration works commencing as cattle currently present will assist in preventing weed growth. Scattered Camphor and Crofton west of the new fencing could be eliminated whilst working in this zone to prevent reinfestation or liaise with landowner to ensure controlled.

Strategy The overall priority of Zone w2 is Low due to a cleared landscape to the west and steep rocky slopes to the east and north which limit connectivity of the higher priority koala habitat. This occurs only on the lower slopes and watercourse but could be expanded and connected to the koala habitat in Zone w1 through exclusion of cattle and natural regeneration. Selected rainforest pioneers could be removed adjacent to eucalypts to improve light levels and eucalypt recruitment rates. Commencing works including initial fencing in Zone w1 will complement works to follow in w2.

The steeper zones above have potential for assisted natural regeneration with natives germinating and Thorny Pea present, however Privet has dominated due to its ability to germinate in low light. Due to erosion issues, treatment of Privet should be staged to allow time for native replacement. Increased light levels will result in both natives and weeds which will require frequent and regular follow-up.

Zone w2 Degraded Closed Forest on eroded, rocky steep slope.

Zone w2 Lower slopes watercourse. Open Forest/Woodland with Forest Red Gum in the upper stratum, 50% exotics (Privet, Camphor, Lantana) and 50% Thorny Pea patches in the mid stratum and 70% Crofton in the ground stratum.

Action Plan Zone w2 (Assisted Natural Regeneration) Priority: Low

Value	Objective	Performance Indicator	Actions	Area	Class & Indicative Cost/ha
Koala habitat	Expand and link koala habitat on lower slopes to Zone w1 by removing cattle and weeds.	All strata 95% natives, eucalypts regenerating naturally	• Establish monitoring photo points and flag known TS • Weed control (commencing on lower slopes and watercourse, proceeding east to upper rocky slopes for improved access): Primary: Flag and hand weed/cut & paint a buffer zone around TS Clear around natives, particularly clearing around the FRG along the watercourse. Cut & paint/drill Privet & Devil's Fig, overspray Lantana, hand pull/cut & scrape or spot spray exotic vines. Spot spray Crofton adjacent to Thorny Pea patches. Follow up: spot spray as required. Consider thinning out rainforest pioneers in patches if it will support adjacent eucalypt recruitment • Monitor annually after primary weed control commences *Other actions required:* o Install fencing and gate on western boundary to exclude cattle (approx. 235m) just prior to commencement of work o Identify northern and southern boundaries with flagging tape o Obtain consent for vehicle access to lower pastures from owner (McNamara, 18 Keerrong Rd) o Off-site weed control west of boundary fencing as resources allow	5.4ha	$28,080/ha High cost category
EEC	Restore degraded EEC by removing weeds which prevent germination of natives. Erosion and water quality also improve.	All strata 80% natives			
TS	Protect and expand Thorny Pea, Fragrant Myrtle and Arrowhead Vine.	TS patches maintained and expanded			

Zone w3

Closed Forest on steep rocky slopes above cattle pasture, poor condition & access although Threatened Species (TS) /potential Endangered Ecological Community (EEC) present

Location northern slopes of western acquisition		**Topography** mod to very steep slopes (10-40°), rocky, above degraded cattle pastures, watercourse in north	
Aspect S to W		**Elevation** 50m to 120m	**Area** 6.5ha
Description	Steep to very steep rocky, eroded upper slopes of Closed Forest as described in the Blakebrook Quarry Ecological Site Assessment which is not suitable koala habitat (CEG,2008). May qualify for protection at State level as the EEC Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions. The potential EEC straddles a steep gully and ephemeral watercourse originating from the west of the main quarry pit floor with rock massifs and large boulders. Lower slopes comprise cattle pasture dominated by exotics particularly adjacent to the watercourse and/or Swamp Foxtail (*Pennisetum alopecuroides*). Evidence of erosion on steeper slopes and slumping along toe of slope. TS Thorny Pea (*Desmodium acanthocladum*) and Arrowhead Vine (*Tinospora tinosporoides*).		
Upper stratum	Exotics	Stratum closed by 10-20m tall Large-leaf Privet (*Ligustrum lucidum*) or Camphor Laurel (*Cinnamomum camphora*) at the edges, approx. 70% across the site.	
	Natives	30m tall Brush Box (*Lophostemon confertus*), Bloodwood (*Corymbia intermedia*) and emergent Figs (*Ficus* spp.) on upper slopes. Silky Oak (*Grevellia robusta*), Lilly Pilly (*Acmena smithii*), Guioa (*Guioa semiglauca*), Red Kamala (*Mallotus philippensis*), Figs (*Ficus* spp.) and White Cedar (*Melia azedarach*) on lower slopes and watercourse.	
Mid stratum	Exotics	Scattered clumps of Crofton (*Ageratina adenophora*) and Camphor on the unfenced NW edge. Infestations of Guava (*Psidium guajava*), Groundsel Bush (*Baccharis halimifolia*) and Devil's Fig (*Solanum torvum*) in the mid and lower cattle pastures. Rocky slopes dominated by Large-leaf Privet varying from 30% to 90% of the stratum with open patches of Lantana (*Lantana camara*).	
	Natives	Scattered Cheese Tree (*Glochidion ferdinandi*), Hairy Walnut (*Endiandra pubens*) Native Holly (*Alchornea ilicifolia*), Rough-leaved Elm (*Aphananthe philippinensis*), Yellow Tulip (*Drypetes deplanchei*), Mrytle Ebony (*Diospyros pentamera*), Bolwarra (*Eupomatia laurina*), Prickly Alyxia (*Alyxia ruscifolia*) with vines Lawyer Vine (*Calamus muelleri)*, Smilax (*Smilax australis*), Water Vine (*Cissus hypoglauca*), Cockspur Thorn (*Maclura cochinchinensis*) and Arrowhead Vine.	
Ground stratum	Exotics	Mistflower (*Ageratina riparia*) patches in NW, L/L Privet understory varies from nil due to cattle impacts through to a carpet of seedlings.	
	Natives	Extensive Thorny Pea patches in NW. Swamp Foxtail (*Pennisetum alopecuroides*) dominates in waterlogged lower cattle pastures with Kangaroo Grass (*Themeda triandra*) and Blady Grass (*Imperata cylindrica*) in the drier cattle pastures. Basket Grass (*Oplismenus spp.*) and scattered patches of Rough Maidenhair Fern (*Adiantum hispidulum*) and Prickly Rasp Fern (*Doodia aspera*) on the moderately steep rocky slopes.	

Access Poor. Generally difficult terrain of steep rocky slopes on the northern and eastern boundaries with very large boulders on the eastern boundary prevents easy access from the quarry. Access on foot via NW corner or via Zone w2 following primary work or obtain consent for vehicle access to lower pastures from owner (McNamara, 18 Keerrong Rd).

Condition and costing Although this zone has good restoration potential with diverse natives germinating and extensive patches of Thorny Pea, the overall condition of this zone is very poor. Invasion by L/L Privet varies from 30% to 90% of the mid and upper stratum, often forming a closed canopy with some large/tall

(20m) trees (average 70%). The understory varies from nonexistent due to cattle, to 50% Mistflower adjacent to Thorny Pea patches, to a carpet of Privet seedlings. Lantana is present as large open patches around scattered natives. An infestation of Guava, Groundsel and Devil's Fig in the lower pastures appears to continue to/originate from the adjacent property which will result in higher reinfestation/follow-up/maintenance. The appropriate management class for assisted regeneration costing as described in the Lismore City Council Urban Green Corridors Plan 2017 Appendix 4 is High.

Fencing The eastern boundary is fenced. The northern boundary is too steep and rocky for cattle. The southern boundary is arbitrary and requires flagging. The western boundary shared by Zone w1 and w2 is not fenced (approx. 700m) or contains parts of old fencing but is required to exclude cattle (approx. 315m applicable to this zone). Fencing should be timed to occur just prior to commencement of regeneration works as cattle currently present will assist in preventing weed growth. Scattered Camphor and Crofton west of the new fencing could be eliminated whilst working in this zone to prevent reinfestation or liaise with landowner to ensure controlled.

Zone w3 Left: Moderate slope in northwest of zone with ground and mid stratum of Mistflower and Thorny Pea below upper of 90% L/L Privet, adjacent to cattle tracks. Right: Lantana patch & scattered natives on moderately steep rocky slope in east of zone.

Strategy Due to difficult terrain, erosion and infestations, the priority for this zone is Low. Following the exclusion of cattle on the lower cattle pastures, the large infestations of Guava, Groundsel and Devil's Fig will require higher resource levels to treat and follow-up. The steeper zones above have potential for assisted natural regeneration with natives germinating and Thorny Pea present however Privet has dominated due to its ability to germinate in low light. Due to erosion issues, treatment of Privet should be staged to allow time for native replacement. Increased light levels will result in both natives and weeds which will require frequent and regular follow-up.

Ideally the western acquisition would be worked from north to south to prevent upslope reinfestation but due to the difficult terrain adjacent to the quarry and the large infestations adjacent to the western boundary, this zone should be worked from the west to the east. Zones w1 and w2 take precedence as they contain koala habitat. Depending on weed control undertaken by the western neighbours, maintenance into the future may be higher than that of other zones surrounded by relatively weed free landscapes such as Zone e1.

Fig on large boulders, eastern slopes of Zone w3 looking east. The Threatened Species Arrowhead Vine occurs in this area.

Action Plan Zone w3 (Assisted Natural Regeneration) Priority: Low

Value	Objective	Performance Indicator	Actions	Area	Class & Indicative Cost/ha
EEC Regenerated cattle pastures TS	Restore EEC by removing weeds which prevent germination of natives. Erosion and water quality also improve. Infestations controlled to prevent dispersal to other zones Protect and expand Thorny Pea (which will assist with erosion control) and Arrowhead Vine.	All strata 80% natives All strata 95% natives TS patches maintained and expanded	• Establish monitoring photo points and flag known TS • Weed control (working from west to east due to terrain): Primary: Flag and hand weed/cut & paint a buffer zone around TS Clear around natives, cut & paint/drill Privet, overspray Lantana, hand pull/cut & scrape or spot spray exotic vines. Spot spray Mistflower adjacent to Thorny Pea patches. Infestation in cattle pastures - basal bark Guava, overspray smaller Devil's Fig, Groundsel Bush and Crofton. Drill taller Devil's Fig. Follow up: spot spray as required/to prevent seeding particularly Privet seedling carpet - ensure this is regular and frequent due to increased light levels. Ensure infestations in cattle pastures followed up in timely manner. • Monitor annually after primary weed control commences *Other actions required:* o Install fencing and gate on western acquisition boundary to exclude cattle (approx. 315m) just prior to commencement of work o Identify southern and northern boundaries with flagging tape o Obtain consent for vehicle access to lower pastures from owner (McNamara, 18 Keerrong Rd) o Off-site weed control west of boundary fencing as resources allow	6.5ha	$28,080/ha High cost category

Zone w4

Rocky slope of invasive weeds and powerline above plateau with Threatened Species (TS) and Endangered Ecological Community (EEC), poor condition, good access, highly visible from quarry access road

Location SE slopes of western acquisition	**Topography** moderate slope, flat plateau, rocky	
Aspect W to SW slope, plateau E to NE	**Elevation** 90m to 130m	**Area** 1.7ha

Description	Rocky slope highly degraded by weeds and edge effects associated with powerlines below a top edge in close proximity to quarry activities. This slope descends to a plateau of Closed Forest as described in the Blakebrook Quarry Ecological Site Assessment (CEG,2008) and was possibly formed by historic landslump/slip activity. The plateau vegetation is protected at State level as the EEC Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions (ERM, 2018a). The TS Arrowhead Vine (*Tinospora tinosporoides*) and Thorny Pea (*Desmodium acanthocladum*) are present.	
Upper stratum	Exotics	Balloon vine infestation adjacent to the powerlines covers much of the canopy in the west.
	Natives	Top edge comprises scattered Bloodwood (*Corymbia intermedia*), Red Ash (*Alphitonia excelsa*), Forest Red Gum (*E. tereticornis*), Willow Bottlebrush (*Callistemon salignus*) and White Cedar (*Melia azedarach*). The rocky slope between the plateau and top edge is difficult to identify due to Balloon vine but Foambark (*Jagera pseudorhus*) and Macaranga (*Macaranga tanarius*) are visible. The plateau contains large emergent Flooded Gum (*E. grandis*) and Figs (*Ficus* spp.) above rainforest species including Mrytle Ebony (*Diospyros pentamera*), Sassafrass (*Doryphora sassafrass*), Tulipwood (*Harpullia pendula*), Bastard Crow's Ash (*Pentaceras australis*), Cordyline (*Cordyline rubra*) with vines including Lawyer Vine (*Calamus muelleri)*, Smilax (*Smilax australis*).
Mid stratum	Exotics	Balloon vine and White Passionflower vine (*Passiflora subpeltata*) adjacent to the powerlines. Large-leaf Privet (*Ligustrum lucidum*) occupies 30% of the stratum on the top edge and road side. The slope between the plateau and top edge is very rocky with large open patches of Lantana (*Lantana camara*). Devil's Fig infestation under the top of the powerlines. 20% Privet on the plateau.
	Natives	Diverse on the plateau and roadside including Glossy Laurel (*Cryptocarya laevigata*), Snow Wood (*Pararchidendron pruinosum*), Steelwood (*Sarcopteryx stipata*), Hairy Walnut (*Endiandra pubens*), Red Bean (*Dysoxylum mollissimum*), Hairy Pittosporum (*Pittosporum revolutum*), Cordyline (*Cordyline* spp.), Mrytle Ebony (*Diospyros pentamera*) with vines Lawyer Vine (*Smilax australis*), Richmond Birdwing (*Pararistolochia praevenosa*), Arrowhead Vine (*Tinospora tinosporoides*). Top edge includes Yellow Tulip (*Drypetes deplanchei*), Mrytle Ebony (*Diospyros pentamera*) and Native Rosella (*Hibiscus heterophyllus*).
Ground stratum	Exotics	Balloon and White Passionflower vine covers the ground stratum adjacent to the powerlines with Devil's Fig and Lantana also present. Coral Berry (*Rivinia humilis*) infestation on the top edge and scattered on the plateau.
	Natives	Plateau and roadside rocky with numerous vines and Birdsnest Fern (*Asplenium australasicum*). Basket Grass (*Oplismenus* spp.) on the top edge.

Access Good from top edge or roadside via the slashed area under the powerlines.

Condition and costing Although this zone has good restoration potential with diverse natives germinating (particularly in the plateau), the overall condition of this zone is very poor. Much of it is extremely rocky with numerous native and exotic vines presumably related to disturbance and edge effects caused by the powerlines and historic quarry activities. Infestations of Balloon vine, Coral Berry and Devil's Fig in addition to a wall of Lantana covered rocks between the plateau and top edge which is difficult to traverse, will require higher follow-up/maintenance costs. This zone has been subject to indiscriminate roadside spraying in the past. The appropriate management class for assisted regeneration costing as described in the Lismore City Council Urban Green Corridors Plan 2017 Appendix 4 is High.

Fencing The southern boundary is fenced. The western and northern boundaries are arbitrary and require flagging. The eastern boundary adjoins the quarry.

Fig. x Zone w4 Looking east from quarry access road to powerlines and Balloon Vine infestation.

Strategy The priority for Zone w4 is High as treatment of weed infestations is required to prevent the dispersal of weeds (particularly exotic vines listed as a Threatening Process in NSW state legislation) to other zones but is of less importance than those containing koala habitat. As the ground stratum is difficult to traverse in parts, access and general direction of weed control should utilise the slashed area below the powerlines which dissect this zone and/or Zone w1, although the top edge may allow the use of splattergun to treat the lantana covered rocky slope below. The Coral Berry, Devil's Fig and Balloon Vine infestations will require higher levels of follow-up and maintenance to control and prevent reinfestation. The objective is to restore the EEC and protect TS by removing the weeds which destroy or degrade native flora and in particular to prevent the expansion of infestations.

