MAC-ENC-PRG-007

OFFSET MANAGEMENT PROGRAM – ONSITE AND NEAR OFFSITE OFFSET AREAS

Document Owner

Edward Nock, Health, Safety and Environment Superintendent

Document Approver

Sarah Withell, Head of Health, Safety and Environment

Revision History

Version number	Date Published	Details
Version 1	12/08/14	Approved by DoE on 12/8/14
Version 2	23/06/15	Amendments following Modification Project Approval for submission to DP&E
Version 3	11/9/15	Revision incorporating MSC and DP&E comments
Version 4	12/01/18	Figure 2.1 and Table 3.2 amended to correct an error.
Version 5	23/08/18	Changes made to Year 4 rehabilitation due to drought.

bhpbilliton

resourcing the future

Planning Services
Resource Assessments
Contact: Melissa Anderson
Phone: 8275 1392
Email: Melissa.anderson@planning.nsw.gov.au

Edward Nock
HSE Superintendent
BHP – Mt Arthur Coal
PMB 8
MUSWELLBROOK NSW 2333

Dear Mr Nock

Mt Arthur Coal Mine – Open Cut Consolidation Project (MP 09_0062)
Approval of Revised Offset Management Programs

I refer to your email dated 3 August 2018, requesting a variation to the planting schedule for Thomas Mitchell Drive and Middle Deep Creek offset areas, and subsequent email of 20 August 2018 submitting the following revised documents for approval:

- Offset Management Program (OMP) – Onsite and Near Offsite Offset Areas (MAC-ENC-PRG-007), pertaining to the Thomas Mitchell Drive On-site and Off-site offset areas.
- OMP – Middle Deep Creek and Oakvale Offset Areas (MAC-ENC-PRG-008), pertaining to the Middle Deep Creek offset area.

The Department notes that both OMP's are components of the Biodiversity Management Plan (BMP) required by condition 40 of Schedule 3 of the Project Approval (MP 09_0062).

The Department has carefully reviewed the changes to the above programs and considers them acceptable given the circumstances of the request. The Department is satisfied that these changes to the OMP's continue to satisfy the requirements of MP 09_0062.

Therefore, the Secretary approves the revised OMP's.

Should you have any enquiries in relation to this matter, please contact Melissa Anderson on the details above.

Yours sincerely,

21/9/18

Megan Dawson
A/Director
Resource Assessments
as nominee of the Secretary

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1.0 Introduction

This Offset Management Program (OMP) is for Mt Arthur Coal's Onsite and Near Offsite Offset Areas (hereafter referred to as the offset and conservation areas) associated with the Mt Arthur Coal Complex. The Mt Arthur Coal Complex is located approximately five kilometres south west of the township of Muswellbrook (refer to **Figure 1.1**) and is wholly owned by Hunter Valley Energy Coal (HVEC) Pty Ltd.

The onsite and near offsite offset and conservation areas cover a combined area of approximately 4154 ha and are comprised of the areas displayed in **Table 1.1** and **Figure 1.1**. With reference to Table 1.1 and Figure 1.1 it is noted that a portion of the Saddler's Creek Conservation Area and Rehabilitation Corridor addresses the requirements of the state Project Approval only. The detailed information on the boundaries of areas under the scope of the EPBC 2011/5866 approval is contained within Preliminary Documentation provided to Department of Sustainability, Environment, Water, Population and Communities (now Department of Environment (DoE)) in December 2011 (Umwelt 2011).

Table 1.1: Offset, Conservation and Rehabilitation Areas

	Project Approval (09_0062 MOD1) (ha)	EPBC Approval (EPBC 2011/5866) (ha)	
Offset Area		**EPBC listed box Gum Woodland**	**Habitat for EPBC listed birds**
Thomas Mitchell Drive Onsite Offset Area	222	55.7	36.5
Thomas Mitchell Drive Offsite Offset Area	495	4.9	63.9 (+ 62.05 marginal)[1]
Roxburgh Road Offset Area[6]	110	0	78.0
Conservation Areas			
Mount Arthur Conservation Area	105	67.0	74.0
Saddlers Creek Conservation Area	426[4]	87.1	51.2
Rehabilitation Areas			
Box Woodland Establishment Area	500[5]	299.2	500.0
Rehabilitation Corridor	2642[3]	NA	1415[5]
Edderton Road Revegetation Area	154[2]		
Total	**4154**	**513.9**	**2280.7**

1 – Marginal habitat was given a 0.5 per ha weighting (124.1 ha x 0.5) due to the scattered nature of the canopy trees present.

2 – As detailed in the Mt Arthur Coal Modification Environmental Assessment, the Edderton Road Revegetation Area is required to contribute 154 ha in addition to the required 2642 ha of rehabilitation corridors.

3 – The 2642 ha total takes into account the current 500 ha overlap between Box Woodland Establishment Area and the Rehabilitation Corridor.

4 – This stated area of 426 ha is consistent with that detailed in the Mt Arthur Coal Modification Environmental Assessment. PA 09_0062 MOD 1 requires a minimum 131 ha size for the Saddlers Creek Conservation Area.5 – This area is a component of the overall 2642 ha rehabilitation area.

6 – This area is referred to as 'Constable Offset Area' in EPBC 2011/5866.

Mt Arthur Coal also has an additional 992 ha offset area known as Middle Deep Creek and a 253.5 ha offset area known as Oakvale Offset Area, located approximately 5 kilometres north-west of the township of Timor, NSW. A separate OMP has been prepared for Middle Deep Creek and Oakvale Offset Areas.

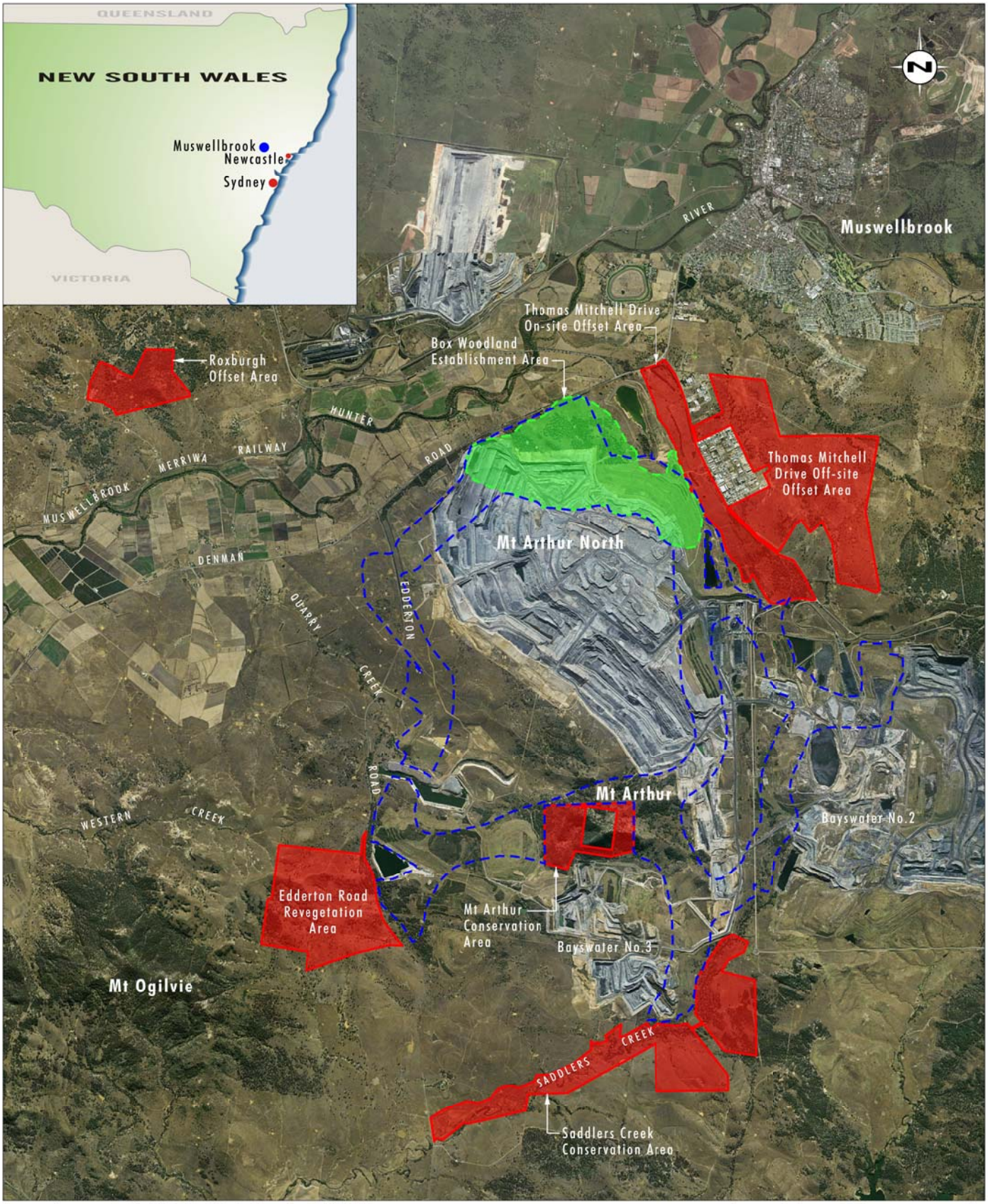

Image Source: AAM (2012), Mt Arthur Coal (2013)
Data Source: Mt Arthur Coal (2015)

0 1.0 2.0 4km
1:90 000

Legend

- Mt Arthur Coal Biodiversity Offset and Conservation Areas
- Proposed Rehabilitation Woodland Corridor
- Box Woodland Establishment Area

FIGURE 1.1

Location Plan

1.1 Background

Mt Arthur Coal's offset and conservation areas were primarily selected due to the potential for these areas to contain the White Box – Yellow Box – Blakely's Red Gum Woodland threatened ecological community (TEC) listed as an endangered ecological community (EEC) under the NSW *Threatened Species Conservation Act 1995* (TSC Act). This community is also listed as a critically endangered ecological community (CEEC) under the Commonwealth *Environment Protection and Biodiversity Conservation Act* (EPBC Act).

The offset and conservation areas were also selected based on the provision of habitat for the regent honeyeater (*Anthochaera phrygia*) (listed as critically endangered under the TSC Act and endangered under the EPBC Act) and the swift parrot (*Lathamus discolor*) (listed as endangered under the TSC Act and EPBC Act). Habitat for these species in the Hunter Valley consists of woodland and forest vegetation communities containing winter flowering Eucalyptus species such as white box (*Eucalyptus albens*) and grey box (*Eucalyptus moluccana*).

In addition to the presence of the White Box – Yellow Box – Blakely's Red Gum Woodland CEEC, the derived native grasslands present within some of the offsets were believed to be of sufficient condition to support the return of a woodland community through targeted management activities.

Detailed vegetation surveys were undertaken as part of the Baseline Ecological Study (Umwelt, 2013) of the offset and conservation areas. Since these surveys were completed, an additional 131 hectares were added to the Saddlers Creek Conservation Area. Ecological surveys of the additional area were undertaken by Hunter Eco (2013). The results of these surveys were reviewed by Umwelt and modifications to the vegetation mapping were made to reflect findings previously made by Umwelt in the adjacent areas. The key modification Umwelt made to the mapping of the additional Saddlers Creek area was the alignment of Hunter Eco's (2013) Hunter Lowland Red Gum Woodland to Hunter Floodplain Red Gum Woodland Complex. The woodland form of the Hunter Floodplain Red Gum Woodland Complex was assigned to the EEC *Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Basin Bioregions* listed under the TSC Act. Whilst this community shares a moderate proportion of characteristic species with the EEC *White Box – Yellow Box – Blakely's Red Gum Woodland* listed under the TSC Act, it has previously been determined that in adjacent areas a higher proportion of species were in common with the EEC *Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Basin Bioregions* (Umwelt, 2013). The derived native grassland form of Hunter Floodplain Red Gum Woodland Complex was assigned to the EEC *White Box – Yellow Box – Blakely's Red Gum Woodland* listed under the TSC Act and both the woodland and derived native grassland forms were assigned to the CEEC *White Box – Yellow Box – Blakely's Red Gum Woodland* listed under the EPBC Act.

1.2 Purpose and Scope

The purpose of this OMP is to describe the schedule of land management works that are to be undertaken by HVEC within the offset and conservation areas in order to fulfil the requirements of the DoE Project Approval EPBC 2011/5866 and the Department of Planning and

Environment (DP&E) Project Approval (09_0062 MOD 1). This OMP is an appendix to the Mt Arthur Coal Biodiversity Management Plan (BMP) and specifically addresses the approval conditions displayed in **Appendix 1**.

The BMP has been prepared to satisfy the ecological requirements of the DP&E Project Approval (09_0062 MOD 1) and DoE Project Approval (EPBC 2011/5866). The BMP broadly describes the ecological management strategies, procedures, controls and monitoring programs that are to be implemented for the management of flora and fauna within the Mt Arthur Coal Approved Project Disturbance Area, offset areas and conservation areas (collectively referred to as the Mt Arthur Coal Complex).