Zone w4
Top: Rocky open slope of Lantana above plateau, below top edge

Bottom: Coral Berry infestation top edge

Action Plan Zone w4 (Assisted Natural Regeneration) Priority: Medium

Value	Objective	Performance Indicator	Actions	Area	Class & Indicative Cost/ha
EEC	Restore EEC by treating weed infestations and prevent dispersal to other zones.	All strata 95% natives	• Establish monitoring photo points and flag known TS • Weed control: (utilizing area under powerlines for access with general work direction north and south outwards. Zone w1 may provide access in parts) Primary: Flag and hand weed/cut & paint a buffer zone around TS. Arrowhead is entangled in Lantana below the top edge. Hand pull larger woody Coral Berry, spot spray smaller plants. Skirt the Balloon vine (spray regrowth), clear around natives, cut & paint/drill Privet, overspray Lantana. Consider use of splatter gun for Lantana on rocky slope from top edge. Overspray smaller Devil's Fig. Drill taller Devil's Fig. Follow up: spot spray as required/to prevent seeding particularly Coral Berry and Balloon Vine.	1.7ha	$28,080/ha High cost category
TS	Protect and expand TS	TS maintained and expanded	• Monitor annually after primary weed control commences *Other actions required:* o Identify western and northern boundary with flagging tape o Ensure area under powerlines is slashed		

Zone s1

Tall Open Forest - Tall Open Forest/Woodland, koala habitat corridor, moderate slopes, poor to moderate condition and access with Threatened Species (TS) present

Location SW portion of southern acquisition	**Topography** gentle to moderately steep (10-30°)	
Aspect SE to W	**Elevation** 50m – 145m	**Area** 5.7ha

Description	Upper slopes of Tall Open Forest and Tall Open Forest/Woodland as described in the Blakebrook Quarry Ecological Site Assessment, (Core Koala Habitat) (CEG,2008) above degraded cattle pasture. The upper SE slopes contain the primary koala food tree species Tallowwood (*E. microcorys*) along with secondary food tree species White Mahogany (*E. acmenoides*), Brush Box (*Lophostemon confertus*), Swamp Box (*L. suaveolens*) and Flooded Gum (*E. grandis*) (FoK,n.d.). Flooded Gum also dominates the upper NW slopes. The upper slopes descend into degraded cattle pasture above a dam in an area of impeded drainage. A 200m row of planted Flooded Gum runs up the moderate to steep southern boundary slope. The TS Thorny Pea (*Desmodium acanthocladum*) was observed during the site visit.	
Upper stratum	Exotics	N/a apart from a few Slash Pines (*Pinus elliottii*) at the dam.
	Natives	Upper slopes dominated by 25-40m tall eucalypts Flooded Gum, Tallowwood, White Mahogany, Pink Bloodwood (*Corymbia intermedia*) and Brush Box with Willow Bottlebrush (*Callistemon salignus*) in the moister areas. Mid to lower pasture slopes comprise scattered rainforest pioneers including Red Kamala (*Mallotus philippensis*) and Sally Wattle (*Acacia melanoxylon*) with emergent Hoop Pine (*Araucaria cunninghamii*).
Mid stratum	Exotics	Upper NW slopes and mid slope cattle pastures are dominated by up to 80% 10-20m tall Large-Leaf Privet (*Ligustrum lucidum*) and Camphor Laurel (*Cinnamomum camphora*) as is the southern boundary planted row of Flooded Gum, while the upper SE slopes are in better condition with approx. 5 - 30% exotics. Taking into consideration the open areas of cattle pastures which contain infestations of Guava (*Psidium guajava*), 50% is an average across the zone.
	Natives	Upper NW slopes comprise Red Kamala (*Mallotus philippensis*), Rough-leaved Elm (*Aphananthe philippinensis*), Foambark (*Jagera pseudorhus*), White Bolly Gum (*Neolitsea dealbata*), Cordyline (*Cordyline* spp.), Pepperberry (*Cryptocarya obovata*) and Native Tamarind (*Diploglottis australis*) while the upper SE slopes include Forest Oak (*Allocasuarina torulosa*), Prickly Alyxia (*Alyxia ruscifolia*), Bat's-wing Coral Tree (*Erythrina vespertilio*), Black Plum (*Diospyros australis*), Sweet Pittosporum (*Pittosporum undulatum*) and Hairy Psychotria (*Psychotria loniceroides*). Scattered rainforest pioneers Red Kamala, Sally Wattle and Macaranga (*Macaranga tanarius*) occur on the mid to lower pasture slopes.
Ground stratum	Exotics	Upper NW slopes degraded by cattle with little to nil understory. Mid to low slopes contain 80% Mistflower (*Ageratina riparia*), Lantana (*Lantana camara*), Crofton (*Ageratina adenophora*) and L/L Privet in scattered clumps amongst exotic pasture grasses including Setaria (*Setaria* spp.). Upper SE slopes 30% similar exotics amongst native grasses.
	Natives	Small clumps and extensive patches of Thorny Pea occur across the zone. The upper SE slopes comprise Kangaroo Grass (*Themeda triandra*), A Burrgrass (*Cenchrus robustus*), Blady Grass (*Imperata cylindrica*), Brisbane Lily (*Proiphys cunninghamii*), Basket Grass (*Oplismenus* spp.), Rough Maidenhair Fern (*Adiantum hispidulum*), Prickly Rasp Fern (*Doodia aspera*) with Swamp Foxtail in the moister areas. The impeded drainage surrounding the dams supports Smart Weed (*Persicaria* spp.).

Access Excellent access to the upper SE slopes from a slashed vehicle track from the quarry adjacent to the southern pit. Investigate access to west/south areas of the zone from western neighbour (Greber, 550A Nimbin Rd) or by foot from the parking area at the cattle grid via zone w1. Due to steep incline half way up the southern boundary, some areas will have to be accessed by foot.

Condition and costing Taking into consideration the varying degrees of weed invasion and open areas in this zone, the overall condition is moderate (weeds make up 20-50% of the site in any strata) and the appropriate management class for assisted regeneration costing as described in the Lismore City Council Urban Green Corridors Plan 2017 Appendix 4 is Moderate.

Fencing The southern boundary is fenced. The eastern boundary is fenced (with a gate and vehicle track for return of stray cattle/firefighting present at SE corner) until it becomes too steep for cattle with an associated change in vegetation type to closed forest forming the arbitrary northern boundary. The western boundary is not fenced (approx. 360m) but is required to exclude cattle which compact the soil and prevent natural regeneration of natives (CBRS,2012b). An existing fence running west-east approx. 130m from the top NW corner of the zone may be useful to section off cattle in stages. Fencing should be timed to occur just prior to regeneration works commencing as the cattle currently present will assist in preventing weed growth until regeneration works commence. A dangerous old mine shaft requires fencing for safety.

Strategy The priority for Zone s1 is Medium. The Open Forest offers the opportunity to link koala habitat from zone w1 to the eastern side of the quarry which has potential landscape connectivity (CEG,2006) via the 200m row of planted Flooded Gum, a koala food tree secondary species (FoK,n.d.). In addition, the property adjacent to the southern boundary appears to be dominated by eucalypts. Existing koala habitat on the upper NW and SE slopes can be enhanced by removing the weed canopy which prevents germination of koala food trees (Keith, 2006) and hinders access by koalas. Although no eucalypts were observed regenerating naturally as was the case in zone w1, the control of exotic grasses, guava infestations and other exotics following exclusion of cattle in the open pasture areas may result in this occurring. If this process does not occur, scattered in-fills of the primary koala food tree species Tallowwood (*E. microcorys*) on the more exposed areas and Forest Red Gum (*E. tereticornis*) on the moister areas could be considered. Similarly, monitoring of regenerating species in the wet and rocky areas surrounding the dam will determine whether any plantings are required.

Zone s1 upper NW slopes: Flooded Gum upper stratum, mid-low stratum dominated by 80% Large-leaf Privet

Zone s1 upper SE slopes: upper stratum Bloodwood, mid stratum Forest Oak, ground stratum Blady Grass, Brisbane Lily, Basket Grass, Rough Maidenhair Fern, Prickly Rasp Fern with minimal exotics (5%)

Action Plan Zone s1 (Assisted Natural Regeneration with scattered in-fill plantings) Priority: Medium

Value	Objective	Performance Indicator	Actions	Area	Class & Indicative Cost/ha
Koala habitat linkage TS	Enhance existing koala habitat by removing weeds in mid and ground stratum which prevent germination of natives, particularly Eucalypts. Expand koala habitat by excluding cattle and allowing food tree species to regenerate naturally and/or in-fill with scattered plantings of Primary KFT species. Protect and expand Thorny Pea	All strata 95% natives, Eucalypt species germinating Cattle pasture replaced with natives particularly eucalypts TS patches maintained and expanded	• Establish monitoring photo points and flag known TS. • Weed control (commence SE corner via quarry vehicle track leading to the south pit working in lines downslope in a westerly direction – repeat from NW corner): Primary: Flag and hand weed/cut & paint a buffer zone around TS. Clear around other natives to prepare for drilling with generator for larger camphor & privet. Hand weed/cut & paint/overspray Lantana, cut & paint/hand-drill smaller Privet & Camphor, spot spray Mistflower, Crofton & exotic grasses but ensure fringing native vegetation is encouraged around dam to prevent cane toad access. Basal bark Guava infestations. Follow up: spot spray as required/to prevent seeding • Monitor annually after primary weed control commences *Other actions required:* o Fence off/flag dangerous old mine shaft o Install fencing/gate on western boundary to exclude cattle (approx. 360m) just prior to commencement of work. Consider using existing fencing running W-E to section off in stages. o investigate potential access to west/south zone via western neighbour o Identify eastern and northern boundaries with flagging tape o Consider scattered in-fill plantings of koala food tree species if weed control does not result in eucalypt germination	5.7ha	$14,040/ha Moderate cost category (assumed to include scattered in-fill plantings if required)

Zone s2

Closed Forest, poor condition & access although Threatened Species (TS)/Endangered Ecological Community (EEC) present, moderate-steep slopes

Location NE slopes of southern acquisition	**Topography** mod to steep slopes (10-40°), rocky	
Aspect NW to S	**Elevation** 65m to 120m	**Area** 2.4ha

Description	Closed Forest as described in the Blakebrook Quarry Ecological Site Assessment which occurs on the steeper slopes and is not suitable koala habitat (CEG,2008). Protected at State level as the EEC Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions which includes some structurally complex forms of dry rainforest associated with basalts on the North Coast foothills (ERM, 2018a). This zone comprises a rocky plateau and steep rocky slope up to the top edge of the quarry. The TS Thorny Pea (*Desmodium acanthocladum*) and Arrowhead Vine (*Tinospora tinosporoides*) occur.
Upper stratum	Exotics	
	Natives	Large emergent 40m tall Flooded Gum (*E. grandis*) and Figs (*Ficus* spp.) above rainforest species including Cudgerie (*Flindersia schottiana*), Bastard Crow's Ash (*Pentaceras australis*), Red Bean (*Dysoxylum mollissimum*) and vines Lawyer Vine (*Calamus muelleri)*, Smilax (*Smilax australis*), Water Vine (*Cissus hypoglauca*), Arrowhead Vine (*Tinospora tinosporoides*).
Mid stratum	Exotics	15-20m tall Large-leaf Privet (*Ligustrum lucidum*) occupies approx. 30 to 80% of the stratum. The edges comprise Lantana (*Lantana camara*), Camphor Laurel (*Cinnamomum camphora*), Tobacco (*Solanum mauritianum*) and Devil's Fig (*Solanum torvum*).
	Natives	Dominated by Red Kamala (*Mallotus philippensis*) with scattered Sandpaper Fig (*Ficus fraseri*), Bastard Crow's Ash (*Pentaceras australis*), Red Bean (*Dysoxylum mollissimum*), Glossy Laurel (*Cryptocarya laevigata*), Snow Wood (*Pararchidendron pruinosum*), Twin-leaf Coogera (*Arytera distylis*), Cudgerie (*Flindersia schottiana*), Bastard Crow's Ash (*Pentaceras australis*) and Cordyline (*Cordyline rubra*) with numerous vines Lawyer Vine (*Smilax australis*), Water Vine (*Cissus hypoglauca*), Arrowhead Vine (*Tinospora tinosporoides*) and Cockspur Thorn vine (*Maclura cochinchinensis*) which dominates the edges.
Ground stratum	Exotics	Generally rocky and sparse with patches of L/L Privet seedlings where cattle are less frequent and Mistflower (*Ageratina riparia*) in the moister areas.
	Natives	Extensive patches of Thorny Pea with numerous vines and Basket Grass (*Oplismenus* spp.). Regenerating Snow Wood (*Pararchidendron pruinosum*) and Cunjevoi (*Alocasia brisbanensis*) in the moister areas.

Access Poor. Generally difficult terrain of steep rocky slopes. Access on foot via either the cattle grid on the quarry access road/Zone s1 or the gate/vehicle track at the SE corner/Zone s3.

Condition and costing Invasion by L/L Privet varies from 30% to 80% of the mid stratum, at times forming a closed mid canopy with some large/tall (20m) trees (average 50%). Similarly, the understory varies from nonexistent due to cattle, to 30 to 80% to a carpet of Privet seedlings. The appropriate management class for assisted regeneration costing as described in the Lismore City Council Urban Green Corridors Plan 2017 Appendix 4 is Moderate.

Fencing is not required for this zone as the eastern and northern boundaries are too steep and rocky for cattle while the fencing to be installed on the western boundary of adjacent Zone s1 secures Zone s2. The

western/southern boundary is arbitrary and is delineated by the change in vegetation type to closed forest associated with the increase in slope.

Zone s2 Closed Forest on rocky steep slopes with numerous vines and mid stratum dominated by L/L Privet. Left: Southern slopes Cunjevoi, Glossy Laurel, mid stratum 80% Privet. Right: Northern slopes emergent Figs on rocky slope with large Lantana patches looking east up to the quarry edge.

Strategy Although Zone s2 is an EEC with good potential for assisted natural regeneration with diverse native seedlings and TS present, the priority is Low due to the terrain and condition. Privet has dominated due to its ability to germinate in low light and cattle have impacted the lower edges of the zone. Following treatment of Privet, increased light levels will result in both natives and weeds which will require frequent and regular follow-up to prevent reinfestation. Objective is to restore the EEC and protect TS by removing the weeds and cattle which destroy or degrade native flora and fauna.

Action Plan Zone s2 (Assisted Natural Regeneration) Priority: Low

Value	Objective	Performance Indicator	Actions	Area	Class & Indicative Cost/ha
EEC	Restore EEC by removing weeds (and cattle along lower edges) which prevent germination of natives. Erosion and water quality also improve.	All strata 80% natives	• Establish monitoring photo points and flag known TS • Weed control (working in lines from SE corner upslope): Primary: Flag and hand weed/cut & paint a buffer zone around TS Clear around natives, cut & paint/drill Privet & Camphor (generator required for large trees), hand weed/cut & paint/overspray Lantana and consider use of splatter gun at edges where non-target impacts low, drill or overspray Devil's Fig & Tobacco. Control native vines along the edges for access. Spot spray Mistflower & exotic grasses. Follow up: spot spray as required/to prevent seeding particularly Privet seedling carpet - ensure this is regular and frequent due to increased light levels • Monitor annually after primary weed control commences *Other actions required:* o Identify southern boundary with flagging tape	2.4ha	$14,040/ha Moderate cost category
TS	Protect and expand TS Thorny Pea and Arrowhead Vine	TS patches maintained and expanded			

On-site: Work Zones and Action Plans (34.4ha)

Zone n1

Disturbed Grassland regenerating to Tall Open Forest, flat-gentle slope, good access & condition

Location NW corner strip		**Topography** flat-gentle slope	
Aspect W to SW		**Elevation** 115m – 130m	**Area** 1ha
Description	Disturbed Grassland (possibly ex-cattle pasture) comprising approx. 1m tall Rhodes Grass (*Chloris gayana*) and Blady Grass (*Imperata cylindrica*) with regenerating natives Brushbox (*Lophostemon confertus*), Bloodwood (*Corymbia intermedia*), Macaranga (*Macaranga tanarius*) and Forest Oak (*Allocasuarina torulosa*). The western edge is dominated by similar natives in good condition with scattered clumps of exotics.		
Upper stratum	Exotics Natives	N/a N/a	
Mid stratum	Exotics Natives	Western edge: 20% scattered clumps of Lantana (*Lantana camara*), scattered 15m tall Large-leaf Privet (*Ligustrum lucidum*) and Camphor Laurel *Cinnamomum camphora*). Edges (to 15m) and scattered within grasses (to 8m): Brushbox (*Lophostemon confertus*), Bloodwood (*Corymbia intermedia*), Macaranga (*Macaranga tanarius*) and Forest Oak (*Allocasuarina torulosa*).	
Ground stratum	Exotics Natives	50% Rhodes Grass, 10% Crofton (*Ageratina adenophora*). Blady Grass.	

Access Good from vehicle tracks at north and south.

Condition and costing The overall condition of this zone is good. Although degraded by exotic Rhodes Grass, natives have been regenerating for some time and the edges are for the most part weed free. This zone is relatively easy to treat, therefore the appropriate management class for assisted regeneration costing as described in the Lismore City Council Urban Green Corridors Plan 2017 Appendix 4 is Low.

Fencing The western boundary is fenced. The northern and southern boundaries require flagging. The eastern boundary adjoins the quarry. Vehicle track and gate on northern boundary of n1/n2.

Strategy This zone of regenerating disturbed grassland acts as a buffer to the quarry and connects the northern zones to the western zones. The priority for Zone n1 is Low due to the natural regeneration process currently under way and good condition. Planting is not considered necessary, as spraying of Rhodes Grass will allow regeneration to expand.

Zone n1 Looking north from centre. Disturbed Grassland of Blady and Rhodes Grass with regenerating Forest Oak, Bloodwood, Brushbox and Macaranga.