As detailed further in **Section 1.3**, both State and Federal approvals require the rehabilitation/regeneration of 2642 ha and 1915 ha of woody vegetation on open cut mining disturbed land respectively. This includes a 500 ha Regenerated Area and a 2142 ha Rehabilitation Corridor (refer to **Figure 1.1**). The BMP outlines the broad strategy for the establishment of these areas, including preliminary rehabilitation objectives.

A detailed program of rehabilitation works for these areas will be included in the Mining Operations Plan (MOP), which will be submitted for approval to the NSW Department of Trade and Investment – Resources & Energy (DRE). This MOP will incorporate the outcomes of the ecological baseline surveys and mine planning considerations, including site constraints and opportunities for native vegetation establishment. The Edderton Road property is located outside of the MOP approved disturbance area, therefore, the management actions for the establishment of 154 ha of EPBC listed bird habitat within this property are detailed within this OMP.

1.3 OMP Objectives

The primary objective of this OMP is to outline the scope of works required within the offset and conservation areas to protect and/or revegetate (or facilitate assisted natural regeneration) of areas of EPBC listed Box Gum Woodland (including Central Hunter Box – Ironbark Woodland and Hunter Floodplain Red Gum Woodland Complex), Central Hunter Ironbark – Spotted Gum – Grey Box Forest, and areas of habitat suitable for the EPBC listed regent honeyeater (*Anthochaera phrygia*) and swift parrot (*Lathamus discolor*).

The biodiversity offset strategy as required in Condition 36 of Schedule 3 of the DP&E Project Approval (09_0062 MOD 1) is displayed in **Table 1.2**. The offset strategy as required in Condition 3 of the DoE Project Approval (EPBC 2011/5866) is displayed in **Table 1.3**. The boundaries and areas referred to in this table are shown in **Figure 1.1**.

Table 1.2: Mt Arthur Coal Complex biodiversity offset requirements under the DP&E Project Approval (09_0062 MOD 1).

Name of Conservation/Offset Area	State Project Approval Minimum Size (ha)
Mount Arthur Conservation Area	105[1]
Saddlers Creek Conservation Area	426[2,4]
Thomas Mitchell Drive Offsite Offset Area	495[2]
Thomas Mitchell Drive Onsite Offset Area	222[2]
Roxburgh Road Offset Area[7]	110[2]
Oakvale Offset Area[3]	253.5[2]
Middle Deep Creek Offset Area	992[2,5]
Rehabilitation Area (including 500 ha of Box Gum Woodland)	2642[2]
Edderton Road Revegetation Area[6]	154[2]
Total	**5399.5**

Notes:

1 – Existing vegetation

2 – Existing vegetation and vegetation to be established

3 – Referred to in Project Approval 09_0062 MOD 1 as the 'Additional Off-site Offset Area' (to be identified under Schedule 3 Condition 37) and offset area approved as 253.5 ha.

4 – Minimum size of this offset area has been corrected from PA 09_0062 MOD 1 to reflect the revised minimum area as detailed in the Mt Arthur Coal Modification Environmental Assessment.

5 – Minimum size of this offset area has been corrected from PA 09_0062 MOD 1 to reflect the actual area of this property.

6 – Edderton Road Revegetation Area is required to contribute 154 ha in addition to the required 2642 ha of rehabilitation corridors.

7 – This area is referred to as 'Constable Offset Area' in EPBC 2011/5866.

Table 1.3: Mt Arthur Coal Complex biodiversity offset requirements under DoE Project Approval (EPBC 2011/5866)

Offset/Conservation Area	EPBC Approval 30 April 2012		Current Status	
	EPBC listed Box Gum Woodland[1]	Habitat for EPBC listed birds	EPBC listed Box Gum Woodland[1]	Habitat for EPBC listed birds
Mount Arthur Conservation Area[2]	67	74	21.4	68.1
Saddler's Creek Conservation Area	87.1	51.2	54.8[5]	54.8[5]
Thomas Mitchell Drive Off-site Offset Area	4.9	63.9 + 62.05 marginal[3]	32.9	77.2 + 119 marginal[3]
Thomas Mitchell Drive On-site Offset Area	55.7	36.5	35.3	58.8
Roxburgh Road Offset Area[6]	0	78	N/A	78.5
Middle Deep Creek Offset Area	493	373	357.3	356.5
Total	**707.7**	**738.7**	**501.7**	**812.9**
Proposed Regeneration				
Box Woodland Establishment Area	299.2	500	N/A	
Rehabilitation Corridors		1415	N/A	61[4]+ 55 marginal[4]
Total	**299.2**	**1915**		**116**

Notes:

1 – Refers to 'State 1' vegetation as detailed within **Section 1.5** of the OMP.

2 – The DoE approval conditions relating to area of EPBC listed woodland and habitat were developed prior to the completion of detailed mapping of the vegetation within the offset and conservation areas. Since the completion of detailed vegetation mapping, (Umwelt, 2013) it has been revealed that it will not be possible to achieve 67 ha of EPBC listed Box Gum Woodland within the Mt Arthur Conservation Area. The shortfall in this area (approximately 46 ha) will be covered within the Thomas Mitchell On-site Offset Area (refer to **Table 1.4** and **Table 1.5**).

3 – Marginal habitat was given a 0.5 per ha weighting (124.1 ha x 0.5) due to the scattered nature of the canopy trees present.

4 – Only Edderton Road was considered in this calculation due to the potential for disturbance by mining operations of other areas of the Rehabilitation Corridors.

5 – Includes 9 ha of 'State 1' vegetation in additional areas of Saddlers Creek Conservation Area outside the boundaries of areas under the scope of the EPBC 2011/5866 approval as contained within Preliminary Documentation.

6 - This area is referred to as 'Constable Offset Area' in EPBC 2011/5866.

As outlined within both the DP&E and EPBC approval conditions and displayed in **Table 1.2** and **Table 1.3**, HVEC are required to revegetate 2642 ha and 1915 ha of rehabilitation corridors respectively. In addition to the 500 ha Box Woodland Establishment Area (refer to **Figure 1.1**), the EPBC approval conditions state that the remaining 1415 of rehabilitation corridors are to be composed of the following areas:

- Woodland corridors (1005 ha);
- Edderton Road revegetation area (154 ha);
- Regeneration corridors (45 ha); and
- Rehabilitation areas (211 ha).

The vegetation within these areas is to be composed of habitat that is suitable for the regent honey-eater and swift parrot.

As displayed in **Table 1.3** the EPBC approval target for listed Box Gum Woodland within the Middle Deep Creek Offset Area is 493 ha and habitat for EPBC listed birds is required to be 373 ha. Therefore the area of EPBC listed Box Gum Woodland required by EPBC 2011/5866 within the on-site and near offsite offset and conservation areas is 214.7 ha (707.7 ha minus 493 ha). The area of habitat for EPBC listed birds required by EPBC 2011/5866 within the on-site and near offsite offset and conservation areas is 365.7 ha (738.7 ha minus 373 ha).

Detailed vegetation surveys were undertaken for the Baseline Ecological Study (Umwelt, 2013), and a review was undertaken by Umwelt of the subsequent surveys undertaken by Hunter Eco (2013) in the additional areas of the Saddlers Creek Conservation Area. The current vegetation within the onsite and near offsite offset and conservation areas provides adequate habitat for EPBC listed birds (456 ha), however there is a lack of EPBC listed bird habitat within the rehabilitation corridors, primarily due to fact that these areas are yet to be mined and/or rehabilitated. The rehabilitation strategy for these corridors is detailed within the MOP.

The Baseline Ecological Study (Umwelt, 2013) field surveys have identified approximately 144 ha of EPBC listed Box Gum Woodland within the onsite and near offsite offset and conservation areas that is considered to be in State 1 condition under the Rawlings *et al*. (2010) State and Transition Model (refer to **Section 1.4**). Approximately 9.3 hectares of State 1 EPBC listed Box Gum Woodland was identified in the additional areas of Saddlers Creek Conservation Area following a review of the field surveys completed by Hunter Eco (2013). In order to achieve the EPBC approval target for listed Box Gum Woodland (total of 707.7 ha within all offset and conservation areas, including Middle Deep Creek Offset Area) a further 79 ha of Box Gum Woodland is to be managed in the onsite and near offsite offset and conservation areas (excluding additional areas of Saddlers Creek Conservation Area) to achieve State 1 condition (**Table 1.4**).

In addition to the above, Condition 38 of Schedule 3 of PA 09_0062 MOD1 states that HVEC shall ensure that the offset strategy and/or rehabilitation strategy is focused on the re-establishment of:

- Significant and/or threatened plant communities, including:
  - Upper Hunter White Box – Ironbark Grassy Woodland;
  - Central Hunter Box – Ironbark Woodland;
  - Central Ironbark – Spotted Gum – Grey Box Forest;
  - Narrabeen Footslopes Slaty Box Woodland;
  - Hunter Floodplain Red Gum Woodland Complex;
  - White Box Yellow Box Blakely's Red Gum Woodland;
  - Hunter Lowlands Red Gum Forest; and
- Significant and/or threatened plant species including:
  - River Red Gum (*Eucalyptus camaldulensis*)

  - Pine Donkey Orchid (*Diuris tricolor*)
  - Tiger Orchid (*Cymbidium canaliculatum*);
  - Weeping Myall (*Acacia pendula*); and
- Habitat for significant and/or threatened animal species.

It should be noted that the Baseline Ecological Study (Umwelt, 2013) has mapped areas dominated by grey/white box hybrids (*Eucalyptus albens x moluccana*) and/or narrow-leaved ironbark (*Eucalyptus crebra*) as MU10 Central Hunter Box – Ironbark Woodland (according to Peake 2006), and not MU11 Upper Hunter White Box – Ironbark Grassy Woodland. MU 10 Central Hunter Box – Ironbark Woodland was a better floristic match than the closely related MU11 Upper Hunter White Box – Ironbark Grassy Woodland for the vegetation present in the Mt Arthur Coal biodiversity offset and conservation areas.

As mentioned above, Condition 38 of Schedule 3 of PA 09_0062 MOD1 state that the offset and /or rehabilitation strategy should focus on the establishment of MU11 Upper Hunter White Box – Ironbark Grassy Woodland, however the establishment of MU10 Central Hunter Box – Ironbark Woodland will satisfy this requirement. This is based on the fact that these two communities are floristically very similar and even grade into one another in the Muswellbrook area (Peake 2006). In some instances where these two communities grade into one another, the site-specific vegetation could arguably be attributed to either community (Peake 2006). It should also be noted that the Narrabeen Footslopes Slaty Box Woodland community was not recorded within the offset and conservation areas during the Baseline Ecological Study (Umwelt, 2013).

1.4 Preliminary Condition Improvement Targets

Rawlings *et al*. (2010) State and Transition Model splits the Box Gum Woodland into five condition states based on a range of condition and land use benchmarks. The definition of each state classification is contained within **Section 4.0** of the BMP.

The State and Transition Model has been used to determine the current condition and, hence, the intensity of revegetation works that will be required within the offset and conservation areas to achieve the DoE project approval conditions in relation to EPBC listed Box Gum Woodland. Detailed descriptions of the current condition each state recorded within the offset and conservation areas are contained within **Section 4.4** of the Baseline Ecological Study (Umwelt 2013). Although developed primarily as an assessment tool for the condition of box gum grassy woodlands it is considered that the State and Transition Model principals are applicable to the remaining vegetation communities within the offset and conservation areas. **Figures 1.2** to **1.5** display the current extent of each state within the offset and conservation areas, including the extent and condition of EPBC listed vegetation (refer to **Table 1.4**).

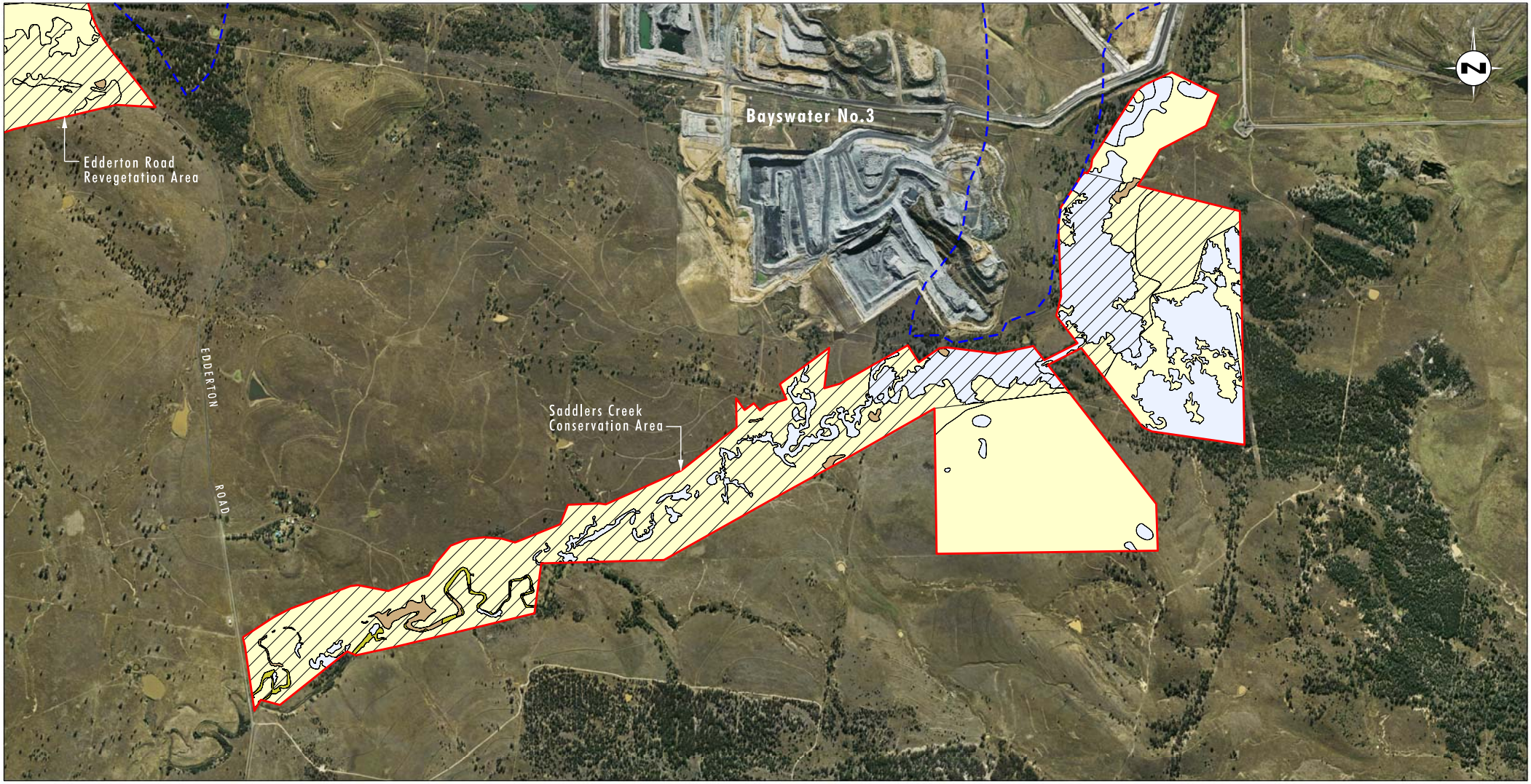

Image Source: Mt Arthur Coal (2013)
Data Source: Mt Arthur Coal (2015)

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Legend

- Mt Arthur Coal Biodiversity Offset and Conservation Areas
- Box Gum Woodland CEEC
- Proposed Rehabilitation Woodland Corridor
- Condition State Not Applicable
- State 1
- State 2
- State 3

FIGURE 1.2

Current Condition of Existing Vegetation Saddlers Creek Conservation Area

File Name (A4): 3113_166.dgn
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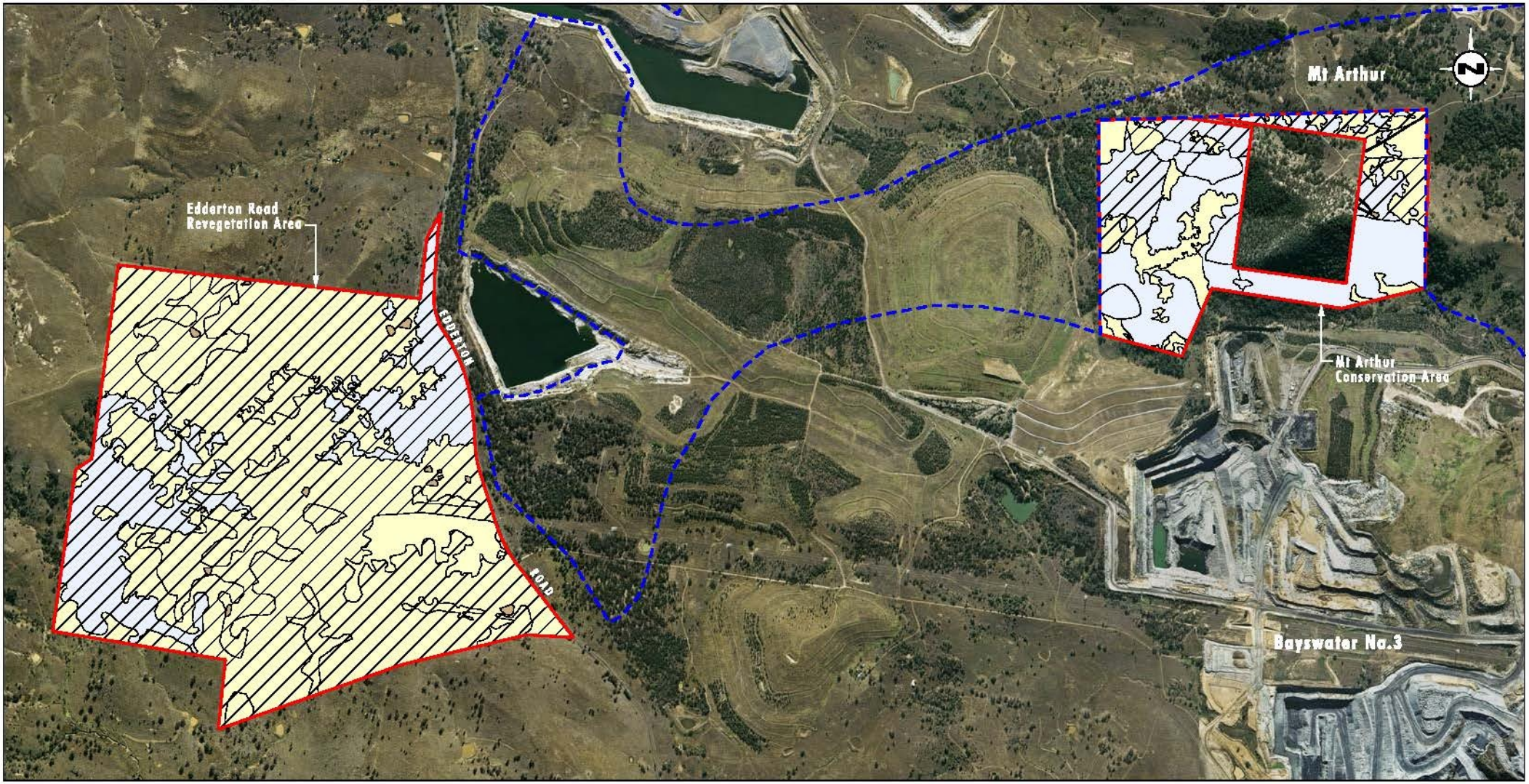

Image Source: Mt Arthur Coal (2013)
Data Source: Umwelt (2013)

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Legend

- Mt Arthur Coal Biodiversity Offset and Conservation Areas
- Proposed Rehabilitation Woodland Corridor
- Condition State Not Applicable
- State 1
- State 2
- Box Gum Woodland CEEC

File Name (A4): R10/3113_094.dgn
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FIGURE 1.3

Current Condition of Existing Vegetation Edderton Road Revegetation Area and Mt Arthur Conservation Area

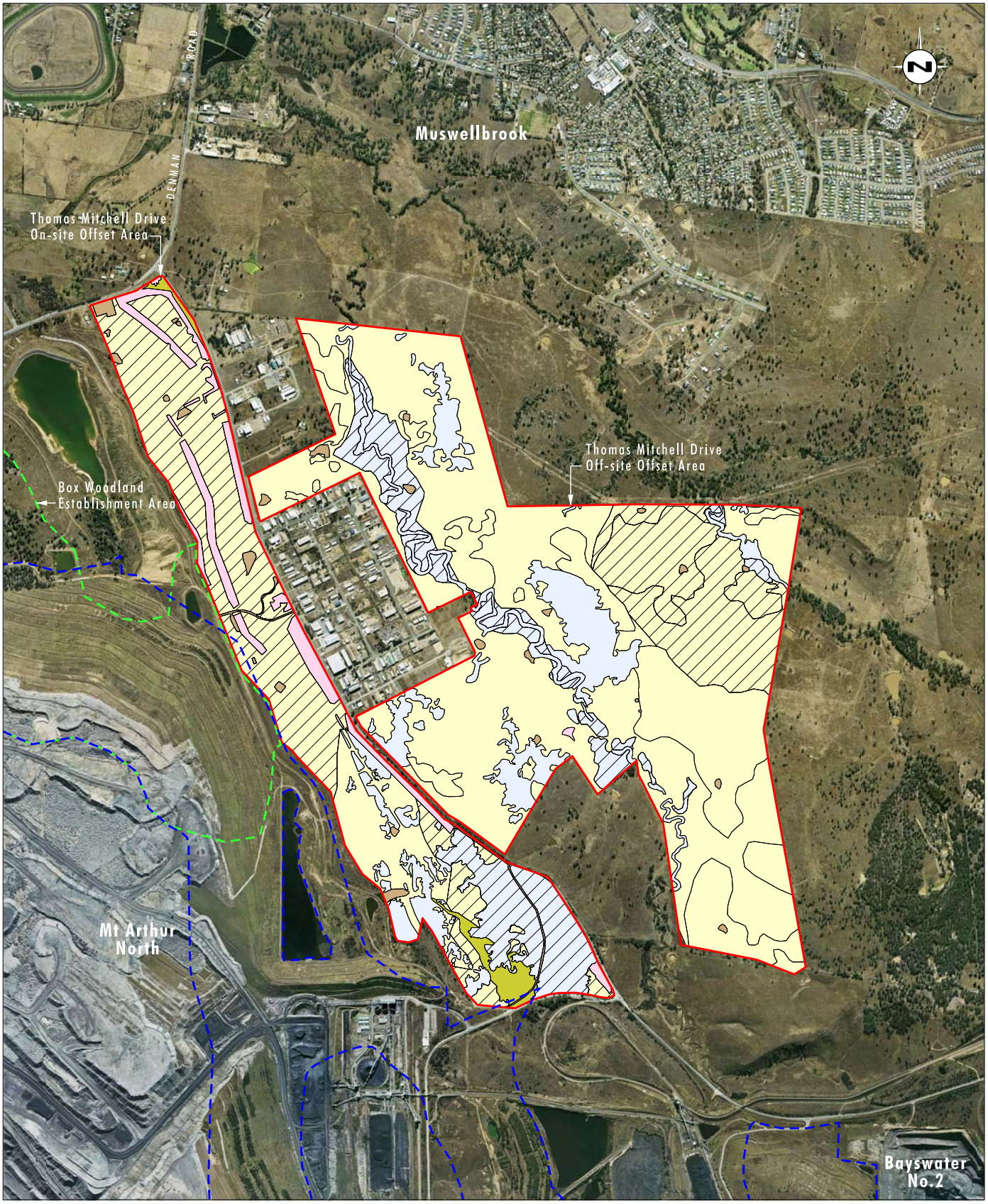

Image Source: Mt Arthur Coal (2013)
Data Source: Umwelt (2013)

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Legend

- Mt Arthur Coal Biodiversity Offset and Conservation Areas
- Box Gum Woodland CEEC
- Proposed Rehabilitation Woodland Corridor
- Box Woodland Establishment Area
- Condition State Not Applicable
- State 1
- State 2
- State 3
- State 5