Action Plan Zone n1 (Assisted natural regeneration) Priority: Low

Value	Objective	Performance Indicator	Actions	Area	Class & Indicative Cost/ha
Buffer to quarry and connection of northern and western zones	Encourage regenerating natives by removing competing exotic grasses to allow Open Forest to develop over time.	All strata 95% natives	• Establish monitoring photo points. • (working from the north southwards downslope): drill scattered Privet & Camphor in western edge, overspray Lantana patches, spray Rhodes Grass adjacent to natives to encourage germination • Maintain grassed areas with follow up spot spray as required to prevent weeds competing with germinating natives • Monitor annually after primary weed control commences *Other actions required/notes:* o Identify southern and northern boundaries with flagging tape	1ha	$5,400/ha Low cost category

Zone n2

Tall Open Forest - Tall Open Forest/Woodland, Core Koala Habitat, good access, moderate condition

Location north west corner of quarry		**Topography** flat to gentle slope	
Aspect		**Elevation** 117m – 120m	**Area** 2ha
Description	Tall Open Forest – Tall Open Forest/Woodland as described in the Blakebrook Quarry Ecological Site Assessment and therefore Core Koala Habitat (CEG,2008). Contains primary koala food trees Tallowwood (*E. microcorys*) in the drier areas and Forest Red Gum (*E. tereticornis*) in the moister areas with secondary food trees Swamp Box (*Lophostemon suaveolens*), Broad-leaved Apple (*Angophora subvelutina*), Broad-leaf Paperbark (*Melaleuca quinquenervia*) and White Mahogany (*E. acmenoides*) (FoK,n.d.). Bunding behind access road has resulted in moister conditions in southern areas.		
Upper stratum	Exotics	N/a	
	Natives	30m tall Tallowwood, Pink Bloodwood (*Corymbia intermedia*), White Mahogany and Broad-leaved Apple. Forest Red Gum and Cabbage Gum (*E. amplifolia*) is scattered throughout.	
Mid stratum	Exotics	20-50% woody weeds dominated by scattered clumps of Lantana (*Lantana camara*), Large-leaf Privet (*Ligustrum lucidum*) and 15m tall Camphor Laurel (*Cinnamomum camphora*) with scattered infestations of Devil's/Giant Devil's Fig/Tobacco (*Solanum torvum, S. chrysotrichum*), *S. mauritianum*) and White and Corky Passionflower Vine (*Passiflora subpeltata, P. suberosa*).	
	Natives	Dominated by rainforest pioneers/secondary species such as Red Kamala (*Mallotus philippensis*), Guioa (*Guioa semiglauca*), Sally Wattle (*Acacia melanoxylon*), Red Ash (*Alphitonia excelsa*) and Macaranga (*Macaranga tanarius*). Forest Oak (*Allocasuarina torulosa*) and Cabbage Gum (*E. amplifolia*) are scattered throughout with Broad-leaf Paperbark and Willow Bottlebrush (*Callistemon salignus*) in the moister areas. Vines include Smilax (Smilax *australis*), Water Vine (*Cissus hypoglauca*) and Cockspur Thorn (*Maclura cochinchinensis*).	
Ground stratum	Exotics	Scattered patches of Rhodes Grass (*Chloris gayana*), White and Corky Passionflower and Crofton (*Ageratina adenophora*).	
	Natives	Dominated by Blady Grass (*Imperata cylindrica*), Mat Rush (*Lomandra* spp.) and Bracken (*Pteridium esculentum*) or Swamp Foxtail in the moister areas.	

Access Excellent via vehicle tracks on the northern, eastern and southern boundaries. Vehicle track and gate on northern boundary of n1/n2.

Condition and costing The overall condition of this zone is moderate with a mosaic of relatively weed free areas interspersed with scattered clumps of woody weeds, particularly Lantana, L/L Privet and Camphor. Edge effects due to vehicle tracks have resulted in a Lantana dominated perimeter, particularly in the north. The appropriate management class for costing as described in the Lismore City Council Urban Green Corridors Plan 2017 Appendix 4 is Moderate (weeds make up 20-50% of the site in any strata).

Fencing The northern and western boundary is fenced, while the southern and eastern boundaries are delineated by vehicle tracks. Blue and white crosses on the ground are reference points for quarry aerial drone stockpile surveys.

Strategy This zone of Core Koala Habitat is in moderate condition and landscape connectivity is limited to the west. However, it also has excellent access and is adjacent to completed Zones n3 and e5. To minimise future maintenance costs, it is recommended that this zone is given a High priority. This will ensure that the north-eastern zones are completed before moving to the south and west zones. The objective is to

enhance koala habitat via assisted natural regeneration by removing the weed canopy which prevents germination of koala food trees and hinders access by koalas (Keith, 2006). Selected rainforest pioneers to be removed adjacent to eucalypts will improve light levels and eucalypt recruitment rates.

Zone n2 NW corner looking south: Tallowwood and Pink Bloodwood upper stratum, mid stratum 20-50% exotics (Lantana, Privet, Camphor and Jacaranda) with edges dominated by Devil's Fig and Lantana. Ground stratum Rhodes Grass.

Zone n2 Southern boundary track looking east. Eucalypt canopy, rainforest mid with 30% Camphor and Privet. Ground stratum Blady grass.

Action Plan Zone n2 (Assisted Natural Regeneration) Priority: High

Value	Objective	Performance Indicator	Actions	Area	Class & Indicative Cost/ha
Core Koala Habitat	Enhance koala habitat by removing weeds in mid and ground stratum which prevent germination of natives, particularly Eucalypts	All strata 95% natives, Eucalypt species germinating	• Establish monitoring photo points • Weed control (working in lines from east to west from the eastern vehicle track adjacent to completed zone n3) Primary: clear around natives, hand weed/cut & paint/overspray Lantana, cut & paint/drill Privet & Camphor & Jacaranda, cut & paint/drill or spot spray Devil's Fig, Tobacco & exotic vines. Spot spray Crofton. Follow up: spot spray as required/to prevent seeding. Remove rainforest pioneers in patches/adjacent to eucalypts to improve eucalypt recruitment. • Monitor annually after primary weed control commences *Other actions required:* o Slash vehicle trails	2 ha	$14,040/ha Moderate cost category

Zone n3

Tall Open Forest - Tall Open Forest/Woodland, Core Koala Habitat, ***Primary and Follow-up works complete***

Location northern boundary of quarry		**Topography** flat to gentle slope	
Aspect S		**Elevation** 120m – 130m	**Area** 2.9ha
Description	Tall Open Forest – Tall Open Forest/Woodland as described in the Blakebrook Quarry Ecological Site Assessment and considered Core Koala Habitat (CEG,2008). Contains primary koala food trees Tallowwood (*E. microcorys*) in the drier areas and Forest Red Gum (*E. tereticornis*) in the moister areas with secondary food trees Swamp Box (*Lophostemon suaveolens*) and White Mahogany (*E. acmenoides*) (FoK,n.d.). A stand of Native Guava (*Rhodomyrtus psidioides*) apparently not greatly impacted by Myrtle Rust (*Austropuccinia psidii*) has been reported to the Dept of Environment, Qld. Changed hydrology may account for the death of eucalypts adjacent to southern bund.		
Upper stratum	Exotics	N/a	
	Natives	Dominated by 30m tall Tallowwood and Pink Bloodwood (*Corymbia intermedia*) with scattered Forest Red Gum, White Mahogany, Swamp Box and Cabbage Gum (*E. amplifolia*).	
Mid stratum	Exotics	Prior to treatment: 20-50% woody weeds dominated by scattered clumps of Lantana (*Lantana camara*), Large-leaf Privet (*Ligustrum lucidum*) and Camphor Laurel (*Cinnamomum camphora*) with scattered infestations of Devil's/Giant Devil's Fig and Tobacco (*Solanum torvum, S. chrysotrichum, S. mauritianum*) and White and Corky Passionflower Vine (*Passiflora subpeltata, P. suberosa*). Northern boundary dominated by 80% Lantana.	
	Natives	Scattered Forest Oak (*Allocasuarina torulosa*), Willow Bottlebrush (*Callistemon salignus*) and Cabbage Gum (*E. amplifolia*) with Red Kamala (*Mallotus philippensis*), Pepperberry (*Cryptocarya obovata*), Red Ash (*Alphitonia excelsa*), Sally Wattle (*Acacia melanoxylon*), Foambark (*Jagera pseudorhus*), Native Guava, Cheese Tree (*Glochidion ferdinandi*), Prickly Alyxia (*Alyxia ruscifolia*), Macaranga (*Macaranga tanarius*) and vines Smilax (Smilax *australis*) and Cockspur Thorn (*Maclura cochinchinensis*).	
Ground stratum	Exotics	Prior to treatment: Scattered infestations of Crofton (*Ageratina adenophora*) and White and Corky Passionflower.	
	Natives	Native Geranium (Geranium solanderi), Purple Coral Pea (Hardenbergia violacea), Basket Grass (*Oplismenus* spp.), Orchids including White Fingers (*Caladenia catenate*), Mosquito (Pixie Caps) (*Acianthus fornicates*) and Green Hood (*Pterostylis* spp.). Tussock Grass (*Poa labillardierei*), Blady Grass (*Imperata cylindrica*), Bracken (*Pteridium esculentum*), Kangaroo Grass (*Themeda triandra*).	

Access Excellent via vehicle tracks on the northern, western and southern boundaries.

Condition and costing The overall condition of this zone prior to primary and follow-up treatment (now completed) was moderate with a mosaic of relatively weed free native grass patches interspersed with scattered clumps of woody weeds, particularly Lantana, L/L Privet and Camphor. Edge effects due to vehicle tracks had resulted in a Lantana dominated perimeter. The adjacent property to the north is well maintained, resulting in reduced future maintenance. The appropriate management class for costing as described in the Lismore City Council Urban Green Corridors Plan 2017 Appendix 4 was Moderate (weeds make up 20-50% of the site in any strata).

Fencing The northern boundary is fenced, while the southern, eastern and western boundaries are delineated by vehicle tracks/bunds.

Strategy The primary and follow-up work in this area of Core Koala Habitat is complete. Eucalypt germination rates have increased in response to increased light levels resulting from the removal of weeds and targeted rainforest pioneers. The objective of enhancing koala habitat via assisted natural regeneration by removing the weed canopy which prevents germination of koala food trees (Keith, 2006) and hinders access by koalas has been achieved.

Zone n3 Looking south from NW corner of zone where weed control primary and follow-up works are completed. Regenerating Tallowwood, Bracken Fern and eucalypt/rainforest mid stratum

Action Plan Zone n3 (Assisted Natural Regeneration) Priority: Completed

Value	Objective	Performance Indicator	Actions	Area	Class & Indicative Cost/ha
Core Koala Habitat	Enhance koala habitat by removing weeds in mid and ground stratum which prevent germination of natives, particularly Eucalypts	All strata 95% natives, Eucalypt species germinating	• Establish monitoring photo points • Weed control (working in lines from west to east in a southerly direction): Primary: clear around natives, hand weed/cut & paint/overspray Lantana, cut & paint/drill Privet & Camphor, cut & paint/drill or spot spray Devil's Fig, Tobacco & exotic vines. Spot spray Crofton. Follow up: spot spray as required/to prevent seeding. Remove rainforest pioneers in patches/adjacent to eucalypts to improve eucalypt recruitment. • Monitor annually after primary weed control commences *Other actions required:* o Slash vehicle trails	2.9ha	$14,040/ha Moderate cost category

Zone e5

Tall Open Forest, Core Koala Habitat, nearing completion of Primary and Follow-up works

Location eastern strip adjoining quarry	**Topography** flat-gentle slope	
Aspect E to SE	**Elevation** 120m – 150m	**Area** 10.4ha

Description	Tall Open Forest as described in the Blakebrook Quarry Ecological Site Assessment and considered Core Koala Habitat (CEG,2008). Also known as Wet Sclerophyll Forest (Keith, 2006). Contains primary koala food tree species Tallowwood (*E. microcorys*) and Forest Red Gum (*E. tereticornis*) and secondary food tree species White Mahogany (*E. acmenoides*), Brush Box (*Lophostemon confertus*) and Swamp Box (*L. suaveolens*) (FoK,n.d.). Koala scats observed at the base of a large Forest Red Gum. A stand of Native Guava (*Rhodomyrtus psidioides*) impacted by Myrtle Rust (*Austropuccinia psidii*) has been reported to the Dept of Environment, Qld. The presence of dead eucalypts may indicate Phytophthora or Mistletoe (*Amyema* spp).
Upper stratum	Exotics	N/a
	Natives	Dominated by 30m tall eucalypts Tallowwood, Pink Bloodwood (*Corymbia intermedia*) and Brush Box. Cabbage Gum (*E. amplifolia*), Forest Red Gum and White Mahogany are scattered throughout.
Mid stratum	Exotics	20-80% woody weeds (average 50%) comprising scattered clumps of Lantana (*Lantana camara*), Large-leaf Privet (*Ligustrum lucidum*) and Camphor Laurel (*Cinnamomum camphora*) with minor amounts of Devil's Fig (*Solanum torvum*), Tobacco (*Solanum mauritianum*) and White and Corky Passionflower Vine (*Passiflora subpeltata, P. suberosa*). Edges 80% Lantana.
	Natives	Sweet Pittosporum (*Pittosporum undulatum*), Mock-olive (*Notelaea longifolia*), Red Kamala (*Mallotus philippensis*), Sally Wattle (*Acacia melanoxylon*), Red Ash (*Alphitonia excelsa*), Celery Wood (*Polyscias elegans*), Native Guava, Prickly Alyxia (*Alyxia ruscifolia*), Black Plum (*Diospyros australis*), Hairy Psychotria (*Psychotria loniceroides*), Forest Oak (*Allocasuarina torulosa*), Muttonwood (*Myrsine variabilis*).
Ground stratum	Exotics	20-80% Lantana (average 50%), 20% Crofton (*Ageratina adenophora*) and Mistflower (*A. riparia*), Paspalum (*Paspalum dilatatum*) and Privet seedlings.
	Natives	Mat Rush (*Lomandra multiflora*), Blady Grass (*Imperata cylindrica*), Kangaroo Grass (*Themeda triandra*), Basket Grass (*Oplismenus* spp.), A Burrgrass (*Cenchrus robustus*), Brisbane Lily (*Proiphys cunninghamii*), Pink Hyacinth Orchid (*Dipodium punctatum*), Cockspur Flower (*Plectranthus parviflorus*), Rough Maidenhair Fern (*Adiantum hispidulum*), Prickly Rasp Fern (*Doodia aspera*), Dianella (*Dianella caerulea*), Settlers Flax (*Gymnostachys anceps***)**.

Access Excellent via vehicle tracks on the western, southern and eastern boundaries.

Condition and costing The overall condition of this zone is moderate with a mosaic of relatively weed free grassland patches interspersed with scattered clumps of woody weeds, particularly L/L Privet. Edge effects due to quarry activities and vehicle tracks have created a Lantana dominated perimeter, particularly along the western and eastern boundaries. The appropriate management class for costing as described in the Lismore City Council Urban Green Corridors Plan 2017 Appendix 4 is Moderate (weeds make up 20-50% of the site in any strata).

Fencing The eastern and northern boundary is fenced. The western boundary adjoins the main quarry and the southern boundary the south pit.

Zone e5 Prior to commencement of weed control. Tall Open Forest with Tallowwood dominated Eucalypt canopy, ground and mid stratum of 50% average exotics (scattered clumps of Lantana, Privet, Camphor) and Lantana dominated edges.

Strategy This area of Core Koala Habitat is currently being treated and the primary and follow-up work is 60% complete. Eucalypt germination rates in treated areas have increased in response to elevated light levels resulting from the removal of weeds and targeted rainforest pioneers. The objective of enhancing koala habitat via assisted natural regeneration by removing the weed canopy which prevents germination of koala food trees (Keith, 2006) is in progress.

Action Plan Zone e5 (Assisted Natural Regeneration) Priority: 60% Completed

Value	Objective	Performance Indicator	Actions	Area	Class & Indicative Cost/ha
Core Koala Habitat	Enhance koala habitat by removing weeds in mid and ground stratum which prevent germination of natives, particularly Eucalypts	All strata 95% natives, Eucalypt species germinating	• Establish monitoring photo points • Weed control (working in lines from west to east in a southerly direction): Primary: clear around natives, hand weed/cut & paint/overspray Lantana, cut & paint/drill Privet & Camphor, cut & paint/drill or spot spray Devil's Fig, Tobacco & exotic vines. Spot spray Mistflower & Paspalum. Follow up: spot spray as required/to prevent seeding. Remove rainforest pioneers in patches/adjacent to eucalypts to improve eucalypt recruitment. • Monitor annually after primary weed control commences *Other actions required:* o Slash vehicle trails	10.4ha	$14,040/ha Mod cost category

Zone w5

Closed Forest on steep rocky slopes, poor condition & access although Threatened Species (TS) /potential Endangered Ecological Community (EEC) present

Location northern slopes of western block	**Topography** mod to very steep slopes (10-40°), rocky,	
Aspect S to W	**Elevation** 70m to 110m	**Area** 3ha

Description	Steep to very steep rocky slopes of Closed Forest as described in the Blakebrook Quarry Ecological Site Assessment which is not suitable koala habitat (CEG,2008). May qualify for protection at State level as the EEC Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions. The TS Thorny Pea (*Desmodium acanthocladum*) is present.	
Upper stratum	Exotics	Stratum closed by 30-50% 10-20m tall Large-leaf Privet (*Ligustrum lucidum*) or 80-90% Camphor Laurel (*Cinnamomum camphora*) at the edges.
	Natives	Scattered 20-30m tall Brush Box (*Lophostemon confertus*), Bloodwood (*Corymbia intermedia*), Figs (*Ficus* spp.), Silky Oak (*Grevellia robusta*), Guioa (*Guioa semiglauca*), Red Kamala (*Mallotus philippensis*), Red Ash (*Alphitonia excelsa*) and Snow Wood (*Pararchidendron pruinosum*).
Mid stratum	Exotics	Rocky slopes contain 10-20% Large-leaf Privet with scattered Lantana (*Lantana camara*). Yellow Bells (*Tecoma stans*) on the exposed margins in the north.
	Natives	Scattered Native Holly (*Alchornea ilicifolia*), Rough-leaved Elm (*Aphananthe philippinensis*), Mrytle Ebony (*Diospyros pentamera*), Bolwarra (*Eupomatia laurina*), Prickly Alyxia (*Alyxia ruscifolia*) Bat's-wing Coral Tree (*Erythrina vespertilio*), Cordyline (*Cordyline* spp.), Guioa (*Guioa semiglauca*), Red Kamala (*Mallotus philippensis*) with vines Lawyer Vine (*Calamus muelleri)*, Smilax (Smilax *australis*), Water Vine (*Cissus hypoglauca*) and Cockspur Thorn (*Maclura cochinchinensis*).
Ground stratum	Exotics	Scattered L/L Privet, clumps of Crofton (*Ageratina adenophora*) on the margins in the north.
	Natives	Rocky, sparse, leaf litter with scattered patches of Rough Maidenhair Fern (*Adiantum hispidulum*) and Mat Rush (*Lomandra* spp.).