FIGURE 1.4

Current Condition of Existing Vegetation
Thomas Mitchell Drive Offset Areas

File Name (A4): R10/3113_095.dgn
20140611 12.02

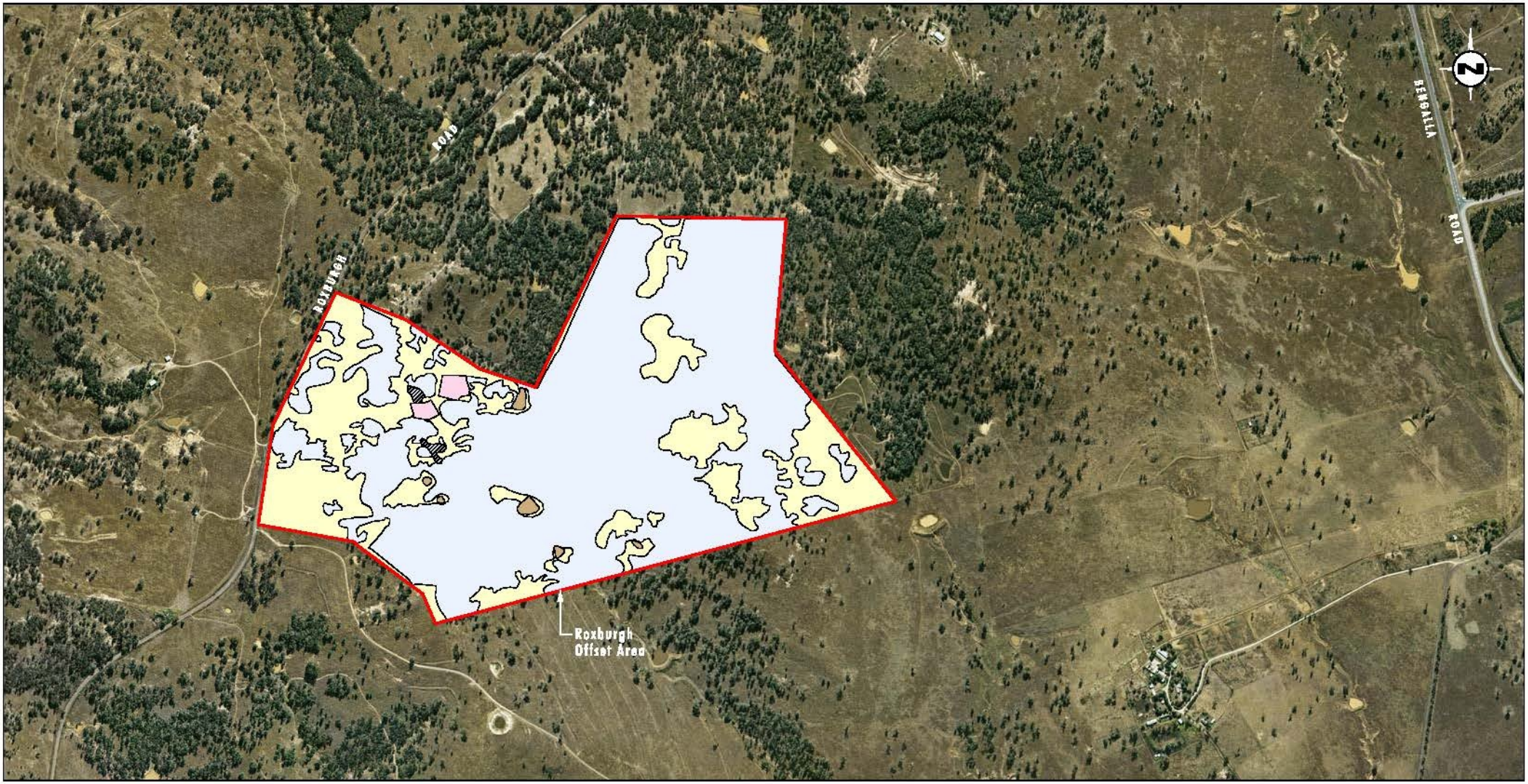

Image Source: Mt Arthur Coal (2013)
Data Source: Umwelt (2013)

0 250 500 750m
1:15 000

Legend

- Mt Arthur Coal Biodiversity Offset and Conservation Areas
- Condition State Not Applicable
- State 1
- State 2
- State 5
- Box Gum Woodland CEEC

FIGURE 1.5

Current Condition of Existing Vegetation
Roxburgh Offset Area

File Name (A4): R10/3113_084.dgn
20131028 8.44

Table 1.4: Offset and conservation areas EPBC listed vegetation current condition states.

Offset/Conservation Area	Box Gum Woodland in State 1 Condition as Required in EPBC Approval	Current Condition			
		State 1 (ha)	State 2 (ha)	Total (ha)	Surplus/Shortfall of State 1 Box Gum Woodland in State 1 Condition (ha)
Mount Arthur Conservation Area	67	21.4	12.8	34.2	- 45.6
Saddlers Creek Conservation Area	87.1	54.8	270.3	325.1	- 41.6[1]
Thomas Mitchell Drive Off-site Offset Area	4.9	32.9	75.1	108	+ 28
Thomas Mitchell Drive On-site Offset Area	55.7	35.3	109.3	144.6	- 20.4
Roxburgh Road Offset Area	0	0.3	0	0.3	0.3
Total	**214.7**	**144.7**	**467.5**	**612.2**	**- 79.3[1]**

Note – Table 1.4 does not include the Rehabilitation Corridors as the establishment of the Box Gum Woodland CEEC within these areas is not a project approval condition. Management of the 299.2 ha of Box Gum Woodland CEEC to be established within the 500 ha Regeneration Area will be detailed within the Mt Arthur Coal MOP.

1 – This figure does not account for the 9 ha of 'State 1' vegetation in additional areas of Saddlers Creek Conservation Area outside the boundaries of areas under the scope of the EPBC 2011/5866 approval as contained within Preliminary Documentation.

The extent of each state of Box Gum Woodland CEEC within the offset and conservation areas following implementation of the actions detailed within this OMP is displayed in **Table 1.5**.

Table 1.5: Offset and conservation areas EPBC listed vegetation condition states following revegetation/regeneration.

Offset/Conservation Area	Box Gum Woodland in State 1 Condition as Required in EPBC Approval	Post OMP Completion Condition			
		State 1 (ha)	State 2 (ha)	Total (ha)	Surplus/Shortfall of State 1 Box Gum Woodland in State 1 Condition (ha)
Mount Arthur Conservation Area	67	34.2	0	34.2	- 32.8
Saddlers Creek Conservation Area	87.1	96.4	228.7	325.1	0[1]
Thomas Mitchell Drive Off-site Offset Area	4.9	32.9	75.1	108	+ 28
Thomas Mitchell Drive On-site Offset Area	55.7	60.2	84.4	144.6	+ 4.5
Roxburgh Road Offset Area	0	0.3	0	0.3	+ 0.3
Total	**214.7**	**224**	**388.2**	**612.2**	**0[1]**

1 – This figure does not account for the 9 ha of 'State 1' vegetation in additional areas of Saddlers Creek Conservation Area outside the boundaries of areas under the scope of the EPBC 2011/5866 approval as contained within Preliminary Documentation.

As shown in **Tables 1.4** and **1.5**, the majority of revegetation/regeneration works targeting the Box Gum Woodland CEEC are planned to occur within the Thomas Mitchell Drive On-site Offset Area and the Mount Arthur and Saddlers Creek Conservation Areas. Following the proposed revegetation/regeneration works documented in this OMP, the total area of this CEEC within the offset and conservation areas will not increase, however portions of currently modified/degraded variants (State 2) of this CEEC will be improved to the higher quality variants (State 1). This will result in works to improve approximately 79 ha of Box Gum Woodland Derived Native Grassland to State 1 conditions.

The proposed vegetation composition of the offset and conservation areas following revegetation/regeneration of grassland and grassy woodland areas is shown in **Figures 1.6** to **1.9**. It should be noted that these figures display the estimated extent of each vegetation community after ten years of the implementation of the actions outlined within this OMP. These figures account for predicted natural regeneration as well as planned active revegetation works.

The determination of which vegetation communities are to be established in each area has been based on detailed ecological surveys of the surrounding vegetation, landform and soil type. The requirements of the EPBC approval (EPBC 2011/5866) (regarding establishment or enhancement of Box Gum Woodland and vegetation/habitat suitable for the regent honeyeater and swift parrot) and the DP&E project approval requirements regarding vegetation to be established have also been considered.

Particular focus has been paid to the restoration of Box Gum Woodland within the offset and conservation areas and degraded variants of this community (particularly Derived Native Grassland) will be targeted for revegetation/regeneration works. However, in order to meet DP&E requirements regarding vegetation to be established, regeneration works will also be implemented within other areas of the offset and conservation areas.

The planned change in vegetation composition following completion of revegetation/regeneration works within the offset and conservation areas is provided in **Table 1.6**.

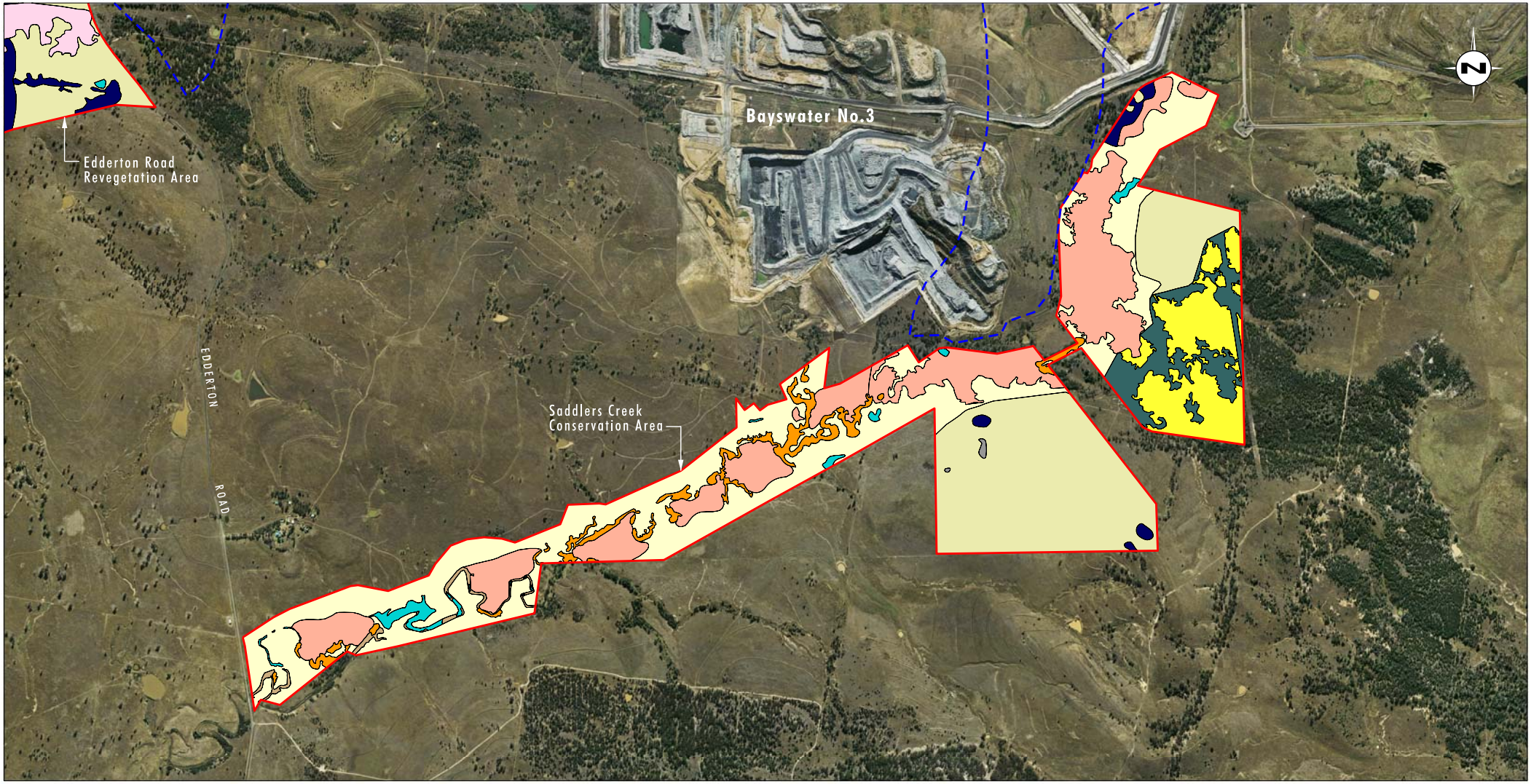

Image Source: Mt Arthur Coal (2013)
Data Source: Mt Arthur Coal (2015)

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1:30 000

Legend

- Mt Arthur Coal Biodiversity Offset and Conservation Areas
- Proposed Rehabilitation Woodland Corridor
- Central Hunter Box - Ironbark Woodland (Box Dominated)
- Central Hunter Box - Ironbark Woodland (Box Dominated) - Derived Native Grassland
- Central Hunter Box - Ironbark Woodland (Ironbark Dominated) - Open Woodland Variant
- Central Hunter Bulloak Forest
- Central Hunter Bulloak Forest - Derived Native Grassland
- Central Hunter Swamp Oak Forest
- Hunter Floodplain Red Gum Woodland Complex
- Hunter Floodplain Red Gum Woodland Complex - Derived Native Grassland
- Reedland
- Water Body
- Weeping Myall Woodland

FIGURE 1.6

Proposed Post-revegetation/Regeneration Vegetation Communities Saddlers Creek Conservation Area