Access Poor. Generally difficult terrain of steep rocky slopes on the northern and eastern boundaries with very steep drop-off preventing easy access from the quarry. Access on foot via NW corner or via Zone w3 following primary work.

Condition and costing This zone has restoration potential with diverse natives germinating and TS, however the overall condition is poor. Invasion by L/L Privet and Camphor varies from 30% to 90% of the mid and upper stratum, often forming a closed canopy with some large/tall (20m) trees (average 50%). The rocky terrain will result in slow progress of restoration works. The appropriate management class for assisted regeneration costing as described in the Lismore City Council Urban Green Corridors Plan 2017 Appendix 4 is High.

Fencing The eastern boundary is fenced, the northern boundary borders the quarry. The southern and western boundaries are too steep and rocky for cattle and do not require fencing but flagging to identify these zone boundaries is recommended.

Strategy Due to the difficult terrain and high cost of restoration, the priority for this zone is Low. Treatment of Privet and Camphor should be staged to allow time for native replacement as increased light levels will result in both natives and weeds which will require frequent and regular follow-up.

Ideally the western block zones would be worked from north to south to prevent reinfestation from upslope but as zones lower down contain koala habitat (w1, part of w2), they have been given a higher priority. Due to the difficult terrain, this zone should be worked from the west to the east following the contours. Depending on weed control undertaken by the western neighbours, maintenance into the future may be higher than that of other zones surrounded by relatively weed free landscapes such as Zone e1.

Zone w5 Looking east from the western boundary. Steep rocky slopes with diverse natives germinating but Camphor and L/L Privet dominate the mid and upper stratum, particularly at the edges.

Action Plan Zone w5 (Assisted Natural Regeneration) Priority: Low

Value	Objective	Performance Indicator	Actions	Area	Class & Indicative Cost/ha
EEC	Restore EEC by removing weeds which prevent germination of natives. Erosion and water quality also improve.	All strata 80% natives	• Establish monitoring photo points and flag known TS • Weed control (working from west to east due to terrain): Primary: Flag and hand weed/cut & paint a buffer zone around TS Clear around natives, cut & paint/hand-drill Privet, Camphor & Lantana. Control native vine thickets. Drill or cut & paint Yellow Bells and spot spray Crofton on exposed margins. Follow up: spot spray as required/to prevent seeding - ensure this is regular and frequent due to increased light levels. • Monitor annually after primary weed control commences	3ha	$28,080/ha High cost category
TS	Protect and expand Thorny Pea (which will assist with erosion control)	TS patches maintained and expanded	*Other actions required:* o Identify southern and western boundaries with flagging tape		

Zone w6

Buffer zone: former (2007) planting, moderate condition, poor access, parts highly visible from access road

Location strip north & south of quarry access road switch back		**Topography** flat track/steep slope	
Aspect E (north of road) W (south of road)		**Elevation** 100m – 120m	**Area** 1.4ha
Description	North of the switchback, a track runs south from the diesel pump on the western side of the quarry pit prior to a steep drop-off to the switch back below. The track comprises an edge of Tall Open Forest on the western side which drops off steeply into Zone w3 with an edge of rainforest pioneers planted in 2007 on the eastern side, now regenerating with Tall Open Forest species. Additional 2007 roadside plantings border both sides of the switch back before sloping steeply up to the track/office. The Threatened Species (TS) Arrowhead Vine (*Tinospora tinosporoides*) was observed at the degraded roadside below the switch back.		
Upper stratum	Exotics	Balloon Vine is beginning to climb into the canopy south of the switch back.	
	Natives	Track: scattered 20m tall Tallowwood (*E. microcorys*), Pink Bloodwood (*Corymbia intermedia*), Brush and Swamp Box (*Lophostemon confertus/suaveolens*).	
Mid stratum	Exotics	Track & roadside: variable 30-90% 10m tall Large-leaf Privet (*Ligustrum lucidum*), Camphor Laurel (*Cinnamomum camphora*), clumps of Lantana (*Lantana camara*), Devil's Fig (*Solanum torvum*) and Yellow Bells (*Tecoma stans*).	
	Natives	Track & roadside: planted Silky Oak (*Grevellia robusta*), Yellow Tulip (*Drypetes deplanchei*), Native Frangipani (*Hymenosporum flavum*), White Aspen (*Acronychia oblongifolia*), regenerating Brush Box, Swamp Box and Pink Bloodwood with Burney Vine (*Trophis scandens*) and Arrowhead Vine.	
Ground stratum	Exotics	Track & roadside: scattered L/L Privet seedlings, patches of Rhodes Grass (*Chloris gayana*) and Crofton (*Ageratina adenophora*).	
	Natives	Track: Sparse Mat Rush (*Lomandra multiflora*).	

Access Poor: quarry pit sediment traps limit access to the north of the site from the diesel pump area only or on foot from the office to the south.

Condition and costing Due to access, scattered woody weed infestations and degraded roadside vegetation, the appropriate management class for costing as described in the Lismore City Council Urban Green Corridors Plan 2017 Appendix 4 is Moderate. Condition moderate.

Fencing Present in parts although not required due to steep drop-offs and proximity to pit and road. The southern boundary bordering Zone w4 is arbitrary and requires flagging.

Strategy This buffer zone of roadside/track degraded vegetation and regenerating former (2007) planting is a Low priority. Although it acts only as a buffer to the access road and quarry pit, a TS was observed at the highly visible roadside, which therefore takes priority over the track.

Zone w6 Degraded roadside vegetation with Arrowhead Vine.

Action Plan Zone w6 (Planting and roadside maintenance) Priority: Low

Value	Objective	Performance Indicator	Actions	Area	Class & Indicative Cost/ha
Buffer TS	Remove weeds which may be dispersed to other zones. Parts are highly visible from the quarry access road Protect and expand Arrowhead Vine	All strata 80% natives TS patches maintained and expanded	• Establish monitoring photo points • Weed control (commencing at roadside where Arrowhead Vine occurs working north on both sides of the road before progressing to the track which is accessible from the diesel pump and working south): Primary: Flag and hand weed/cut & paint a buffer zone around TS, clear around natives, hand weed/cut & paint/overspray Lantana, cut & paint/drill Privet & Camphor, cut & paint/drill or spot spray Devil's Fig, Yellow Bells & exotic vines. Spot spray Crofton, Rhodes Grass & Privet seedlings Follow up: spot spray as required/to prevent seeding. • Monitor annually after primary weed control commences *Other actions required:* o Identify southern boundary with flagging tape	1.4ha	$14,4040ha Moderate cost category

Zone s3

Tall Open Forest, Core Koala Habitat, excellent access, good condition

Location centre of south block	**Topography** flat to gentle slope	
Aspect W	**Elevation** 125m – 130m	**Area** 5ha

Description	Tall Open Forest as described in the Blakebrook Quarry Ecological Site Assessment, (Core Koala Habitat) (CEG,2008). Contains the primary koala food tree species Tallowwood (*E. microcorys*) with secondary food tree species Brush Box (*Lophostemon confertus*) and White Mahogany (*E. acmenoides*) (FoK,n.d.).	
Upper stratum	Exotics	
	Natives	Dominated by 35m tall eucalypts Tallowwood, Pink Bloodwood (*Corymbia intermedia*) and White Mahogany. Brush Box and Cabbage Gum (*E. amplifolia*) is scattered throughout.
Mid stratum	Exotics	5-30% scattered Lantana (*Lantana camara*), Large-leaf Privet (*Ligustrum lucidum*) and Camphor Laurel (*Cinnamomum camphora*).
	Natives	Sparse Eucalypt and Forest Oak (*Allocasuarina torulosa*) in the drier areas becoming rainforest dominated **i**n the moister areas with Macaranga (*Macaranga tanarius*), Brush Kurrajong (*Commersonia fraseri*), Cudgerie (*Flindersia schottiana*), Native Rosella (*Hibiscus heterophyllus*) and Willow Bottlebrush (*Callistemon salignus*).
Ground stratum	Exotics	5-30 % scattered Crofton
	Natives	Generally sparse with patches of Tussock Grass (*Poa labillardierei*), Blady Grass (*Imperata cylindrica*), Kangaroo Grass (*Themeda triandra*), Prickly Rasp Fern (*Doodia aspera*) and Lomandra (*Lomandra multiflora*).

Access Excellent access from the eastern and new northern boundary vehicle track.

Condition and costing The appropriate management class for assisted regeneration costing as described in the Lismore City Council Urban Green Corridors Plan 2017 Appendix 4 is Low (weeds make up 5-20% of the site in any strata). Condition good.

Fencing The southern boundary is fenced. Most of the eastern boundary borders the south pit apart from the far southern end which is arbitrary and adjoins Zone s4 to the east (requires flagging) while the northern portion is delineated by a vehicle track. The western boundary is fenced in the south while the northern portion does not require fencing to preclude cattle due to a change in topography to the steep and rocky terrain of Zone s2 to the west.

Strategy This zone of Core Koala Habitat is a High priority. Zone s3 provides a corridor around the south pit for koalas and other flora and fauna by linking Zone s1 (to the west) to the eastern side of the quarry which has landscape connectivity (CEG,2006). It is in good condition with excellent access and the property adjacent to the southern boundary is dominated by eucalypts. Existing fencing will result in lower costs than in other similar zones requiring fencing such as w1 and s1, but it should be commenced after the north-eastern zones are complete in order to minimise maintenance costs in future. Adjacent Zone s4 in poorer condition should be commenced following completion of Zone s3.
Existing koala habitat can be enhanced by removing the weed canopy which prevents germination of koala food trees (Keith, 2006) and hinders access by koalas.

Zone s3 Adjacent to quarry south pit: upper stratum dominated by Tallowwood and Pink Bloodwood, mid stratum of rainforest pioneers with 20% exotics (L/L Privet and Lantana)

Zone s3 Eastern boundary looking west: Tallowwood, White Mahagony upper stratum, sparse mid stratum with 10% scattered Lantana, Lomandra ground stratum.

Action Plan Zone s3 (Assisted Natural Regeneration) Priority: High

Value	Objective	Performance Indicator	Actions	Area	Class & Indicative Cost/ha
Core Koala Habitat	Enhance existing koala habitat by removing weeds in mid and ground stratum which prevent germination of natives, particularly Eucalypts	All strata 95% natives, Eucalypt species germinating	• Establish monitoring photo points • Weed control (commence at northern boundary via quarry vehicle track working in lines from west to east in a southerly direction): Primary: Hand weed/cut & paint/overspray Lantana, cut & paint/hand-drill Privet & Camphor, spot spray Crofton. Follow up: spot spray as required/to prevent seeding • Monitor annually after primary weed control commences *Other actions required:* o Identify southern portion of the eastern boundary adjoining Zone s4 with flagging tape	5ha	$5,400/ha Low cost category

Zone s4

Tall Open Forest - Tall Open Forest/Woodland, Core Koala Habitat, poor access and condition

Location Eastern portion of south block	**Topography** flat to gentle slope	
Aspect E	**Elevation** 115m – 130m	**Area** 7.3ha

Description	Tall Open Forest and Tall Open Forest/Woodland as described in the Blakebrook Quarry Ecological Site Assessment, (Core Koala Habitat) (CEG,2008). Contains the primary koala food tree species Tallowwood (*E. microcorys*) with secondary food tree species White Mahogany (*E. acmenoides*), Brush Box (*Lophostemon confertus*) and Swamp Box (*L. suaveolens*) (FoK,n.d.). The presence of dead eucalypts may indicate Phytophthora, Mistletoe (*Amyema* spp) or changed hydrology due to quarry activities. NW corner bund and soil stockpile particularly weedy. An area of former quarry disturbance on the northern boundary is regenerating with many Tallowwood, Bloodwood and Cabbage Gum (*E. amplifolia*) saplings. Mid stratum absent in parts due to past cattle grazing as evidenced by a cattle drinking trough on the eastern boundary.	
Upper stratum	Exotics	N/a
	Natives	Dominated by 35m tall Tallowwood, White Mahogany and Pink Bloodwood (*Corymbia intermedia*). Brush Box, Swamp Box and Cabbage Gum (*E. amplifolia*) are scattered throughout.
Mid stratum	Exotics	50-80% dominated by Lantana (*Lantana camara*) with scattered clumps of 15-20m tall Large-Leaf Privet (*Ligustrum lucidum*) and Camphor Laurel (*Cinnamomum camphora*). Tobacco (*Solanum mauritianum*) infestation in NW.
	Natives	Eucalypt dominated in the drier areas with Brush/Swamp Box and Forest Oak (*Allocasuarina torulosa*) becoming rainforest dominated in the moister areas with Muttonwood (*Myrsine variabilis*), Red Kamala (*Mallotus philippensis*), Sally Wattle (*Acacia melanoxylon*), Bat's-wing Coral Tree (*Erythrina vespertilio*), Native Rosella (*Hibiscus heterophyllus*), Cudgerie (*Flindersia schottiana*), Acronychia (*Acronychia pubescens, A. oblongifolia*), Mrytle Ebony (*Diospyros pentamera*) and Willow Bottlebrush (*Callistemon salignus*).
Ground stratum	Exotics	Sparse in the drier areas to infestations of 80% Crofton (*Ageratina adenophora*), 10% Setaria (*Setaria* spp.), 10% Blue Billygoat Weed (*Ageratum houstonianum*) in the moister areas.
	Natives	Open areas dominated by Blady Grass (*Imperata cylindrica*), Kangaroo Grass (*Themeda triandra*) and Tussock Grass (*Poa labillardierei*). Mat Rush (*Lomandra multiflora*), Prickly Rasp Fern (*Doodia aspera*), Purple Coral Pea (Hardenbergia violacea), Giant Moss (*Dawsonia* superba) and Basket Grass (*Oplismenus* spp.) are scattered throughout.

Access The only vehicle access is from the southern boundary vehicle track which adjoins the eastern boundary of Zone s3 and terminates at Zone s5 due to the change in topography. There is no intention at this point in time to construct a track on the western side of Zone s4 (J. Livingstone, personal communication, 14/9/18). Access by foot is possible from the old cattle run through barbed wire fencing.

Condition and costing Areas with a mid stratum almost 100% dominated by Lantana or a ground stratum by 80% Crofton are interspersed with open grassy areas which are relatively weed free resulting in an average of 50% exotics across the zone (moderate condition). The appropriate management class for assisted regeneration costing as described in the Lismore City Council Urban Green Corridors Plan 2017 Appendix 4 is Moderate (weeds make up 20-50% of the site in any strata).

Fencing The southern, eastern and northern boundaries are secured from cattle by fencing around the south block perimeter. Most of the western boundary borders the south quarry pit except for the southern portion which is an arbitrary line adjoining Zone s3 to the west requiring flagging. The northern half of the eastern boundary is adjacent to a well-maintained property and the southern half is an arbitrary line bordering Zone s5 to the east delineated by a change in topography to a steep, rocky slope.

Strategy The priority for Zone s4 is High. This zone of Core Koala Habitat links zones to the west (s1 and s3) to the eastern side of the quarry which has good landscape connectivity (CEG,2006). The property adjacent to the southern boundary appears to be dominated by eucalypts and the property to the east is well-maintained. This zone should be commenced after Zone s3 to the west which has similar vegetation in better condition. Existing koala habitat can be enhanced by removing the weed canopy which prevents germination of koala food trees (Keith, 2006) and hinders access by koalas as evidenced by the many eucalypts regenerating naturally in the disturbed and bare area on the northern boundary.