File Name (A4): 3113_167.dgn
20140214 9.05

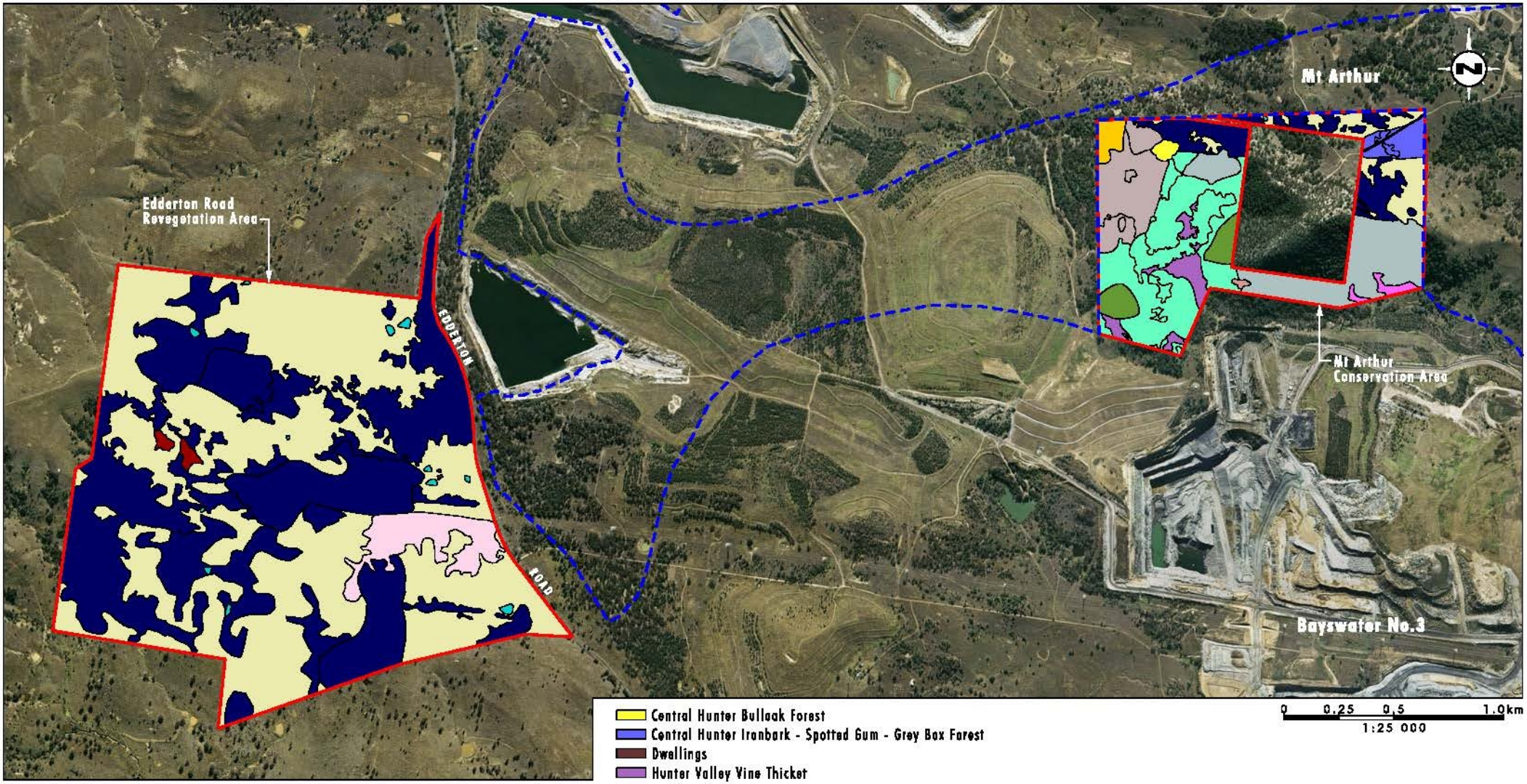


Image Source: Mt Arthur Coal (2013)
Data Source: Umwelt (2013)

Legend

- Mt Arthur Coal Biodiversity Offset and Conservation Areas
- Proposed Rehabilitation Woodland Corridor
- Central Hunter Box - Ironbark Woodland - Rough-barked Apple Variant
- Central Hunter Box - Ironbark Woodland (Box Dominated)
- Central Hunter Box - Ironbark Woodland (Box Dominated) - Derived Native Grassland
- Central Hunter Box - Ironbark Woodland (Ironbark Dominated) - Open Woodland Variant
- Central Hunter Bullaak Forest
- Central Hunter Ironbark - Spotted Gum - Grey Box Forest
- Dwellings
- Hunter Valley Vine Thicket
- Red Gum Grassy Forest
- Red Gum Grassy Forest - Rough-barked Apple Variant
- Roads and Tracks
- Upper Hunter Depauperate Dry Rainforest
- Upper Hunter Hills Box - Ironbark - Red Gum Woodland
- Upper Hunter Hills Sheltered Moist Forest
- Upper Hunter Hills Sheltered Moist Forest - Derived Grassland
- Water Body
- Western Hunter Narrabeen Footslopes Ironbark - Cypress Pine Woodland

File Name (A4): R10/3113_097.dgn
20130814 9.58

FIGURE 1.7

Proposed Post-revegetation/Regeneration Vegetation Communities Edderton Road Revegetation Area and Mt Arthur Conservation Area

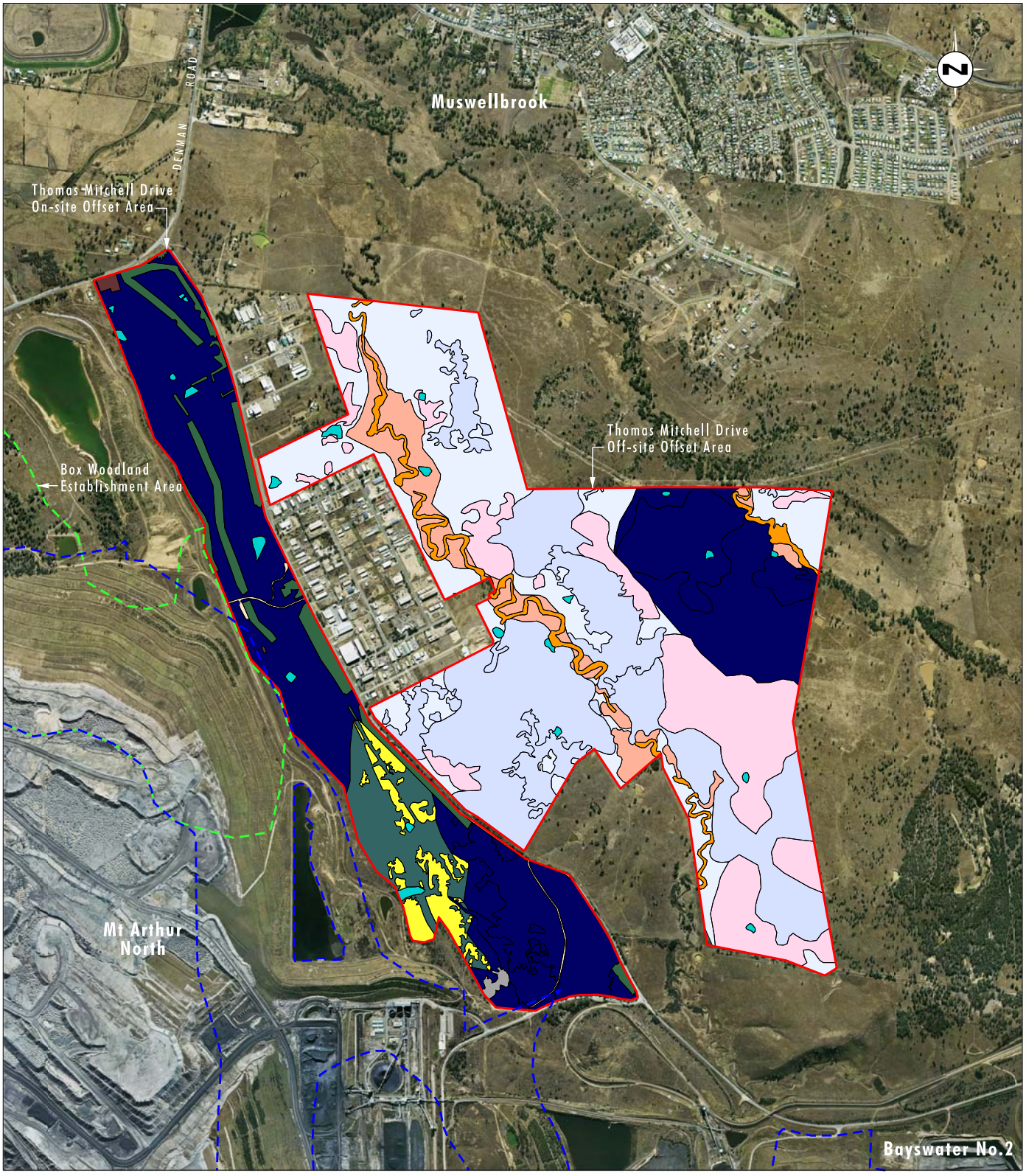


Image Source: Mt Arthur Coal (2013)
Data Source: Umwelt (2013)

0 0.5 1.0 1.5km
1:30 000

Legend

- Mt Arthur Coal Biodiversity Offset and Conservation Areas
- Proposed Rehabilitation Woodland Corridor
- Box Woodland Establishment Area
- Central Hunter Box - Ironbark Woodland (Box Dominated)
- Central Hunter Box - Ironbark Woodland (Ironbark Dominated)
- Central Hunter Box - Ironbark Woodland (Ironbark Dominated) - Derived Native Grassland
- Central Hunter Box - Ironbark Woodland (Ironbark Dominated) - Open Woodland Variant
- Central Hunter Box - Ironbark Woodland (Ironbark Dominated) - Regeneration Variant
- Central Hunter Bulloak Forest
- Central Hunter Bulloak Forest - Derived Native Grassland
- Central Hunter Swamp Oak Forest
- Hunter Floodplain Red Gum Woodland Complex
- Dwellings
- Plantation
- Roads and Tracks
- Water Body
- Yarran Shrubland

FIGURE 1.8

Proposed Post-revegetation/Regeneration Vegetation Communities Thomas Mitchell Drive Offset Areas

File Name (A4): R10/3113_098.dgn
20140611 12.05

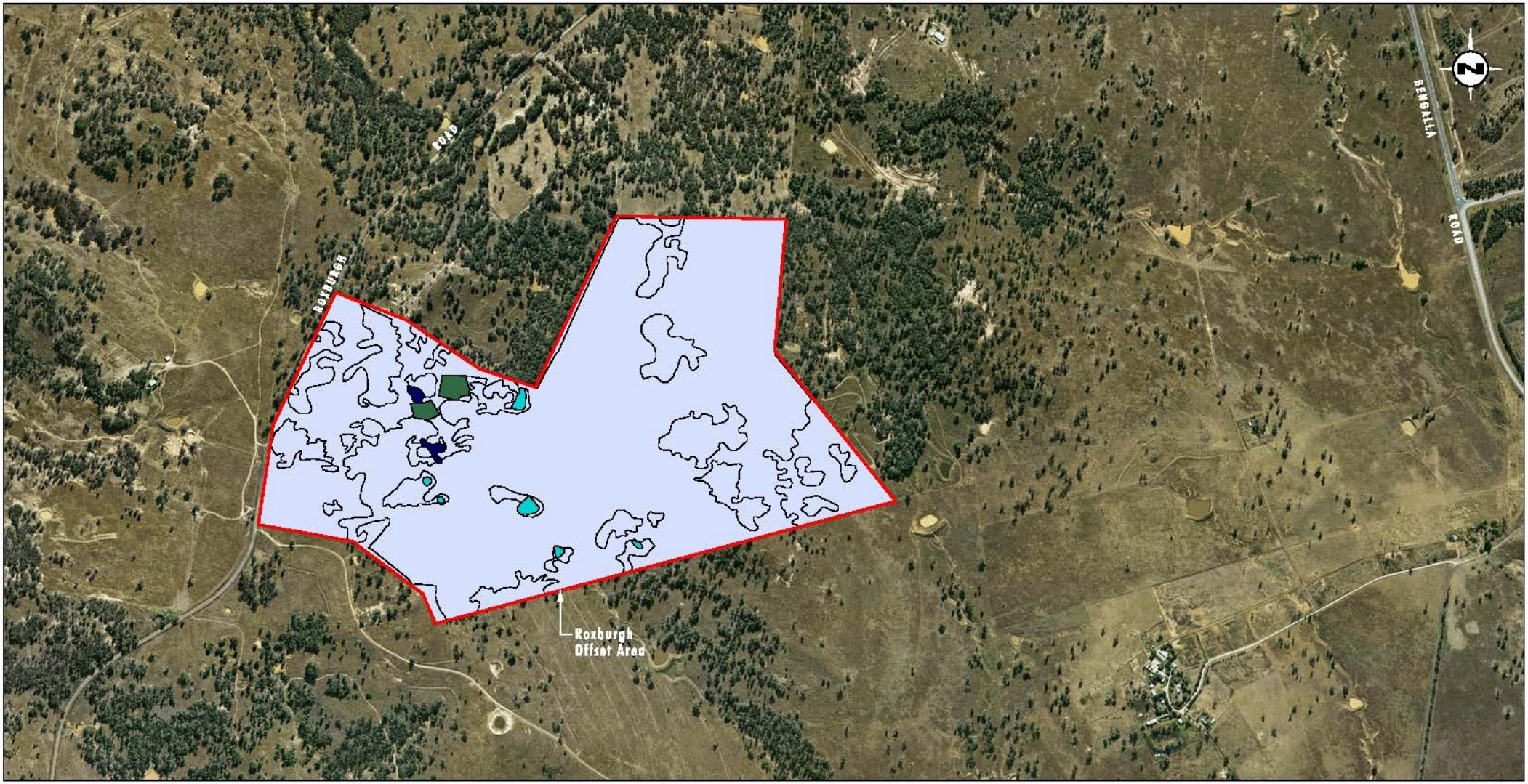


Image Source: Mt Arthur Coal (2013)
Data Source: Umwelt (2013)

0 250 500 750m
1:15 000

Legend

- Mt Arthur Coal Biodiversity Offset and Conservation Areas
- Central Hunter Box - Ironbark Woodland (Box Dominated)
- Central Hunter Box - Ironbark Woodland (Ironbark Dominated)
- Plantation
- Water Body

File Name (A4): R10/3113_099.dgn
20131028 8.45

FIGURE 1.9

Proposed Post-revegetation/Regeneration Vegetation Communities Roxburgh Offset Area

Table 1.6: Vegetation composition of post-revegetation/regeneration within the offset and conservation areas

Vegetation Community	Current Area (Ha)	Post-revegetation Area (Ha)	Net Change to Area (Ha)
Central Hunter Box - Ironbark Woodland - Rough-barked Apple Variant	1.3	1.3	0.0
Central Hunter Box - Ironbark Woodland (Box Dominated)	111.8	438.7	+ 326.9
Central Hunter Box - Ironbark Woodland (Box Dominated) - Derived Native Grassland	473.6	228.4	-245.2
Central Hunter Box - Ironbark Woodland (Box Dominated) - Open Woodland Variant	73.5	0.0	-73.5
Central Hunter Box - Ironbark Woodland (Ironbark Dominated)	121.4	306.4	+ 185.0
Central Hunter Box - Ironbark Woodland (Ironbark Dominated) - Derived Native Grassland	269.5	84.8	-184.7
Central Hunter Box - Ironbark Woodland (Ironbark Dominated) - Open Woodland Variant	100.4	100.4	0.0
Central Hunter Bulloak Forest	50.5	50.5	0.0
Central Hunter Bulloak Forest - Derived Native Grassland	48.6	48.6	0.0
Central Hunter Ironbark - Spotted Gum - Grey Box Forest	0.4	3.8	+ 3.4
Central Hunter Ironbark - Spotted Gum - Grey Box Forest - Derived Native Grassland	3.4	0.0	-3.4
Central Hunter Swamp Oak Forest	29.3	29.3	0.0
Dwellings	1.0	1.0	0.0
Exotic Grassland	8.2	0.0	-8.2
Hunter Floodplain Red Gum Woodland Complex	51.2	86.5	+ 35.3
Hunter Floodplain Red Gum Woodland Complex - Derived Native Grassland	166.0	130.8	-35.2
Hunter Valley Vine Thicket	4.3	4.3	0.0
Plantation	24.5	24.5	0.0
Red Gum Grassy Forest	9.1	12.9	+ 3.8
Red Gum Grassy Forest - Derived Native Grassland	3.8	0.0	-3.8
Red Gum Grassy Forest - Rough-barked Apple Variant	2.0	2.0	0.0
Reedland	3.1	3.1	0.0
Roads and Tracks	2.4	2.4	0.0
Upper Hunter Depauperate Dry Rainforest	0.2	0.2	0.0
Upper Hunter Hills Box - Ironbark - Red Gum Woodland	53.9	61.4	+7.5
Upper Hunter Hills Box - Ironbark - Red Gum Woodland - Derived Native Grassland	7.5	0.0	-7.5

Vegetation Community	Current Area (Ha)	Post-revegetation Area (Ha)	Net Change to Area (Ha)
Upper Hunter Hills Sheltered Moist Forest	18.9	18.9	0.0
Upper Hunter Hills Sheltered Moist Forest - Derived Grassland	1.2	1.2	0.0
Water Body	11.8	11.8	0.0
Weeping Myall Woodland	0.4	0.4	0.0
Western Hunter Narrabeen Footslopes Ironbark - Cypress Pine Woodland	4.3	4.3	0.0
Yarran Shrubland	1.3	1.3	0.0
Total	**1658.8**	**1659.2**	**0.4**

*All values subject to minor mapping/GIS-based discrepancies and rounding to the nearest single decimal place.

As displayed in **Table 1.6** and **Figures 1.6** to **1.9** the vegetation communities that will see the greatest increase in area and condition improvement following implementation of the actions outlined within this OMP are Central Hunter Box - Ironbark Woodland (Box Dominated) (327 ha), Central Hunter Box - Ironbark Woodland (Ironbark Dominated) (185 ha) and Hunter Floodplain Red Gum Woodland Complex (35 ha).

As mentioned, the areas calculated in **Table 1.6** are indicative of the anticipated extent of each vegetation community following ten years of implementation of this OMP. It is anticipated that the majority of Derived Native Grassland remaining within the Thomas Mitchell Off-site Area will become treed vegetation after this period through a combination of natural regeneration (assisted through restricted stock access and weed management) and revegetation works following this ten year period.

1.5 Revegetation/Regeneration and Land Management Requirements

The context for the scope of revegetation/regeneration and land management works as described in **Sections 2.0** and **3.0** are based on the requirement to maintain and protect existing native vegetation communities and increase the extent and condition of vegetation communities across HVEC's offset and conservation areas. The State and Transition Model (Rawlings *et al*. 2010) has been used to determine the current condition and, hence, the intensity of revegetation works required. The State and Transition Model is further described in **Section 4.0** of the BMP. A description of the baseline condition for the offset and conservation areas is included in the Baseline Ecological Study (Umwelt, 2013) and **Section 2.0** of the BMP.

2.0 Schedule of Revegetation/Regeneration Works

2.1 Ten Year Revegetation/Regeneration Schedule

Given that the primary objective of the proposed land management works is to increase the extent of treed vegetation and improve the condition of degraded areas of Box Gum Woodland CEEC to State 1 condition; it is considered appropriate to focus works within State 2 portions of this community within the offset and conservation areas. It is also considered that the extension and condition improvement of existing vegetation will provide the greatest benefit to native fauna. As displayed in **Figures 2.1** to **2.3** the majority of land management works are planned to occur within Thomas Mitchell On-site and Off-site Offset Areas and the Saddler's Creek and Mount Arthur Conservation Areas.

The 10 year revegetation/regeneration schedule is indicative of the portions of the offset and conservation areas that will be targeted for condition improvement and will be updated annually to reflect any changes in the previous year's schedule. Revegetation areas will concentrate on areas that are considered to provide the greatest benefit in terms of connectivity and provision of habitat for threatened species. Revegetation works during years 5 to 10 of the program will also involve the management of previous years' revegetation including supplementary planting and weed management where required. It is considered highly likely that natural regeneration of many areas will minimise the need for active revegetation (apart from weed management and feral fauna management) across large portions of the site. Therefore, the management areas identified within **Figures 2.1** to **2.4** have been selected due to the low likelihood of natural regeneration of native tree species occurring in these areas.

A more detailed schedule of works will be developed for years 5 to 10 by the end of year 4 based on the results of the monitoring program, and in respect to progress towards preliminary completion criteria. It is envisaged that a number of the activities presented in **Error! Reference source not found.** will remain applicable throughout the ten year schedule, such as weed and pest management, seed collection, bushfire management etc. for areas identified in **Figure 2.1** to **Figure 2.3.**

2.2 Revegetation Schedule for Priority Areas (Years 1 to 4)

A summary of the works that are planned to be implemented within the first 4 years of the OMP implementation is shown in **Table 2.1**, which also includes a reference to where the works are described in more detail within the OMP. It is the intention that the implementation program be reviewed every three years; thereby this schedule will be updated as works progress.

Table 2.1: Summary of first four years OMP implementation program

Works	Year 1	Year 2	Year 3	Year 4	Section of OMP
Implementation of feral animal controls such as baiting and/or shooting.	✔	✔	✔	✔	**Section 3.8**
Mapping of existing fencing including current condition.	✔				**Section 3.6**
Intensive weed management within subsequent year proposed revegetation areas.	✔	✔	✔	✔	**Section 3.2**
Detailed GIS mapping of weed infestations and management of recorded noxious weed species throughout offset and conservation areas.	✔	✔	✔	✔	**Section 3.2**
Seed collection of required revegetation species.	✔	✔	✔	✔	**Section 3.3**
Propagation of tubestock for subsequent year proposed planting areas.	✔	✔	✔	✔	**Section 3.4**
Erection of temporary fencing around subsequent year proposed revegetation areas if grazing is being undertaken.	✔	✔	✔	✔	**Section 3.6**
Revegetation/regeneration works*.		✔	✔	✔	**Section 3.4**
Implementation of activities within the Mt Arthur Coal Bushfire Prevention Procedure.		✔	✔	✔	**Section 3.9**

*Active revegetation is not considered necessary within the Roxburgh Offset Area where natural regeneration is considered likely to continue if protected from impacts such as grazing.

Year 1 of the implementation program will primarily involve continuation of HVEC's current land management works such as weed management and feral animal control; however seed collection and tubestock propagation of key revegetation species will be a high priority in preparation for planting of revegetation areas in Year 2 of the program. The timing of revegetation works will be influenced by seasonal conditions; however, initial planting is anticipated to occur in autumn 2015. Scheduling of planting works will also be influenced by the amount of viable seed available and nursery growth rates of tubestock being propagated.

Priority areas have been nominated due to the low likelihood of natural regeneration occurring but also with consideration for their location within the landscape. Additional considerations were the proposed revegetation community type and the improvement of habitat connectivity throughout the site, thus enabling the movement of native fauna throughout the offset and conservation areas and surrounding areas. Research on providing habitat for woodland birds and other native wildlife (Munro and Lindenmayer 2011) has shown that revegetation has the greatest benefit when planted:

- in block-shaped areas rather than narrow strips;
- in gullies or flat areas;
- next to other plantings or areas of woodland; and
- established around large old trees.

Considering the points outlined above, the priority revegetation areas displayed in **Figures 2.1** to **2.3** are located in areas that are considered to provide connectivity between existing patches of remnant woodland within flatter areas and lower slopes (where possible) across the offset and conservation areas. These areas are primarily located within State 2 and State 3 areas of the site. **Plate 2.1** shows a typical example of an area that will be actively revegetated, while **Plate 2.2** shows a typical example of an area that is considered likely to regenerate naturally if protected from weed invasion and grazing.

The nomination of the priority management areas does not eliminate the need to conduct land management works (particularly weed and feral fauna management) within other portions of the offset and conservation areas and it is considered that the implementation of management actions will result in a condition improvement of the remnant vegetation throughout the offset and conservation areas.

The total annual target for revegetation areas is approximately 30 ha. This target is to be considered as indicative and is likely to be influenced by seasonal conditions and availability of local provenance seed. As an example, during drought conditions the revegetation may be required to be delayed by a season so that planting conditions are favourable and the risk of high mortality amongst tubestock is minimised.

This schedule is also to be considered as indicative and must be dynamic in order to overcome any unforeseen challenges to successful revegetation that may arise. If, for example, it is identified that further weed management activities are required within an area scheduled for revegetation in Year 2, the seedlings that were to be planted in that area may be planted in an area of lower weed density where they will have a higher chance of survival. The weed infested area will be managed and planted with tubestock at a time when weed density is not considered to be a threat to planted seedlings. Similarly, natural regeneration of some areas may occur in the period between planning and execution of revegetation works, thus eliminating or minimising the extent of active revegetation required for these areas.