Zone s4 Willow Bottlebrush and Cabbage Gum upper stratum with mid and ground stratum 80% Crofton, Blue Billygoat and Lantana

Zone s4 Tallowwood, White Mahogany, Cabbage Gum upper stratum with mid stratum 80% Lantana

Action Plan Zone s4 (Assisted Natural Regeneration) Priority: High

Value	Objective	Performance Indicator	Actions	Area	Class & Indicative Cost/ha
Core Koala Habitat	Enhance existing koala habitat by removing weeds in mid and ground stratum which prevent germination of natives, particularly Eucalypts	All strata 95% natives, Eucalypt species germinating	• Establish monitoring photo points. • Weed control (commence at southern boundary vehicle track and work in lines from west to east in a northerly direction): Primary: Clear around natives. Hand weed/cut & paint/overspray Lantana, cut & paint/hand-drill smaller Privet & Camphor and consider generator for larger trunks, spot spray Crofton. Drill Tobacco in NW corner near bund. Follow up: spot spray as required/to prevent seeding. • Monitor annually after primary weed control commences *Other actions required:* o Identify s3/s4 boundary in the south with flagging tape o Identify western boundary with flagging tape as no new vehicle track is planned as at Sep 2018 o Treat top edge of s5 (at top of steep rocky drop-off) while working in this zone to prevent infestation downslope.	7.3ha	$14,040/ha Moderate cost category

Zone s5

Closed Forest, Endangered Ecological Community (EEC), steep rocky slope

Location SE corner of southern block	**Topography** steep slope (40-45°), rocky	
Aspect E	**Elevation** 97m to 125m	**Area** 1.4ha

Description	Closed Forest as described in the Blakebrook Quarry Ecological Site Assessment which occurs on the steeper slopes and is not suitable koala habitat (CEG,2008). Protected at State level as the EEC Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions which comprises subtropical rainforest and some related, structurally complex forms of dry rainforest associated with basalts on the North Coast foothills (ERM, 2018a).	
Upper stratum	Exotics	N/a
	Natives	Closed stratum of rainforest species Sally Wattle (*Acacia melanoxylon*), Red Kamala (*Mallotus philippensis*), Cudgerie (*Flindersia schottiana*), Teak (*Flindersia* Australia), Scrub Turpentine (*Rhodamnia rubescens*).
Mid stratum	Exotics	5-20% Large-leaf Privet (*Ligustrum lucidum*) mainly at the edges.
	Natives	Native Rosella (*Hibiscus heterophyllus*), Small-leaved Acalypha (*Acalypha capillipes*), Native Holly (*Alchornea ilicifolia*), Orange Thorn (*Citriobatus pauciflorus*), White Aspen (*Acronychia oblongifolia*), Prickly Alyxia (*Alyxia ruscifolia*), Mrytle Ebony (*Diospyros pentamera*), Pothos *(Pothos longipes)* with thickets of Water Vine (*Cissus hypoglauca*) and Burney Vine (*Trophis scandens*).
Ground stratum	Exotics	5-20% scattered L/L Privet, clumps of Crofton (*Ageratina adenophora*) mainly at the edges.
	Natives	Rocky with Bird's Nest Fern (*Asplenium australasicum*) and scattered patches of Rough Maidenhair Fern (*Adiantum hispidulum*) and Prickly Rasp Fern (*Doodia aspera*).

Access Poor. Generally difficult terrain of steep slopes. Access on foot from southern boundary vehicle track which ends at the beginning of this zone.

Condition and costing This steep rocky slope is in good condition with exotics mainly along the top edges, therefore the appropriate management class for assisted regeneration costing as described in the Lismore City Council Urban Green Corridors Plan 2017 Appendix 4 is Low.

Fencing The eastern and southern boundaries are fenced. The western boundary is arbitrary and is delineated by the change in vegetation type to closed forest associated with the steep slope.

Strategy This EEC is in good condition but due to the difficult terrain which is not koala habitat, is a Low priority. The adjacent property is also relatively weed free with low potential for reinfestation. The top edge of this zone could be treated whilst working in the adjacent zone (added to s4 Action Plan).

Zone s5 Closed Forest on steep, rocky slope in good condition with minor (5%) L/L Privet

Action Plan Zone s5 (Assisted Natural Regeneration) Priority: Low

Value	Objective	Performance Indicator	Actions	Area	Class & Indicative Cost/ha
EEC	Protect EEC by removing weeds which prevent germination of natives	All strata 80% natives	o Establish monitoring photo points o Weed control (working in lines from south to north along the contours): Primary: Clear around natives, cut & paint/drill Privet Follow up: spot spray as required/to prevent seeding o Monitor annually after primary weed control commences *Other actions required/notes:* o It is assumed that the top edge has been treated whilst working in s4 and that access is from the southern boundary track	1.4ha	$5,400/ha Low cost category

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Appendices

Appendix 1 NPWS Bush Regenerators Checklist

Source (Tweed-Byron Bush Futures Project, n.d.)

The following guidelines are derived from the relevant sections of NPWS Draft Checklist for Bush Regeneration Activities in the Habitat of Threatened Species, Endangered Populations and Endangered Ecological Communities.

Management Planning:	**yes**	**no**	**more info attached**
The proposed activities will be in accordance with a management plan or site plan (map). Please attach the plan or relevant sections of the plan or strategy to the licence application.			
The project has been discussed with the relevant Landcare coordinator. If not, provide details of any other professional advice you have sought, e.g. from a qualified bush regenerator.			
A NPWS Wildlife Atlas database search of a 5km radius of the site has been undertaken to identify threatened flora/fauna species known or likely to occur on the site.			
Prior to commencing any works on site, a permit or permission will be obtained from the relevant landowner(s) or land manager(s).			
Training and supervision:	**yes**	**no**	**more info attached**
All activities by workers will be regularly checked and approved by the co-ordinator.			
All workers will be informed of any threatened species or endangered ecological communities known from the area or which may occur in the area and the potential impacts of activities on these species/communities e.g. vines on the edge of a littoral rainforest remnant may protect the remnant from salt-bearing winds.			
All workers have adequate weed and native plant identification skills i.e. all workers can identify and differentiate between weeds and native plants that occur on the site.			
Workers will be familiar with the identifying features of threatened flora that are known or likely to occur in the project area. Where threatened species known from the area are similar to weed species, the distinguishing features between these will be understood prior to commencing the work.			
Access to site:	**yes**	**no**	**more info attached**
All vehicular access to the site will be restricted to formed roads.			
Unnecessary damage to sites will be avoided e.g. avoid working in wet weather to lessen soil compaction.			
To reduce the possibility of introducing plant diseases and weeds the following measures will be applied: (1) Secateurs will be sharp and cleaned with methylated spirits; and (2) Footwear will be cleaned of loose soil and preferably treated with bleach between sites.			
Impacts on flora:	**yes**	**no**	**more info attached**
Prior to any works being undertaken, the presence or absence of threatened flora will be determined by a thorough walking search of the area.			
All threatened flora will be tagged with highly visible flagging tape before work commences. If a number of individuals occur in a clump, the area should be marked out with flagging tape.			
Cutting or damaging of threatened flora will be avoided.			
All plants will be positively identified before they are removed (pulled, cut, poisoned etc).			
Weed removal within two metres of a threatened species will be			

undertaken by hand.			
Impacts on fauna:	**yes**	**no**	**more info attached**
All workers will be aware of any threatened fauna that are known or likely to occur on site, and the potential impacts of the proposed activities on those species.			
The habitat and refuge potential of weeds and rubbish will be considered prior to removal e.g. Lantana can provide cover for threatened fauna such as the Bush-hen. Dead Lantana and poisoned Camphor Laurels should, where possible, be left in situ.			
Weeds will be removed gradually in areas where an infestation is extensive. Ideally, 50% of weeds that may provide habitat should be left until native plant species have re-established and provide alternative refuge.			
Disturbance to, and removal of rocks, logs and other potential refuge sites will be avoided.			
A herbicide registered for use near waterways will be used within five metres of waterways.			
Herbicide spraying will be restricted to a distance greater than five metres from watercourses where threatened frogs are known or likely to occur and within a ten metre radius of records of threatened frogs.			
A buffer of one metre along other watercourses will be maintained in which no herbicide will be sprayed.			
Care will be taken to minimise disturbance to shy or cryptic species e.g. the Marbled Frogmouth roosts in vine 'curtains'.			
Care will be taken to minimise disturbance to the leaf litter layer.			
Reconstruction through revegetation: (Note - this section does not address propagation or planting of threatened species. This activity would need to be separately addressed).	**yes**	**no**	**more info attached**
Seed collection or cuttings will be from species, populations or ecological communities other than those listed as threatened (unless licensed)			
Prior to collecting any seed or cuttings permission will be obtained from the relevant landholder or manager of the site e.g. a licence is required to collect native plants on National Parks estate.			
Seed collection from any one species will be limited to less than 10% of the available crop at that site.			
Seed collection from any individual plant will be limited to less than 10% of the available crop.			
If your seed source is used by other seed collectors, has consideration been given to minimising any cumulative impacts to the source plants? Some individual plants are known as a reliable seed source and their seed is collected extensively. This may result in – (1) a reduction in genetic diversity); and (2) an impediment to the individual's natural ability to regenerate.			
When collecting propagation material from a wild population, collection will be random from as many individuals as possible across the population to ensure a representative range of genetic material is collected. Collectors will avoid selection of propagation material on the basis of physical attributes e.g. tallest, most attractive, greatest amount of seed or flowers.			
Plantings will be sourced from stock of local provenance.*			
Will propagated material collected only be used at the subject site? i.e. excess material will only be used at other sites if it meets the provenance criteria.			
(Plants are likely to be purchased from reputable commercial nurseries – appropriate seed collecting techniques assumed)			
A buffer of five metres will be maintained around all threatened plant			

specimens. Planting will only be undertaken outside this buffer. This requirement is intended to protect the roots of the threatened plant from damage or introduction of disease.			
Care will be taken to ensure that mulch does not introduce weeds or impede natural regeneration at the site.			
Care will be taken to ensure that weeds and/or *Phytophthora cinnamomi* are not introduced to a site from pots of cultivated plants.			
Consideration will be given to the possible impacts of plantings on the ecological requirements of threatened species at the site e.g. reduced light, competition, etc.			
Species will be planted within their natural habitat and range. Plantings will be guided by the plants' local habitat preferences e.g. the species used for plantings along watercourses should be those that naturally occur in that habitat in your local area.			
Herbicide use: (Note - A permit from the National Registration Authority for Agricultural and Veterinary Chemicals PO Box E240, Kingston ACT 2604 may be required for herbicide use that is not consistent with conditions specified on the label).	**yes**	**no**	**more info attached**
A buffer of two metres will be maintained around all threatened plant specimens. Herbicide use will only be undertaken outside this buffer.			
Herbicide use will cease where there are any signs of threatened species being affected by herbicide e.g. browning off, wilting or deformed growth.			
All herbicide spray operators will be capable of undertaking precise and effective weed control.			
Spray will be directed away from threatened flora.			
Herbicide will only be sprayed in suitable weather conditions when the impact of spray drift (windy) or run-off (wet) on threatened flora is minimised.			
Marker dyes e.g. white field marker' will be mixed with herbicide before use. Marker dye enables the worker to see where the spray is landing.			
Reporting and data records:	**yes**	**no**	**more info attached**
Any new records of threatened species will be provided within three months to NPWS. These records will be in a format appropriate for entry into the Wildlife Atlas, once identification of a threatened species is confirmed by a recognised authority.			

*Local provenance species should be regarded as those species propagated from material that has been collected from a natural wild population as close as possible to a site. For example, within the local catchment which may be based on a local creek.

Management Class and Cost Estimate

All cost are based on a bush regeneration cost of $360/ day (ie $45/hr), working in a team of three

This spreadsheet provides broad cost estimates only and can be used to estimate long term cost for bush regeneration labour. Costs do not include cost associated with revegetation activities.

Actual cost will vary depending on variables including cost, skills and experience of bush regenerators working at site, and the resilience of native vegetation and influence of climatic events.

Management Class	Criteria	Years till lowest level maintenance achieved	Team days per year in year 1	Person days in year 1	Year 1 cost/ha	Year 2 cost /ha	Year 3 cost/ ha	Year 4 cost / ha	Year 5/ cost /ha	Year 6 /cost/ha	year 7 cost/ ha	Year 8/ cost/ ha	Year 9 cost/ ha	Year 10 cost / ha	Total cost/ ha till maintenace level achieved	Average annual cost/ ha until maintenance level achieved
1 -Maintenance	Weeds make up <5% of site in any strata. No signifcant weed issues present on the site	0	1	3	$1,080	$1,080	$1,080	$1,080	$1,080	$1,080	$1,080	$1,080	$1,080	$1,080	$1,080	$1,080
2 -Low	Weeds make up 5-20% of site in any strata. No major vine or woody weed infestations present and good regeneration of native species.	2	3	9	$3,240	$2,160	$1,080	$1,080	$1,080	$1,080	$1,080	$1,080	$1,080	$1,080	$5,400	$2,700
3 -Moderate	Weeds make up 20-50% of site in any strata. May include isolated or scattered outbreaks of major vine, woody and ground weeds.	4	6	18	$6,480	$4,320	$3,240	$2,160	$1,080	$1,080	$1,080	$1,080	$1,080	$1,080	$14,040	$4,680
4 -High	Weeds make up >50- 80% of site occuring in any strata. Includes areas dominated by woody and vine weeds including a canopy of camphor and/or privet	6	12	36	$12,960	$4,320	$4,320	$3,240	$3,240	$2,160	$1,080	$1,080	$1,080	$1,080	$28,080	$5,616
5 -Severe	Weeds make up >80% of site occuring in all strata. Including presence of vine and woody weeds such as Maderia vine, Asparagus, Cats Claw, Ochna, Tradescantia, Privet and Camphor.	8	18	54	$19,440	$6,480	$5,400	$4,320	$3,240	$3,240	$3,240	$2,160	$1,080	$1,080	$45,360	$6,480

Primary Weed Control

Follow up weed control

Maintenance weed control

Blakebrook Quarry Bush Regeneration Plan Monitoring Addendum (Lot 201 DP 1227138)

Version 2 final

Updated to incorporate the 45ha off-site Biodiversity Offset Area

Prepared by:
Fiona Dawson
BEnvSc (SCU); BCom (AKU); CLM Cert 3&4
Friends of the Koala (Honorary Life Membership)
Under contract to Lismore City Council, July 2019

Lismore City Council acknowledges the people of the Bundjalung nation, traditional custodians of the land on which we work.

Prepared by Fiona Dawson under contract for Lismore City Council

Contents

Introduction

This Bush Regeneration Plan Monitoring Addendum updates the 2012 Bush Regeneration Monitoring guidelines encompassed within Annex E (Section 3 and Appendix 1) of the Blakebrook Quarry Biodiversity & Rehabilitation Management Plan (BRMP) (ERM, 2018a) by incorporating an additional 45ha of land acquired as an off-site Biodiversity Offset Strategy in January 2017.

Monitoring methodology

As with the Bush Regeneration Plan, this Addendum is subject to the BRMP which tends to focus on maintenance and monitoring of reconstructed areas while the Biodiversity Offset Strategy (BOS) requires the maintenance and monitoring of Offset sites (including assisted regeneration) to be integrated into the wider schedule for rehabilitation works provided in Chapter 9, 11 and 13 of the BRMP (ERM, 2018b). The BOS recommends that a suitably qualified and experienced professional be engaged to perform ongoing maintenance and monitoring including bushland rehabilitation, pest control and weed removal with relevant performance indicators for each of the management zones provided in Annex C (ERM, 2018b). All external reporting for Blakebrook Quarry will be approved by the Manager Commercial Services (ERM, 2018b).

Best practice requires adaptive management as a standard monitoring approach for any ecological restoration project (SERA, 2017). This is achieved by an independent and suitably qualified person routinely inspecting the site to identify whether restoration actions assessed against objectives and performance indicators are working or need to be modified. Photo points identified by GPS coordinates should be established in each zone prior to work commencing and taken at least annually and Daily Record Sheets should be collated from bush regenerators which are also required under the Pesticides Act (CBRS,2012b; SERA, 2017).

Accordingly, at least one galvanised star picket with zone numbered aluminium tag will be installed in each zone. A total of four photos will be taken at each point in the directions of north, south, east and west to allow comparative analysis over time and these baseline photos are provided in this document. Photo point GPS coordinates are listed in Table 1. Daily Record Sheets from bush regeneration activities are to be filed in Council's TRIM records management system and include the following: location of and area worked, weather and growing conditions; type, volume and rate of chemicals used; targeted weeds and method of herbicide application and native flora and fauna observations. These will be used to assess the effectiveness of weed control techniques and rates of recruitment of native plant species. Both photo comparison and analysis of Daily Record Sheets will inform the adaptive management approach whereby maintenance regimes can be adjusted to ensure they meet objectives and are cost-effective. Reporting will comprise comparison baseline photos and brief progress report based on the performance indicators summarised in Table 2 by work zone.

Frequency of monitoring

Section 9.3 of the BRMP recommends that photos be taken at the reference point in each zone every 6 months for the first five years then annually thereafter. Section 13 requires bi-annual reporting for the first three years following commencement of regeneration works followed by annual reporting for the following seven years (ERM, 2018a). The BRMP and all related documents are valid for a ten-year period and will be formally reviewed and updated every ten years (ERM, 2018a). Accordingly, reporting will be conducted on a bi-annual basis for the first three years following commencement of regeneration works and then annually for the following seven years

until the ten-year review. Review of the progress of bush regeneration activities and outcomes will also inform the funding cycle and it is envisaged that some years may lead to funds being underspent while others may require additional resources to meet regeneration targets.

Table 1: Photo Point Locations

Photo points	**Y coordinate**	**X coordinate**
Off-site zones		
e1a	-28.759777	153.256836
e1b	-28.75912	153.257948
e2a	-28.761461	153.256239
e2b	-28.7613	153.258824
e3a	-28.762317	153.25606
e3b	-28.762429	153.259039
e4	-28.76419	153.260051
s1a & s1b*		
s2*		
w1*		
w2a & w2b*		
w3a & w3b*		
w4	-28.764910	153.248934
On-site zones		
w6a (formerly zone 1)	-28.761216	153.250517
w5 (formerly zone 2)	-28.760116	153.2508
n1 (formerly zone 3)	-28.758166	153.2502833
n2a (formerly zone 4)	-28.756466	153.2521833
n2b (formerly zone 5)	-28.757183	153.25305
n3a (formerly zone 6)	-28.757933	153.25285
e5a (formerly zone 7)	-28.759533	153.2559333
e5b (formerly zone 8)	-28.7648	153.2539333
e5c (formerly zone 9)	-28.7666	153.253600
s5 (formerly zone10)	-28.770083	153.2541666
s4a (formerly zone 11)	-28.769933	153.2535333
S4b (formerly zone 12)	-28.76955	153.2512833
s3a (formerly zone 13)	-28.768216	153.2525166
S4c (formerly zone 14)	-28.767083	153.2553
s3b (formerly zone 15)	-28.766583	153.25235
s3c (formerly zone 16)	-28.7672	153.25095
s3d (formerly zone 17)	-28.767266	153.25075
w6b (formerly zone 18)	-28.763883	153.2497

*****_proposed locations – photos to be taken and points installed prior to commencement of works_

Map of Photo Points

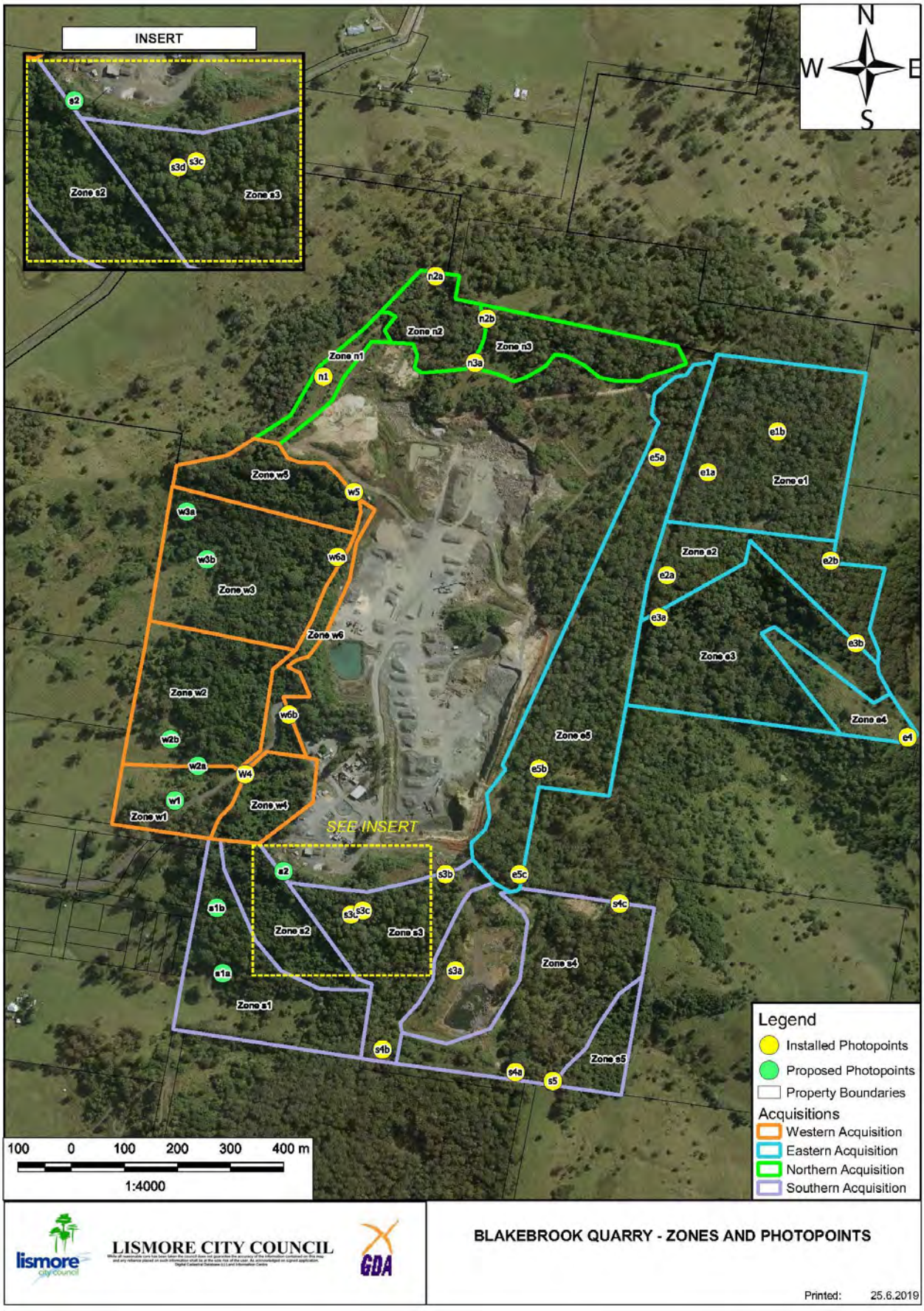


Table 2a: Off-site Performance Indicators Summary

Off-site zone	Area	Description & *timing*	Value	Objective	Performance Indicator	Actions
e1	7.8ha	Tall Open Forest, good condition *Primary & follow up complete Year 3*	Core Koala Habitat	Enhance existing koala habitat by removing weeds in mid and ground stratum which prevent germination of natives, particularly Eucalypts	All strata 95% natives, Eucalypt species germinating	• Weed control (working in lines from west to east in a southerly direction): Primary: clear around natives, hand weed/cut & paint/overspray Lantana, cut & paint/drill Privet & Camphor, cut & paint/drill or spot spray Devil's Fig, Tobacco & exotic vines. Spot spray Mistflower & Paspalum but ensure fringing native vegetation around dam is encouraged to prevent cane toad access. Follow up: spot spray as required/to prevent seeding • Remove rainforest pioneers in patches/adjacent to eucalypts to improve eucalypt recruitmente3 • Replace existing gate on western boundary for improved access • Install fencing and gate on northern boundary to exclude cattle (approx. 200m) just prior to commencement of work with wildlife friendly fencing • Control minor scattered Lantana north of new fence as gesture of good will or liaise with landowner to ensure controlled • Resolve adjoining landowner (Birney) cattle water access needs
e2	3.5ha	Tall Open Forest, poor condition *Primary & follow up complete Year 4*	Core Koala Habitat	Enhance koala habitat by removing weeds in mid and ground stratum which prevent germination of natives, particularly Eucalypts	All strata 95% natives, Eucalypt species germinating	• Weed control (working in lines from west to east in a southerly direction): Primary: clear around natives, hand weed/cut & paint/overspray Lantana, cut & paint/drill Privet & Camphor, cut & paint/drill or spot spray Devil's Fig, Tobacco & exotic vines. Spot spray Mistflower & Paspalum, including around Dam 1 but ensure fringing native vegetation is encouraged to prevent cane toad access. Follow up: spot spray as required/to prevent seeding particularly Lantana. • Remove rainforest pioneers in patches/adjacent to eucalypts to improve eucalypt recruitment • Install fencing and gate on eastern boundary track to exclude cattle (approx. 350m) just prior to commencement of work with wildlife friendly fencing • Consent from eastern neighbour (Stassi, 365 Booerie Creek Rd) for occasional vehicle access to zone via vehicle track has been granted if pre-arranged • Off-site Lantana control to the east and north of the eastern boundary track (approx. 0.5ha) as resources allow

e3	8ha	Closed Forest, poor condition *Year 11-20*	EEC TS	Restore EEC by removing cattle and weeds in mid and ground stratum which prevent germination of natives. Erosion and water quality also improve. Protect and expand Thorny Pea	All strata 80% natives TS patches maintained and expanded	• Weed control (working in lines from west to east from top of slope downwards): Primary: Flag and hand weed/cut & paint a buffer zone around TS. Clear around natives, cut & paint/drill Privet, hand weed/cut & paint/overspray Lantana, hand pull/cut & scrape or spot spray exotic vines. Spot spray Mistflower & Paspalum including perimeter of Dam 2 but ensure fringing native vegetation is encouraged to prevent cane toad access. Follow up: spot spray as required/to prevent seeding particularly Privet seedling carpet - ensure this is regular and frequent due to increased light levels • Monitor stock incursions and condition of fence on southern (485m) boundary and repair as required • Liaise with neighbouring property owners Stassi (365 Booerie Creek Rd) and Redford (289 Booerie Creek Rd) to conduct integrated weed control to prevent high maintenance costs into the future
e4	1.7ha	Disturbed grassland, poor condition *Year 11-20*	Revegetated koala habitat	Enhance koala habitat & connectivity within site & landscape by replacing Rhodes Grass with Forest Red Gum in-fill plantings	85% success rate of planted trees	• Spot spray paddock weeds but ensure fringing native vegetation is encouraged around standing water to prevent cane toad access, drill Privet & Camphor in clumps & southern fence line • Planting preparation (working in stages from SE corner): blanket spray Rhodes Grass & scattered Crofton, Devils Fig to prepare for planting but ensure fringing native vegetation is encouraged around standing water to prevent cane toad access. Consider use of slashing planting area under access permission from neighbour (as above) or blanket spray. Follow up prior to planting • Plant 100 trees @ 4-5m spacings in clumps or as scattered in-fills after brush cutting dead Rhodes Grass (water source from dam 2) • Maintain plantings and zone with follow up spot spray as required/to prevent seeding. Over time, understory will develop • Remove guards when appropriate during follow up
w1	2.3ha	Tall Open Forest, moderate condition	Core Koala Habitat	Enhance existing koala habitat by removing weeds in mid and ground stratum which prevent germination of natives, particularly Eucalypts.	All strata 95% natives, Eucalypt species germinating	• Weed control (commencing from plateau at top of slope on eastern side of quarry access road working in lines from north to south in a westerly direction across road and downslope. Install fencing before crossing road): Primary: Flag and hand weed/cut & paint a buffer zone around TS. Clear around other natives (in particular skirting around FRG to allow access for koalas) to prepare for drilling with generator for larger camphor & privet.

		Primary & follow up complete Year 8	TS	Expand koala habitat by excluding cattle and allowing Forest Red Gum and other natives to regenerate naturally. Protect and expand Thorny Pea.	Cattle pasture replaced with natives particularly Forest Red Gum TS patches maintained and expanded	Hand weed/cut & paint/overspray Lantana, cut & paint/drill smaller Privet & Camphor, cut & paint/drill or spot spray Devil's Fig, Tobacco & Crofton. Spot spray weeds in cattle pasture area particularly those adjacent to regenerating FRG. Consider staking/guarding some of the FRG seedlings to assist with monitoring progress and prevent possible wallaby damage. Follow up: spot spray as required/to prevent seeding. • Remove rainforest pioneers in patches/adjacent to eucalypts to improve eucalypt recruitment. • Identify eastern and northern boundaries with flagging tape • Ensure area below powerlines slashed (Devil's Fig infestation) • Prior to works commencing on western side of quarry road, install wildlife friendly fencing and gate on western boundary to exclude cattle (approx. 150m) using existing fencing running W-E to section off • Obtain consent for vehicle access to lower pastures from owner (McNamara, 18 Keerrong Rd) • Off-site weed control west of boundary fencing as resources allow
w2	5.4ha	Closed Forest, steep to very steep, rocky, poor condition above koala habitat on lower slopes *Year 11-20*	Koala habitat EEC TS	Expand and link koala habitat on lower slopes to Zone w1 by removing cattle and weeds. Restore degraded EEC by removing weeds which prevent germination of natives. Erosion and water quality also improve. Protect and expand Thorny Pea, Fragrant Myrtle and Arrowhead Vine.	All strata 95% natives, eucalypts regenerating naturally All strata 80% natives TS patches maintained and expanded	• Weed control (commencing on lower slopes and watercourse, proceeding east to upper rocky slopes for improved access): Primary: Flag and hand weed/cut & paint a buffer zone around TS • Clear around natives, particularly clearing around the FRG along the watercourse. Cut & paint/drill Privet & Devil's Fig, overspray Lantana, hand pull/cut & scrape or spot spray exotic vines. Spot spray Crofton adjacent to Thorny Pea patches. Follow up: spot spray as required. • Consider thinning out rainforest pioneers in patches if it will support adjacent eucalypt recruitment • Install fencing and gate on western boundary to exclude cattle (approx. 235m) just prior to commencement of work • Identify northern and southern boundaries with flagging tape • Obtain consent for vehicle access to lower pastures from owner (McNamara, 18 Keerrong Rd) • Off-site weed control west of boundary fencing as resources allow

w3	6.5ha	Closed Forest, steep to very steep, rocky, poor condition above cattle pasture on lower slopes *Year 11-20*	EEC Regenerated cattle pastures TS	Restore EEC by removing weeds which prevent germination of natives. Erosion and water quality also improve. Infestations controlled to prevent dispersal to other zones Protect and expand Thorny Pea (which will assist with erosion control) and Arrowhead Vine.	All strata 80% natives All strata 95% natives TS patches maintained and expanded	• Weed control (working from west to east due to terrain): Primary: Flag and hand weed/cut & paint a buffer zone around TS. Clear around natives, cut & paint/drill Privet, overspray Lantana, hand pull/cut & scrape or spot spray exotic vines. Spot spray Mistflower adjacent to Thorny Pea patches. Infestation in cattle pastures - basal bark Guava, overspray smaller Devil's Fig, Groundsel Bush and Crofton. Drill taller Devil's Fig. Follow up: spot spray as required/to prevent seeding particularly Privet seedling carpet - ensure this is regular and frequent due to increased light levels. Ensure infestations in cattle pastures followed up in timely manner. • Install fencing and gate on western acquisition boundary to exclude cattle (approx. 315m) just prior to commencement of work • Identify southern and northern boundaries with flagging tape • Obtain consent for vehicle access to lower pastures from owner (McNamara, 18 Keerrong Rd) • Off-site weed control west of boundary fencing as resources allow
w4	1.7ha	Degraded rocky slope and powerlines above plateau of Closed Forest *Primary & follow up complete Year 2*	EEC TS	Restore EEC by treating weed infestations and prevent dispersal to other zones. Protect and expand TS	All strata 95% natives TS maintained and expanded	• Weed control: (utilizing area under powerlines for access with general work direction north and south outwards. Zone w1 may provide access in parts). Primary: Flag and hand weed/cut & paint a buffer zone around TS. Arrowhead is entangled in Lantana below the top edge. Hand pull larger woody Coral Berry, spot spray smaller plants. Skirt the Balloon vine (spray regrowth), clear around natives, cut & paint/drill Privet, overspray Lantana. Consider use of splatter gun for Lantana on rocky slope from top edge. Overspray smaller Devil's Fig. Drill taller Devil's Fig. Follow up: spot spray as required/to prevent seeding particularly Coral Berry and Balloon Vine. Ensure powerlines slashed. • Identify western and northern boundary with flagging tape
s1	5.7ha	Tall Open Forest and Tall Open Forest/Woodland in moderate condition above degraded cattle pasture	Koala habitat linkage	Enhance existing koala habitat by removing weeds in mid and ground stratum which prevent germination of natives, particularly Eucalypts.	All strata 95% natives, Eucalypt species germinating	• Weed control (commence SE corner via quarry vehicle track leading to the south pit working in lines downslope in a westerly direction – repeat from NW corner): Primary: Flag and hand weed/cut & paint a buffer zone around TS. Clear around other natives to prepare for drilling with generator for larger camphor & privet. Hand weed/cut & paint/overspray Lantana, cut & paint/hand-drill smaller Privet & Camphor, spot spray Mistflower,

		Primary & follow up complete Year 10	TS	Expand koala habitat by excluding cattle and allowing food tree species to regenerate naturally and/or in-fill with scattered plantings of Primary KFT species. Protect and expand Thorny Pea	Cattle pasture replaced with natives particularly eucalypts TS patches maintained and expanded	Crofton & exotic grasses but ensure fringing native vegetation is encouraged around dam to prevent cane toad access. Basal bark Guava infestations. Follow up: spot spray as required/to prevent seeding • Fence off/flag dangerous old mine shaft • Install fencing/gate on western boundary to exclude cattle (approx. 360m) just prior to commencement of work. Consider using existing fencing running W-E to section off in stages. • investigate potential access to west/south zone via western neighbour • Identify eastern and northern boundaries with flagging tape • Consider scattered in-fill plantings of koala food tree species if weed control does not result in eucalypt germination
s2	2.4ha	Closed Forest, poor condition *Year 11-20*	EEC TS	Restore EEC by removing weeds (and cattle along lower edges) which prevent germination of natives. Erosion and water quality also improve. Protect and expand TS Thorny Pea and Arrowhead Vine	All strata 80% natives TS patches maintained and expanded	• Weed control (working in lines from SE corner upslope): Primary: Flag and hand weed/cut & paint a buffer zone around TS. Clear around natives, cut & paint/drill Privet & Camphor (generator required for large trees), hand weed/cut & paint/overspray Lantana and consider use of splatter gun at edges where non-target impacts low, drill or overspray Devil's Fig & Tobacco. Control native vines along the edges for access. Spot spray Mistflower & exotic grasses. Follow up: spot spray as required/to prevent seeding particularly Privet seedling carpet - ensure this is regular and frequent due to increased light levels • Identify southern boundary with flagging tape