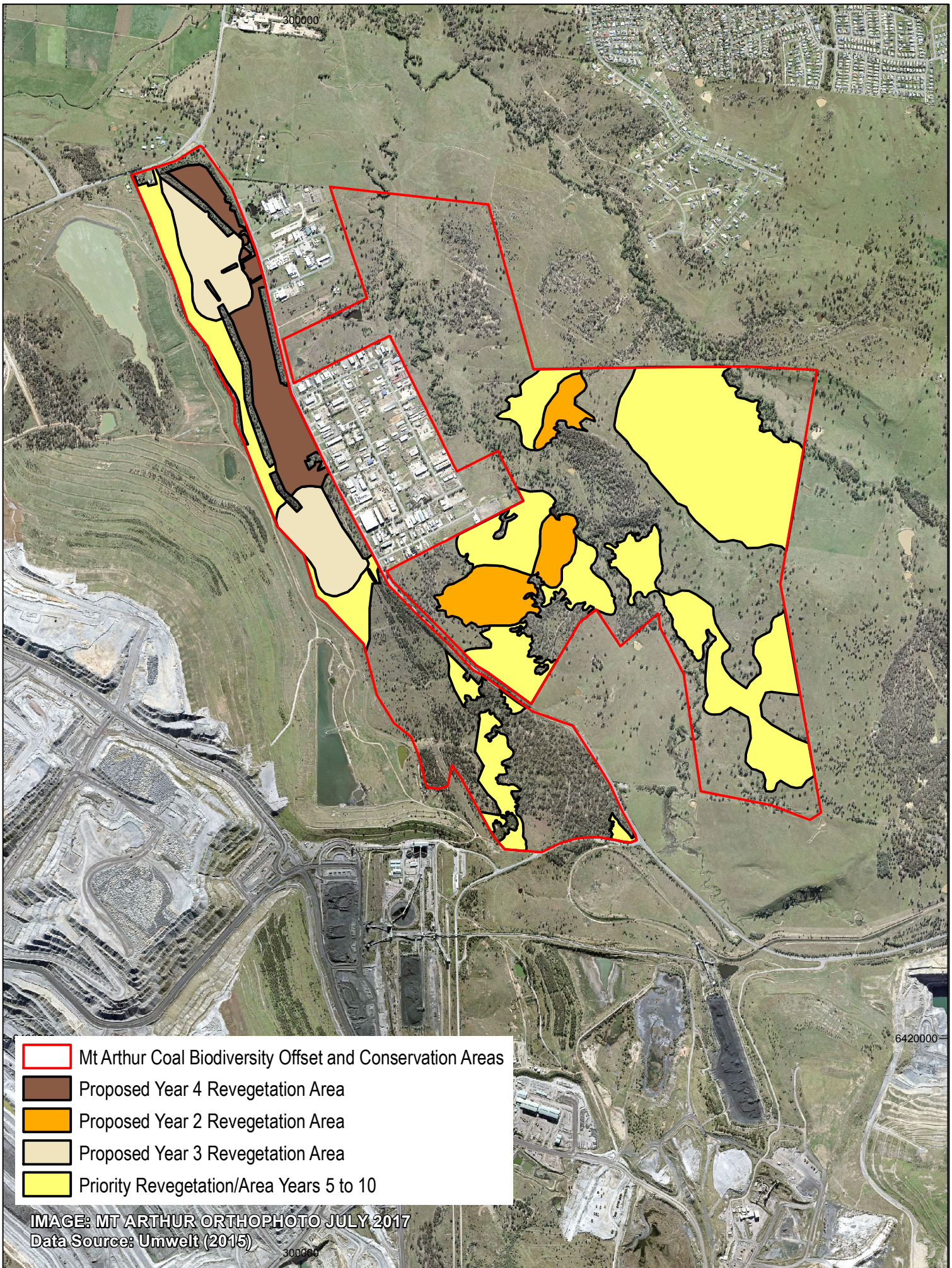
Plate 2.1: An area within the Thomas Mitchell Drive On-Site Offset Area that will be targeted for active revegetation works

Plate 2.2: An example of natural regeneration from a parent tree within the Thomas Mitchell Drive On-Site Offset Area

2.3 Performance Assessment

To enable the assessment of the adequacy of the management actions undertaken in the first 4 years shown in **Error! Reference source not found.**, performance indicators have been developed (BMP, Section 3.3). The indicators relevant to the onsite and offsite offset and conservation areas are shown in Appendix 3 (Mt Arthur Coal Rehabilitation Tables) of the MOP. The domain applicable to the offset and conservation areas is identified as Domain 7.
As further trials and research lead to an improved rehabilitation/revegetation knowledge base, or the drivers for rehabilitation/revegetation (i.e. technological ability, community and regulatory expectations or the surrounding environment) evolve and change, the modification or refinement of Performance Indicators may be warranted.

As well as monitoring progress toward rehabilitation objectives, non-achievement of these progress benchmarks can also be used to identify the requirement for remedial management actions or the modification of management actions. A Trigger Action Response Plan (TARP) has been developed to provide clear guidance on the implementation of responsive or corrective actions. This TARP is presented in **Table 4.0** of the BMP.



BHP

Mapping Services Brisbane

0 500 1,000 Meters

Transverse Mercator Projection
GDA 1994 MGA Zone 56

THOMAS MITCHELL DRIVE OFFSET AREAS
TEN YEAR REVEGETATION SCHEDULE

Drawn: nocke1	Date: 14/12/2017	Revision:	FIGURE
Checked:	Filename: 171213_Figure_2_1_TMD_Offset_Rehab_OMP.mxd		

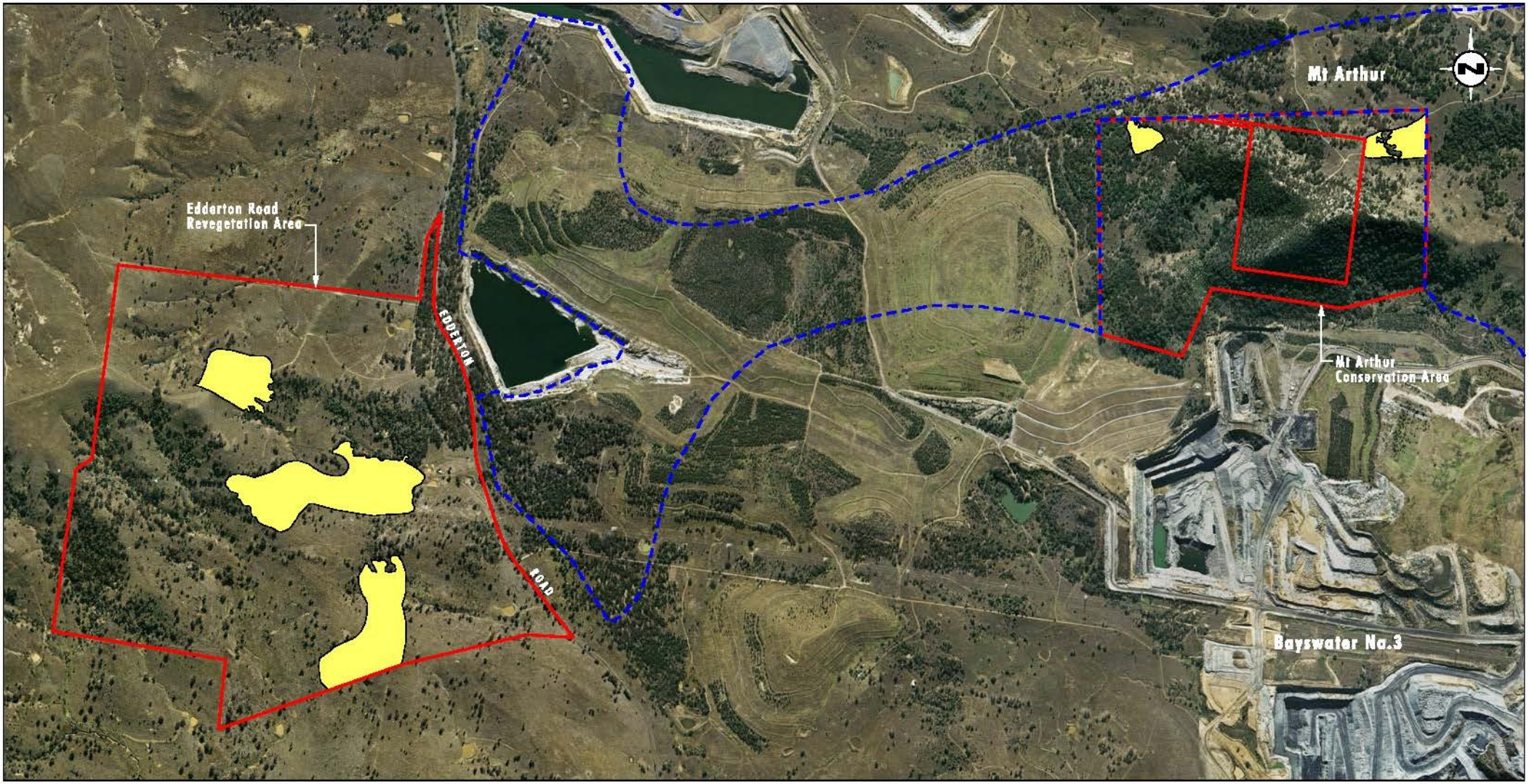


Image Source: Mt Arthur Coal (2013)
Data Source: Umwelt (2013)

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1:25 000

Legend

- Mt Arthur Coal Biodiversity Offset and Conservation Areas
- Proposed Rehabilitation Woodland Corridor
- Priority Revegetation/Regeneration Area Years 5 to 10

FIGURE 2.2

Edderton Road Revegetation Area and Mt Arthur Conservation Area Ten Year Revegetation Schedule

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20130814 9.35

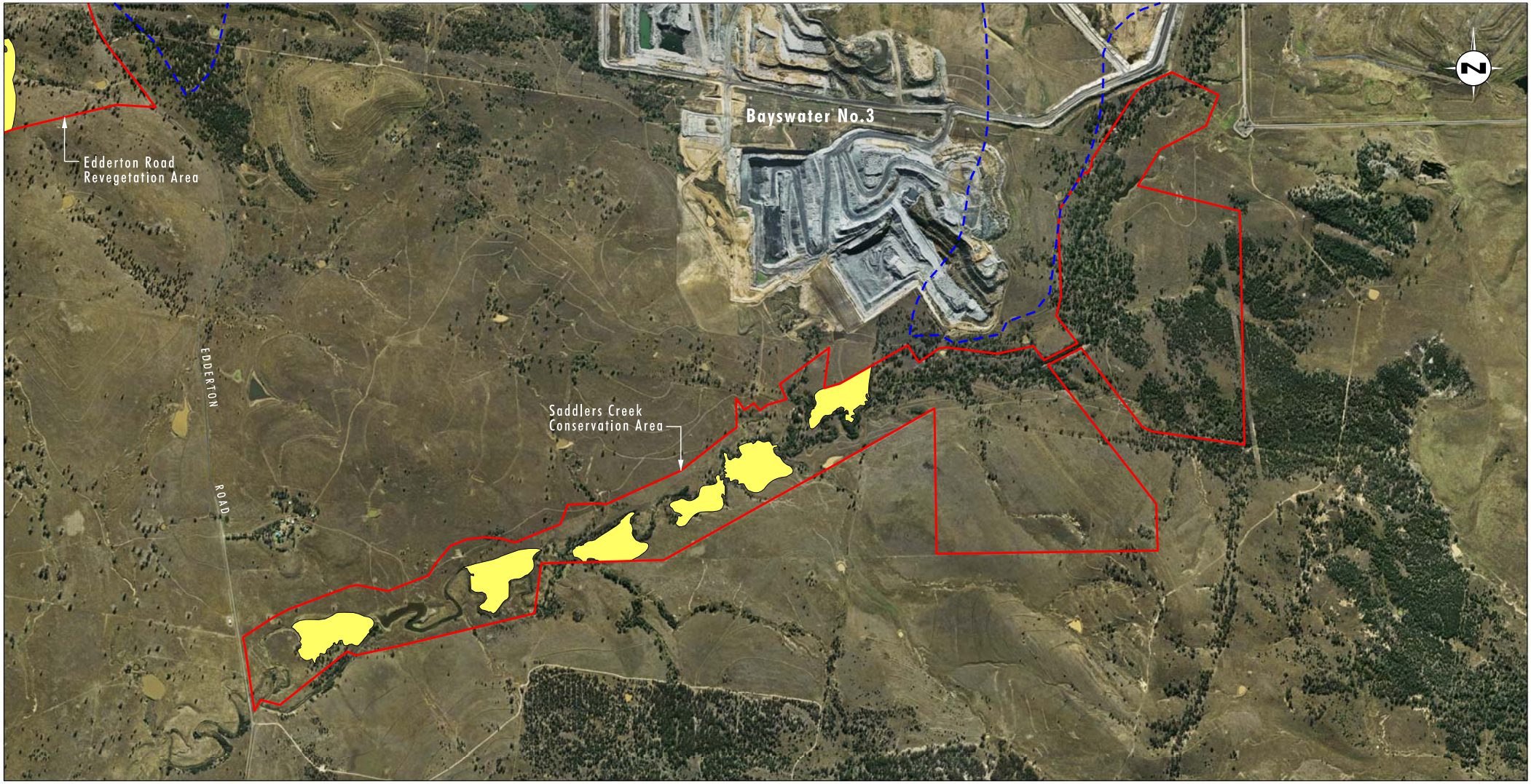

Image Source: Mt Arthur Coal (2013)
Data Source: Mt Arthur Coal (2015)

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1:30 000

Legend

- Mt Arthur Coal Biodiversity Offset and Conservation Areas
- Proposed Rehabilitation Woodland Corridor
- Priority Revegetation/Regeneration Area Years 5 to 10

FIGURE 2.3

Saddlers Creek Conservation Area Ten Year Revegetation Schedule

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20140214 9.05

3.0 Description of Revegetation/Regeneration and Land Management Works

3.1 General Overview

Collection of sufficient volumes of local provenance seed and weed management are considered to be the highest priorities in order to achieve successful revegetation/regeneration within the offset and conservation areas. HVEC will continue to improve the existing seed collection program, as adequate supply of local provenance seed is considered crucial to the success of the revegetation program. While weed density at the site is considered to be moderate, HVEC will concentrate weed management activities on proposed revegetation areas, as well as State 3 areas, as this will increase the chances of success of subsequent revegetation works in these areas. The following sections detail land management works required within the offset and conservation areas.

3.2 Weed Management and Site Preparation

The presence of weed species has the potential to be a hindrance to the establishment of native vegetation within the offset and conservation areas. If left unmanaged invasive weeds can also significantly decrease the value of vegetation to native fauna species. Based on the monitoring results from **Section 5.0**, a map would be developed to allow identification of the weed infestations across the offset and conservation areas. This map will inform targeted management actions based on type and intensity of infestation.