Table 2b: On-site Performance Indicators Summary

On-site zone	Area	Description & *timing*	Value	Objective	Performance Indicator	Actions
n1	1ha	Disturbed grassland regenerating, good condition *Year 11-20*	Buffer to quarry and connection of northern and western zones	Encourage regenerating natives by removing competing exotic grasses to allow Open Forest to develop over time.	All strata 95% natives	• Weed control (working from the north southwards downslope): drill scattered Privet & Camphor in western edge, overspray Lantana patches, spray Rhodes Grass adjacent to natives to encourage germination • Maintain grassed areas with follow up spot spray as required to prevent weeds competing with germinating natives • Identify southern and northern boundaries with flagging tape
n2	2ha	Tall Open Forest – Tall Open Forest/Woodland, moderate condition *Primary & follow up complete year 1*	Core Koala Habitat	Enhance koala habitat by removing weeds in mid and ground stratum which prevent germination of natives, particularly Eucalypts	All strata 95% natives, Eucalypt species germinating	• Weed control (working in lines from east to west from the eastern vehicle track adjacent to completed zone n3) Primary: clear around natives, hand weed/cut & paint/overspray Lantana, cut & paint/drill Privet & Camphor & Jacaranda, cut & paint/drill or spot spray Devil's Fig, Tobacco & exotic vines. Spot spray Crofton. Follow up: spot spray as required/to prevent seeding. • Remove rainforest pioneers • Slash vehicle trails
n3	2.9ha	Tall Open Forest – Tall Open Forest/Woodland, moderate condition *Primary & follow up complete*	Core Koala Habitat	Enhance koala habitat by removing weeds in mid and ground stratum which prevent germination of natives, particularly Eucalypts	All strata 95% natives, Eucalypt species germinating	• Weed control (working in lines from west to east in a southerly direction): Primary: clear around natives, hand weed/cut & paint/overspray Lantana, cut & paint/drill Privet & Camphor, cut & paint/drill or spot spray Devil's Fig, Tobacco & exotic vines. Spot spray Crofton. Follow up: spot spray as required/to prevent seeding. • Remove rainforest pioneers in patches/adjacent to eucalypts to improve eucalypt recruitment • Slash vehicle trails
e5	10.4ha	Tall Open Forest, moderate condition *Primary & follow up complete year 1*	Core Koala Habitat	Enhance koala habitat by removing weeds in mid and ground stratum which prevent germination of natives, particularly Eucalypts	All strata 95% natives, Eucalypt species germinating	• Weed control (working in lines from west to east in a southerly direction): Primary: clear around natives, hand weed/cut & paint/overspray Lantana, cut & paint/drill Privet & Camphor, cut & paint/drill or spot spray Devil's Fig, Tobacco & exotic vines. Spot spray Mistflower & Paspalum. Follow up: spot spray as required/to prevent seeding. • Remove rainforest pioneers in patches/adjacent to eucalypts to improve eucalypt recruitment. • Slash vehicle trails

w5	3ha	Closed Forest, steep to very steep, rocky, poor condition *Year 11-20*	EEC TS	Restore EEC by removing weeds which prevent germination of natives, improve erosion Protect and expand Thorny Pea, improve erosion	All strata 80% natives TS patches maintained and expanded	• Weed control (working from west to east due to terrain): Primary: Flag and hand weed/cut & paint a buffer zone around TS. Clear around natives, cut & paint/hand-drill Privet, Camphor & Lantana. Control native vine thickets. Drill or cut & paint Yellow Bells and spot spray Crofton on exposed margins. Follow up: spot spray as required/to prevent seeding - ensure this is regular and frequent due to increased light levels. • Identify southern and western boundaries with flagging tape
w6	1.4ha	Former planting adjacent quarry access road, highly visible, moderate condition *Year 11-20*	Buffer to quarry and access road TS	Remove weeds which may be dispersed to other zones Protect and expand Arrowhead Vine.	All strata 80% natives TS patches maintained and expanded	• Weed control (commencing at roadside where Arrowhead Vine occurs working north on both sides of the road before progressing to the track which is accessible from the diesel pump and working south): Primary: Flag and hand weed/cut & paint a buffer zone around TS, clear around natives, hand weed/cut & paint/overspray Lantana, cut & paint/drill Privet & Camphor, cut & paint/drill or spot spray Devil's Fig, Yellow Bells & exotic vines. Spot spray Crofton, Rhodes Grass & Privet seedlings. Follow up: spot spray as required/to prevent seeding. • Identify southern boundary with flagging tape
s3	5ha	Tall Open Forest, good condition *Primary & follow up complete year 6*	Core Koala Habitat	Enhance existing koala habitat by removing weeds in mid and ground stratum which prevent germination of natives, particularly Eucalypts	All strata 95% natives, Eucalypt species germinating	• Weed control (commence at northern boundary via quarry vehicle track working in lines from west to east in a southerly direction): Primary: Hand weed/cut & paint/overspray Lantana, cut & paint/hand-drill Privet & Camphor, spot spray Crofton. Follow up: spot spray as required/to prevent seeding • Identify southern portion of the eastern boundary adjoining Zone s4 with flagging tape
s4	7.3ha	Tall Open Forest – Tall Open Forest/Woodland, moderate condition	Core Koala Habitat	Enhance existing koala habitat by removing weeds in mid and ground stratum which prevent germination of natives, particularly Eucalypts	All strata 95% natives, Eucalypt species germinating	• Weed control (commence at southern boundary vehicle track and work in lines from west to east in a northerly direction): Primary: Clear around natives. Hand weed/cut & paint/overspray Lantana, cut & paint/hand-drill smaller Privet & Camphor and consider generator for larger trunks, spot spray Crofton. Drill Tobacco in NW corner near bund. Follow up: spot spray as required/to prevent seeding. • Identify s3/s4 boundary in the south with flagging tape

		Primary & follow up complete year 7				• Identify western boundary with flagging tape as no new vehicle track is planned as at Sep 2018 • Treat top edge of s5 (at top of steep rocky drop-off) while working in this zone to prevent infestation downslope
s5	1.4ha	Closed Forest, good condition *Year 11-20*	EEC	Protect EEC by removing weeds which prevent germination of natives	All strata 80% natives	• Weed control (working in lines from south to north along the contours): Primary: Clear around natives, cut & paint/drill Privet. Follow up: spot spray as required/to prevent seeding • It is assumed that the top edge has been treated whilst working in s4 and that access is from the southern boundary track

Off-site: Work Zones Baseline Photos (45ha)

Photos source: Fiona Dawson, Dec 2018

The photos for zones e1, e2, e3, e4 and w4 were taken in December 2018 as baseline data to visually monitor the progress of regeneration works and changes in weed distribution and abundance. These zones are either complete, nearing completion or will commence in the near future as regards primary and follow-up work. The photos of the proposed photo points for the remaining offsite zones indicated on the Map of Photo Points will be taken immediately prior to the commencement of regeneration work in the zones (zone s1, s2, w1, w2, w3).

Zone e1a

North

East

South

West

Zone e1b

North

East

South

West

Zone e2a

North

East

South

West

Zone e2b

North

East

South

West

Zone e3a

North

East

South

West

Zone e3b

North

East

South

West

Zone e4

North

East

South

West

Zone w4

North

East

South

West

Zone s1 a/b, s2, w1, w2 a/b, w3 a/b

Proposed locations mapped only – photos to be taken and photo points installed prior to commencement of regeneration works

On-site: Work Zones Baseline Photos (34.4ha)

Photos source: Eco Connections, July 2012

The following photos were taken on 16 August 2012 during the installation of the photographic reference points for each zone and can be used as baseline data to visually monitoring progress of regeneration works as well as changes in weed distribution and abundance.

.

Zone n1

Location: Centrally located in zone on top of rise near western boundary

North

East

South

West

Zone n2a

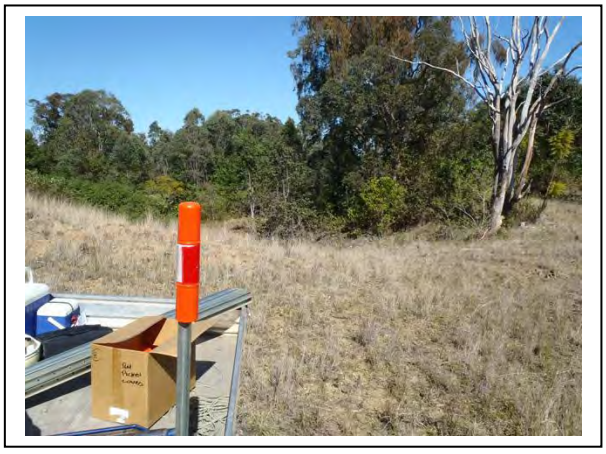
Location: In NE corner of zone on burm in machinery turnaround area.

North

N.B. Not relevant as looking into adjoining property to the north.

East

N.B. Looking along part of northern property boundary.



South

N.B. Looking into northern part of zone 5.

West

N.B. Looking along part of northern property boundary.

Zone n2b

Location: In NE corner of zone next to northern boundary.

North

N.B. Not relevant as looking into adjoining property to the north.

East

N.B. Looking into north-western corner of zone 19.

South

West

Zone n3a

Location: SW corner of zone 30m north of junction in trail.

North

East

South

West

Zone e5a

Location: SW corner of zone opposite ‘extraction pole No. 10.’

North

East

South

N.B. Not relevant as shows extraction zone

West

Zone e5b

Location: Southern boundary of zone next to T-junction in access trail.

North

East

South

West

N.B. Looking into northern portion of Zone 9

Zone e5c

Location: SE corner of zone opposite cattle yard on eastern boundary.

North

East

N.B. Not relevant as looking into adjoining property to the east.

South

West

N.B. Not relevant as looking into future southern pit (extraction zone)

Zone s3a

Location: NE corner of zone opposite the northern end of the main southern stockpile.

North

East

South

West

Zone s3b

Location: NE corner of zone 100m west of main stockpile (future southern pit) and 100m south of old explosives safe.

North

N.B. Some of this area may be within expansion area of current main pit.

East

South

N.B. Recent (16/8/12) under-scrubbing and de-grassing incursion in 'Dedicated Vegetation Protection Area'

West

Zone s3c

Location: NW corner of zone on old internal fence line next to rotted post.

North

N.B. Looking along boundary of adjacent Zones 15 & 17 to the north.

East

South

West

Zone s4a

Location: SW corner of zone immediately south of *Ficus*

North

East

South

N.B. Looking into narrow buffer of adjoining property to the south.

West

N.B. Not relevant as looking into future southern pit (extraction zone)

Zone s4b

Location: SW corner of zone 30m north of boundary gate to neighbouring property next to a small old dam at the junction of southern boundary trail.

North

N.B. Looking into buffer to future southern pit (extraction zone)

East

South

N.B. Looking into narrow buffer of adjoining property to the south.

West

N.B. Looking into south-east corner of adjoining zone 13.

Zone s4c

Location: 10m from SE boundary fence and 50m east of the south-east stockpile (completed 16/8/12).

North

East

South

West

Zone s3d

Location: Mid-eastern boundary of zone on old burnt stump 50m SE of bund wall.

North

East

N.B. Looking into adjacent zone 16.

South

West

Zone s5

Location: SW corner of zone on south east boundary fence line 100m east of the *Ficus*.

North

East
N.B. Boundary fence to right of photo.

South
N.B. Not relevant as looking into adjoining property to the east.

West
N.B. Boundary fence to left of photo.

Zone w5

Location: On edge of boundary trail 50m west of diesel tank.

North

East

South

West

Zone w6a

Location: On junction of western boundary track.

North

East

South

Zone w6b

Location: NW corner of zone on entry corner of quarry access road 100m west of office.

North

East

South

West

N.B. Looking at buffer planting completed approx. 2007.

References

Chenoweth EPLa and Bushland Restoration Services (CBRS). (2012b). *South East Queensland Ecological Restoration Framework: manual.* . Brisbane.: Prepared on behalf of SEQ Catchments and South East Queensland Local Governments.

ERM. (2018a). *Blakebrook Quarry Biodiversity & Rehabilitation Management Plan*.

ERM. (2018b). *Blakebrook Quarry Biodiversity Offset Strategy*.

SERA. (2017). National Standards for the Practice of Ecological Restoration in Australia. *Standards Reference Group SERA (2017)*. Retrieved from http://www.seraustralasia.com/standards/home.html

Annex C

Indicative Management Actions (Dawson 2018)

Offset Management Zone	Area	Value	Objective	Performance Indicator	Actions	Indicative Cost/ha
Zone e1 Assisted Regeneration	7.8 ha	Core Koala Habitat	Enhance koala habitat by removing weeds in mid and ground stratum which prevent germination of natives, particularly Eucalypts.	All strata 95% natives, Eucalypt species germinating	• Establish monitoring photo points • Weed control (working in lines from west to east in a southerly direction): • Follow up spot spray as required/to prevent seeding. • Remove rainforest pioneers in patches/adjacent to eucalypts to improve eucalypt recruitment. • Upgrade existing gate on western boundary for access • Install fencing on northern boundary to exclude cattle (approx. 200m) just prior to commencement of work with wildlife friendly fencing • Monitoring	$5400
Zone e2 Assisted Regeneration	3.5 ha	Core Koala Habitat	Enhance koala habitat by removing weeds in mid and ground stratum which prevent germination of natives, particularly Eucalypts.	All strata 95% natives, Eucalypt species germinating	• Establish monitoring photo points • Weed control (working in lines from west to east in a southerly direction): • Follow up spot spray as required/to prevent seeding. • Remove rainforest pioneers in patches/adjacent to eucalypts to improve eucalypt recruitment. • Confirm access and ensure fencing is adequate to exclude cattle • Monitoring	$14,040
Zone e3 Assisted Regeneration	8 ha	EEC Threatened Species	Restore EEC and protect TS by removing cattle and weeds in mid and ground stratum which	All strata 95% natives TS patches maintained and expanded	• Establish monitoring photo points and flag known TS • Weed control (working in lines from west to east from top of slope downwards):	$14,040

Offset Management Zone	Area	Value	Objective	Performance Indicator	Actions	Indicative Cost/ha
			prevent germination of natives. Improve erosion and water quality		• Flag and hand weed/cut & paint a buffer zone around TS • Monitor fence for cattle entry points/repairs • Monitoring	
Zone e4 Revegetation	1.7 ha	Revegetated koala habitat	Enhance koala habitat & connectivity within site & landscape by replacing Rhodes Grass with Forest Red Gum plantings in stages.	85% success planted trees	• Establish monitoring photo points. • Ensure tube stock with appropriate provenance is available for an autumn planting • Planting preparation (working in stages from NW to SE): If slashing area not possible, blanket spray Rhodes Grass & scattered Crofton, Devils Fig to prepare for staged planting. • Follow up prior to planting. • Plant @ 4-5m spacing after brush cutting dead Rhodes Grass (water available from dam 2). • Maintain plantings and zone with follow up spot spray as required/to prevent seeding. • Over time, understory will develop. • Monitoring • Remove guards when appropriate during follow up.	$5400 plus $1,500 (approx. 100 trees @ $15 per tree)
Zone w1 Assisted Regeneration	2.3 ha	Core koala habitat Threatened Flora	Enhance existing koala habitat by removing weeds in mid and ground stratum which prevent germination of natives, particularly Eucalypts. Expand koala habitat by excluding cattle and	All strata 95% natives, Eucalypt species germinating Cattle pasture replaced with natives particularly Forest Red Gum	• Establish monitoring photo points and flag known TS. • Weed control (start from plateau at top of slope on eastern side of quarry access road working in lines from north to south in a westerly direction across road and downslope): • Consider staking/guarding some of the FRG seedlings to assist with monitoring progress and preventing possible wallaby damage.	$14,040

Offset Management Zone	Area	Value	Objective	Performance Indicator	Actions	Indicative Cost/ha
			allowing Forest Red Gum and other natives to regenerate naturally. Protect and expand Thorny Pea and Fragrant Myrtle.	TS patches maintained and expanded	• Remove rainforest pioneers in patches/adjacent to eucalypts to improve eucalypt recruitment. • Install fencing on western boundary to exclude cattle (approx. 150m) using existing fencing running W-E to section off just prior to commencement of work with wildlife friendly fencing • Identify eastern and northern boundaries with flagging tape • Ensure area below powerlines slashed (Devil's Fig infestation)	
Zone w2 Assisted Regeneration	5.4 ha	Koala Habitat EEC Threatened Species	Expand and link koala habitat on lower slopes to Zone w1 by removing cattle and weeds. Restore degraded EEC by removing weeds which prevent germination of natives. Protect and expand Thorny Pea and Arrowhead Vine.	All strata 95% natives, eucalypts regenerating naturally	• Establish monitoring photo points and flag known TS • Weed control (commencing on lower slopes and watercourse, • proceeding to upper rocky slopes for improved access). • Flag and hand weed/cut & paint a buffer zone around TS. • Clear around natives, particularly clearing around the FRG along the watercourse. • Spot spray Crofton adjacent to Thorny Pea patches. • Remove rainforest pioneers in patches/adjacent to eucalypts to improve eucalypt recruitment. • Install fencing on western boundary to exclude cattle (approx. 235m) • just prior to commencement of work • Identify northern and southern boundaries with flagging tape	$28,080

Offset Management Zone	Area	Value	Objective	Performance Indicator	Actions	Indicative Cost/ha
Zone w3 Assisted Regeneration	6.5 ha	EEC Threatened Species	Restore EEC by removing weeds which prevent germination of natives. Remove weeds from cattle pastures and prevent dispersal to other zones Protect and expand Thorny Pea (which will assist with erosion control) and Arrowhead Vine.	All strata 95% natives TS patches maintained and expanded	• Establish monitoring photo points and flag known TS • Weed control (working from west to east due to terrain). • Flag and hand weed/cut & paint a buffer zone around TS • Spot spray Mistflower adjacent to Thorny Pea patches. • Install fencing on western acquisition boundary to exclude cattle (approx. 315m) just prior to commencement of work • Identify southern and northern boundaries with flagging tape	$28,080
Zone w4 Assisted Regeneration	1.7 ha	EEC Threatened Species	Restore EEC by treating weed infestations and prevent dispersal to other zones. Protect and expand threatened species	All strata 95% natives TS patches maintained and expanded	• Establish monitoring photo points and flag known TS • Flag and hand weed/cut & paint a buffer zone around TS. • Weed control • Identify western and northern boundary with flagging tape • Ensure area under powerlines is slashed	$28,080
Zone s1 Assisted Regeneration	5.7 ha	Koala habitat linkage Threatened Species	Enhance existing koala habitat by removing weeds in mid and ground stratum which prevent germination of natives, particularly Eucalypts.	All strata 95% natives, Eucalypt species germinating Cattle pasture replaced with natives	• Establish monitoring photo points and flag known TS. • Weed control (commence SE corner via quarry access track, working in lines downslope in a westerly direction – repeat from NW corner):	$14,040

Offset Management Zone	Area	Value	Objective	Performance Indicator	Actions	Indicative Cost/ha
			Expand koala habitat by excluding cattle and allowing food tree species to regenerate naturally and/or in-fill with scattered plantings of Primary KFT species. Protect and expand Thorny Pea	particularly eucalypts TS patches maintained and expanded	• Flag and hand weed/cut & paint a buffer zone around TS. • Monitoring • Fence off/flag dangerous old mine shaft • Install fencing/gate on western boundary to exclude cattle (approx. 360m) just prior to commencement of work. Consider using existing fencing running W-E to section off in stages. • Identify eastern and northern boundaries with flagging tape • Consider scattered in-fill plantings of koala food tree species if weed control does not result in eucalypt germination	
Zone s2 Assisted Regeneration	2.4 ha	EEC Threatened Species	Restore EEC and protect TS by removing weeds (and cattle along lower edges) which prevent germination of natives. Protect and expand Thorny Pea and Arrowhead Vine	All strata 95% natives TS patches maintained and expanded	• Establish monitoring photo points and flag known TS • Weed control (working in lines from southern/eastern boundary upslope) • Flag and hand weed/cut & paint a buffer zone around TS • Monitor • Identify southern boundary with flagging tape	$14,040
	45 ha					$

Source: Dawson (2018) Blakebrook Quarry Bush Regeneration Plan (Lot 201 DP 1227138)

Note: Detailed weed control actions and timing are not included as it is assumed that professional bush regenerators possess this information and plan work days in accordance with weather, seasons and specific weed requirements.

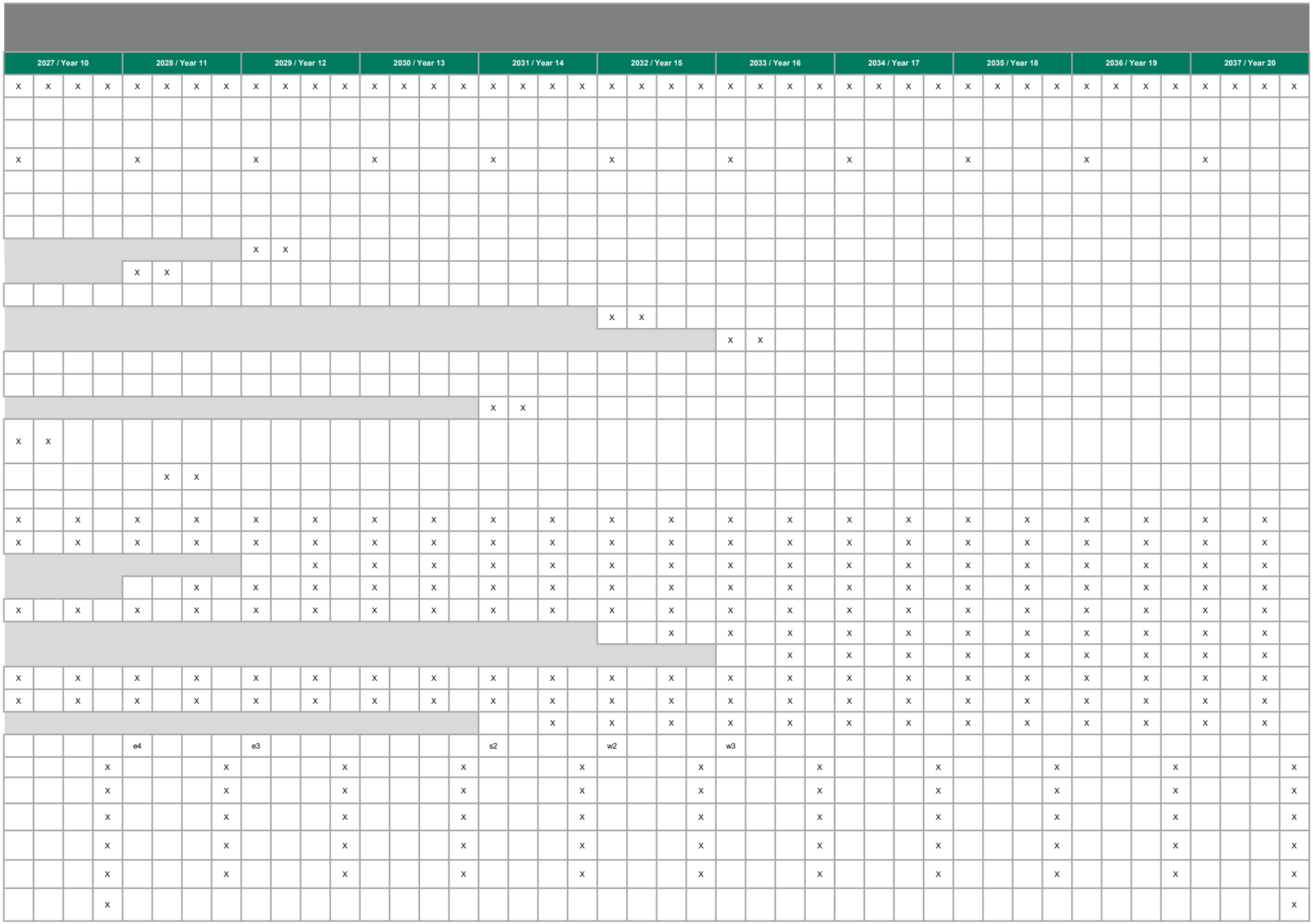
Annex D

Indicative Timetable for Implementation of the Biodiversity Offset Strategy

Blakebrook Quarry: Biodiversity Offset Strategy
Indicative Timetable

Task	2018 / Year 1				2019 / Year 2				2020 / Year 3				2021 / Year 4				2022 / Year 5				2023 / Year 6				2024 / Year 7				2025 / Year 8				2026 / Year 9			
Implement the Biodiversity Offst Strategy	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Confirm long term security for the offset area				C																																
Establish monitoring photo points in all BOS zones and flag known threatened species				X	X																															
Management of pest fauna species					X				X				X				X				X				X				X				X			
Primary weed control																																				
Zone e1 Assisted Regeneration					X	X																														
Zone e2 Assisted Regeneration									X	X																										
Zone e3 Assisted Regeneration																																				
Zone e4 Revegetation																																				
Zone w1 Assisted Regeneration																					X	X														
Zone w2 Assisted Regeneration																																				
Zone w3 Assisted Regeneration																																				
Zone w4 Assisted Regeneration					X	X																														
Zone s1 Assisted Regeneration																					X	X														
Zone s2 Assisted Regeneration																																				
Source local tubestock Zone e4. Seedlings to ordered at least six to twelve months prior to scheduled planting to ensure enough time for seed collection, propagation and hardening-off.																																				
Revegetation using native species Zone e4 (AUTUMN)																																				
Secondary and Maintenance Weed Control (or as required)																																				
Zone e1 Assisted Regeneration							X		X		X		X		X		X		X		X		X		X		X		X		X		X		X	
Zone e2 Assisted Regeneration											X		X		X		X		X		X		X		X		X		X		X		X		X	
Zone e3 Assisted Regeneration																																				
Zone e4 Revegetation																																				
Zone w1 Assisted Regeneration																							X		X		X		X		X		X		X	
Zone w2 Assisted Regeneration																																				
Zone w3 Assisted Regeneration																																				
Zone w4 Assisted Regeneration							X		X		X		X		X		X		X		X		X		X		X		X		X		X		X	
Zone s1 Assisted Regeneration																							X		X		X		X		X		X		X	
Zone s2 Assisted Regeneration																																				
Install gates, signage and fencing					e1 + w4				e2												w1 + s1															
Monitoring and maintenance of fencing and signage								X				X				X				X				X				X				X				X
Monitoring and maintenance of erosion control measures								X				X				X				X				X				X				X				X
Monitoring and maintenance of newly established native plants								X				X				X				X				X				X				X				X
Visual assessment of rehabilitation and regneration areas (photographic record at all monitoring points)								X				X				X				X				X				X				X				X
Reporting on the success of rehabilitation and regeneration works								X				X				X				X				X				X				X				X
Review of Rehabilitation, Revegetation and Biodiversity Offset Strategy Management Plan																																				

C = COMPLETE


2027 / Year 10
2028 / Year 11
2029 / Year 12
2030 / Year 13
2031 / Year 14
2032 / Year 15
2033 / Year 16
2034 / Year 17
2035 / Year 18
2036 / Year 19
2037 / Year 20
e4
e3
s2
w2
w3

Annex E

Copies of Agency Correspondence

NSW GOVERNMENT | Office of Environment & Heritage

Our Ref: DOC18/741083
Your Ref: MP 07_0020 MOD 1

Lismore City Council
PO Box 23A
Lismore NSW 2480

Attention: Ms Eleisha Went

Dear Ms Oldham

Re: Biodiversity Offset Strategy for Blakebrook Quarry

Thank you for your e-mail dated 28 September 2018 about the Biodiversity Offset Strategy and the Operational Plan/Regeneration Plan for the Blakebrook Quarry seeking comments from the Office of Environment and Heritage (OEH). I appreciate the opportunity to provide further input.

We have reviewed the draft Biodiversity Offset Strategy (BOS) Report prepared by *Environmental Resources Management Australia Pty Ltd* (ERM) (dated September 2018 – Rev 1.0 on cover, Rev 2.0 in revisions table) and the Biodiversity Offset Areas Map supplied, which is proposed as the basis for a Local Environmental Plan (LEP) amendment and re-zoning to E2 (Environmental Conservation). Based on this review, the OEH considers that, generally the Biodiversity Offset Strategy meets most of the requirements of the conditions of approval and our earlier comments.

The BOS reaffirms that the additional offset lands have been secured through acquisition by the Lismore City Council and that the land titles and associated lot and boundary consolidations have occurred and are now registered on title and in council ownership. The areas of external or additional offset appear to meet an adequate offset area ratio, the 'like for like' test, and the proximity to impact requirement, all subject to the areas being rehabilitated and effectively managed in perpetuity.

The council has indicated that its preferred option for securing these offsets is to rezone the land to E2 within 12 months. This is considered or proposed to satisfactorily secure the land for conservation.

In addition, the OEH suggests that the council should further consider changing the classification of these lands to a Community (rather than operational) categorisation, which would then require the preparation of a formal Plan of Management to provide a framework for the BOS and the implementation of a Vegetation Rehabilitation Management Plan (RVMP – Dawson *in prep*) to enable better protection from future land use change and ongoing management certainty.

The Biodiversity Offsets Area Map Figure provided is considered to satisfactorily represent the proposed change in land use zone, with the green shaded areas to be rezoned E2 at the next LEP amendment.

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The BOS mentions fencing of the property, but there is no explanation of the proposed fencing standard. Some consideration as to the type of fencing that will be provided needs to be undertaken, mindful of the threatened fauna species known or likely to utilise the area as habitat or as a movement corridor, especially given the purpose of the offset areas as habitat for iconic species such as the Koala.

Koalas are a consideration within the BOS and rehabilitation and re-plantings are proposed to be undertaken to (amongst other things) enhance the offset for a small population of the koala, already known to occupy the land, but the South East Lismore Comprehensive Koala Plan of Management (CKPoM) is not referred to directly or cited in the references of the Offset Strategy. The OEH considers that whilst the Blakebrook Quarry area is just outside the area covered by the CKPoM, the directions within that KPoM should be referred to and the actions proposed made in the BOS area and its (draft) RVMP should be made consistent with the CKPoM actions, and incorporated where possible, either in practice or longer-term principle, particularly any considerations regarding enhanced connectivity over time.

Section 3.2 of the Offset Strategy refers to the already established and dedicated vegetation protection area and divides this into three Condition/Treatment Zones A, B and C. These are not depicted in Map Figure 2 and it would improve the report if this was included on that Map figure or in an additional specific zoning map.

Further, the new offsets area is also divided into Zones E1-4, W1-4 and S1-2 of different treatment/management requirements and is depicted in Figure 4. This makes for some confusion about zones and treatments between areas. A new zone name/numbering/lettering system that better reconciles the existing and new offset areas is required, ideally with an explanatory paragraph describing these two areas and the lettering numbering system chosen (e.g. a definition of zones E, W & S). Furthermore, the BOS needs a final structural, grammatical and spelling check. For example, Tables in Section 5 are referred to as Table 4.2 and labelled as Table 4.1, whilst Table 4.2 persists in Section 4.

The OEH recommends that the council should:

1. Consider changing the classification of the land proposed to be zoned E2 from operational to community and establishing an overarching Plan of Management for the land.
2. Update the Biodiversity Offset Strategy and the Vegetation Rehabilitation Management Plan to:
    a. include fencing design specifications that are suited to the species for which the area and its purpose is designed.
    b. be consistent with the South East Lismore Comprehensive Koala Plan of Management.
    c. improve readability and consistency throughout by making structural and nomenclatural improvements.

If you have any further questions about this issue, Mr Ross Wellington, Senior Conservation Planning Officer, Conservation and Regional Delivery, OEH, can be contacted on 6640 2514 or at ross.wellington@environment.nsw.gov.au.

Yours sincerely

Dimitri Young 24 October 2018

DIMITRI YOUNG
Senior Team Leader Planning, North East Branch
Conservation and Regional Delivery

Planning Services
Resource Assessments
Contact: Jack Murphy
Phone: (02) 8217 2016
Email: jack.murphy@planning.nsw.gov.au

Ms Eleisha Went
Commercial Services Compliance Coordinator
Lismore City Council
PO Box 23A
Lismore NSW 2480

Email: eleisha.went@lismore.nsw.gov.au

Dear Ms Went,

Blakebrook Quarry Modification 1 (MP 07_0020)
Biodiversity Offset Strategy

I refer to your email dated 20 December 2018, submitting the Biodiversity Offset Strategy for Blakebrook Quarry, which has been prepared in accordance with condition 5 of Schedule 3 of MP 07_0020.

The Department considers that the document has not adequately addressed the relevant requirements of the condition. The Department's comments on this document are enclosed in **Attachment A**.

The Department requests that this document is re-submitted once these comments have been addressed, and no later than **12 February 2019**.

Should you have any enquiries in relation to this matter, please contact Jack Murphy.

Yours sincerely,

Howard Reed 15-1-19.

Howard Reed
Director
Resource Assessments
as nominee of the Secretary

Attachment A
Blakebrook Quarry – Post Approval

Biodiversity Offset Strategy – MP 07-0020 – condition 5, Schedule 3	**Satisfactory (Yes/No/Partial)**	**Comment**	**Action Required**
The Proponent must:			
(a) implement the Biodiversity Offset Strategy;	Partial	See Section 3 and Section 4 – Append or hyperlink any referenced documents e.g. Bush Regeneration Plan. So that the Biodiversity Offset Strategy may be read as a standalone document. See Section 4.2 – Please provide further details of what the on-site induction will entail or alternatively append the induction.	To note comments and amend the plan accordingly.
(b) ensure that adequate resources are dedicated towards the implementation of this strategy;	Partial	See Section 5.1 – Further details are required on how adequate resources will be ensured.	To note comments and amend the plan accordingly.
(c) provide appropriate long-term security for the offset area; and	Partial	See Section 5 – Include the final decision for the long-term security of the offset made in consultation with OEH.	To note comments and amend the plan accordingly.
(d) provide a timetable for the implementation of the offset strategy prior to 30 June 2010, or as otherwise agreed by the Secretary;	No	Please include a timetable detailing the implementation of the offset strategy.	To note comments and amend the plan accordingly.
To the satisfaction of the Secretary.			
General Comments:			
• Please append evidence of the consultation with OEH. • See Operation Overview – In the first sentence of the second paragraph “that” is repeated, please amend.			

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