Eleven noxious weed species were recorded within the Mt Arthur Coal biodiversity offset and conservation areas during the Baseline Ecology Study (Umwelt, 2013). These species are declared as noxious under the *Noxious Weeds Act 1993* and the subsequent Noxious Weeds (Weed Control) Order 2014 (**Table 3.1**). Seven of these species are declared as noxious in the Upper Hunter County Council Local Control Authority Area, which includes Muswellbrook Shire Council, Singleton Council and Upper Hunter Shire Council areas. Four species of weeds recorded are declared as noxious within Local Control Authority Areas outside of Upper Hunter County Council, which although not directly applicable to the Mt Arthur Coal biodiversity offset and conservation areas are still considered to be potentially problematic to environmental values. Of all of the declared noxious weeds recorded, coolatai grass (*Hyparrhenia hirta*), is the most prevalent across the Mt Arthur Coal biodiversity offset and conservation areas and it will be actively controlled.

Two additional weed species have been identified within the Mt Arthur Coal biodiversity offset and conservation areas that, although no declared as noxious, are considered to require management due to their invasive nature and potential to dominate groundcover vegetation. These species were creeping pear (*Opuntia humifusa*) and galenia (*Galenia pubescens*).

Table 3.1: Noxious weeds recorded within offset & conservation areas

Family	Botanical name	Common name	Weed control class	Legal requirements
Declared Noxious Weed in the Local Control Authority Area of Upper Hunter County Council*				
Clusiaceae	*Hypericum perforatum*	St. Johns wort	4	Locally Controlled weed. The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed.
Cactaceae	*Opuntia aurantiaca*	tiger pear	4	
Cactaceae	*Opuntia stricta* var. *stricta*	common prickly pear	4	
Asteraceae	*Senecio madagascariensis*	fireweed	4	Locally Controlled Weed. The plant must not be sold, propagated or knowingly distributed.
Fabaceae (Caesalpinioideae)	*Gleditsia triacanthos*	honey locust	3	Regionally Controlled Weed. The plant must be fully and continuously suppressed and destroyed and the plant must not be sold, propagated or knowingly distributed.
Crassulaceae	*Bryophyllum delagoense*	mother of millions	3	
Solanaceae	*Lycium ferocissimum*	African boxthorn	3	
Declared Noxious Weed in Local Control Authority Areas outside of the Upper Hunter County Council				
Poaceae	*Hyparrhenia hirta*	coolatai grass	3	Locally Controlled Weed. The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed.
Lamiaceae	*Marrubium vulgare*	horehound	4	
Aizoaceae	*Galenia pubescens*	galenia	4	Locally Controlled Weed. The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread.
Asteraceae	*Xanthium spinosum*	Bathurst burr	4	Noxious in other Local Control Authority Areas. The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread.
Species not Declared as Noxious but Considered to Require Management				
Asteraceae	*Carthamus lanatus*	saffron thistle	4	No legal requirements; however should be managed as spreads readily.
Cactaceae	*Opuntia humifusa*	creeping pear	4	No legal requirements; however management is as per that of the other Opuntia species.

Note: Where noxious weeds are not listed in the Upper Hunter County Council the Weed Control Class has been sourced from the nearest Local Control Authority Area.

* - the Local Control Authority Area of Upper Hunter County Council includes local council areas of Muswellbrook Shire Council, Singleton Council and Upper Hunter Shire Council.

3 – Plants that pose a potentially serious threat to primary production or the environment of a region to which the order applies, are not widely distributed in the area and are likely to spread in the area or to another area.

4 – Plants that pose a potentially serious threat to primary production, the environment or human health, are widely distributed in an area to which the order applies and are likely to spread in the area or to another area.

Given the highly invasive nature of coolatai grass and its potential to detrimentally impact revegetation efforts, the monitoring and management of this species will be a high priority wherever it is observed within the offset and conservation areas. While this species presents a threat to the establishment of revegetation/regeneration areas it also has the potential to invade areas of remnant vegetation.

In order to provide seedlings in revegetation/regeneration areas with the greatest chance of survival, weed management will be undertaken (where required) for an extended period prior to planting of the area. The extent of pre-sowing weed management works will be determined by the density and species type of weeds requiring control. An extended weed management program prior to planting may reduce the seedbank stored within the topsoil, reducing the need for weed management following planting. This method will be beneficial for the control of both grass and broad-leaf weeds, however many broad-leaved weeds can store viable seed within the soil for several years and weed management is likely to be ongoing in affected areas.

Generally, weed management/grass density reduction will be undertaken in strips approximately one metre wide, however this width will be determined by weed density at the time of planting. Removal of the ground covering vegetation (particularly native grasses) may expose the site to risk of further weed infestation as well as water and wind erosion and will only be conducted where considered essential to the success of revegetation works. Planting of tubestock will then be undertaken within these strips following slashing and deep ripping, where appropriate. **Section 3.4** contains further information on site preparation for planting of tubestock.
The timing of weed management activities will be undertaken in line with consultant recommendations and relevant industry publications, including the *Noxious and environmental weed control handbook, NSW Department of Primary Industries 2011*.

Strategic grazing may be used in areas where it is considered beneficial in terms of weed management. **Section 3.5** contains more detail on grazing management within the offset and conservation areas.

3.3 Seed Collection Strategy

Seed collection shall continue to be a high priority for HVEC in order to maximise the amount of viable local provenance seed for use in the ongoing revegetation activities. A seed collection program has been implemented at Mt Arthur Coal and, where relevant, this program will incorporate any recent innovations to industry best practice techniques.

Appendix 2 contains the list of species associated with each vegetation community that is planned for revegetation within the offset and conservation areas. It is not the intention to establish all of these species within their associated vegetation community, rather to use the species list as a guide for seed collection and propagation targets. Each vegetation community contains several recalcitrant species for which propagation is either untried or has previously been unsuccessful. Some of these species may be required to be propagated in order for revegetation to meet State 1 condition. These species present opportunities for trials such as seed treatments and propagation from cuttings. As such trials of various propagation methods will be undertaken opportunistically throughout the revegetation program. **Appendix 2** highlights

the species within each vegetation community that are essential to be established in order for the community to attain benchmark condition.

Local provenance seed will be targeted for collection within the offset and conservation areas and other local vegetation, when viable seed is available. This will require the use of light vehicles and associated equipment within these areas; however no new roads or permanent tracks will be established within the offset and conservation areas for the purposes of seed collection.

The Mt Arthur Coal seed collection program will continue to focus on:

- seed collection of species (from target communities listed in **Appendix 2**) that are deemed suitable for propagation (i.e. high seed production, high levels of viability, known propagation history, suitable representation within target community (refer to **Appendix 2**);
- meeting the required volumes of local provenance seed in order to propagate the numbers of tubestock displayed in **Table 3.2**; and
- detailed recording of the collection and propagation process, including seed collection methods, timing, seed storage, seed quantity, viability testing, propagation methods and successes. Such records will be fed back into the process to allow for continual improvement.

These activities are currently implemented under a seed banking quality assurance system. This document provides key requirements for the collection and handling of seed stocks, particularly:

- planning;
- harvest;
- drying/cleaning;
- storage/packaging;
- testing;
- reporting; and
- review.

The timing of seed collection activities will be undertaken in line with consultant recommendations and relevant industry publications, including the *Grassy Box Woodland Seed Collection Guide, Greening Australia 2011.*

3.4 Revegetation/Regeneration Works

Natural regeneration of Box Gum Woodland is currently occurring and is expected to continue to occur throughout the site (apart from the Derived Grasslands). Monitoring of the progress of natural regeneration areas will be undertaken as described in **Section 5.0**.

The total seedling requirements for years 2 to 4 of the OMP, based on the proposed schedule are shown in **Table 3.2**. Seedling numbers have been estimated in consideration of the final target native species density for Box Gum Woodland, being a patchwork of scattered clumps of trees interspersed with grasses and the occasional shrub (Rawlings *et al*. 2010).

Table 3.2: Seedling requirements for years 2 to 4 of OMP implementation

Year	Vegetation Community	Area (Ha)	Layer	Estimated Seedlings Required at 3 metre Spacing's
2	Central Hunter Box-Ironbark Woodland (Ironbark dominated)	30	Canopy	9000
			Mid/Understorey	3000
	Total Year 2	**30**		**12000**
3	Central Hunter Box-Ironbark Woodland (box dominated)	30	Canopy	9000
			Mid/Understorey	3000
	Total Year 3	**30**		**12000**
4	Central Hunter Box-Ironbark Woodland (box dominated)	30	Canopy	24750
			Mid/Understorey	8250
	Total Year 4	**30**		**12000**

Final canopy species density estimates for mature grassy woodlands are in the order of 30 to 40 stems per ha; however, many seedlings die over time to end up with this spacing (Rawlings *et al*. 2010). In order to allow for seedling mortalities as revegetation areas mature, it is recommended that small trees (trees that have grown to less than 10 cm trunk diameter at breast height) have a density of at least 400 stems per ha. As trees mature to dimensions greater than 10cm diameter and taller than breast height it is considered that 250 stems per ha is a minimum target density (Rawlings *et al*. 2010).

Actual planting rates may be more or less dense and will be determined by site representatives following assessment of on-the-ground conditions at time of planting (e.g. assessment of progress of natural regeneration). However it is considered much more economical to plant more seedlings initially and thin later if necessary, than it would be to plant less and conduct supplementary planting at a later date (if required). Survival rates of seedlings will be affected by soil condition, climatic conditions, grazing by feral and native herbivores as well as weed and grass density within the planting area. For these reasons, the spacing of seedlings will be reviewed on an ongoing basis to determine their adequacy in meeting the final stems per ha target rate.

Revegetation works within large areas of treeless grassland are likely to occur in the form of clump plantings, creating a series of vegetated areas throughout the treeless area. This approach provides the benefit of creating stands of vegetation of various age groups while also accelerating habitat connectivity through the creation of a 'stepping stone' effect for native fauna. The dimensions of these revegetation areas will be determined by HVEC representatives upon assessment of on-the-ground conditions prior to planting.

Direct seeding of native species may also be used where considered appropriate and rates will be adjusted as required following site based trials. The seed mix will be comprised of native tree and shrub species and will be supplemented by planting of tubestock of native species as required.

Owing to drought conditions experienced during FY18 and into FY19, the planting of tubestock for Year 4 was placed on hold because of the likelihood of failure. Following consultation with the DPE it was agreed to trial seeding of native species within the FY18 ripped area instead of tubestock planting. Noting that it should take about two years to determine the success of the seeding program. The FY18 area will be seeded during FY19 in addition to the rehabilitation works to be carried out for Year 5. Section 2.1 provides details on the development of the program for years 5 to 10.

The species list for each of the target revegetation communities is outlined in **Appendix 2**. However it is not the intention to establish all of these species within their associated vegetation community, rather to use the species list as a guide for seed collection and propagation targets.

The timing of revegetation activities will be undertaken in line with consultant recommendations and relevant industry publications, including *A guide to managing Box Gum Grassy Woodlands, (Rawlings et al. 2010).*

Assisted Natural Regeneration

Natural regeneration is reliant upon seedlings germinating from seed naturally distributed from existing remnant vegetation. This approach will be utilised in portions of State 2 areas where there is potential for increased density and extension of existing remnant vegetation without conducting active revegetation works. Significant portions of the offset and conservation areas are currently exhibiting evidence of natural regeneration (emerging seedlings from parent trees) that requires only protection from stock (via exclusion or managed rotational grazing, refer to **Section 3.5**), feral animal control and weed management in order for existing seedlings to reach maturity.

Depending on site conditions, the pace of natural regeneration and germination rates may be improved by preparation of a receptive seed bed through intensive weed management, scarification and/or ripping of the surface around parent trees. However, ripping will not be conducted in areas of high weed infestation due to the potential for weed species to colonise disturbed ground.

As part of the ecological monitoring program, proposed natural regeneration sites will be monitored for the presence of naturally occurring seedlings. Where seedlings are not evident and are considered unlikely to occur, planting of tubestock or direct seeding may be implemented. In many areas, weed management and the exclusion of cattle is considered likely to facilitate natural regeneration of the remnant bushland.

Tubestock Planting

Tubestock planting (combined with direct seeding where appropriate) will be utilised within portions of State 2 and State 3 areas (where it is considered natural regeneration of native species is unlikely to occur in a timely manner). Species composition and stems per ha rates for tubestock planting will be reflective of the target revegetation communities and pre-clearing vegetation community type (refer to **Table 3.2** and **Appendix 2**) with seedlings propagated from local provenance seed stock where possible.

Where appropriate, slashing and ripping will be undertaken in revegetation areas prior to planting. Areas close to weed infestations will be assessed to determine if ripping is likely to result in further weed infestation. In such cases, further weed management will be undertaken prior to ripping taking place or less intensive forms of site preparation (e.g. augering of planting areas) will be used. The spacing of rip lines will be determined by the required planting density of the tubestock. Ripping with a tractor (or similar piece of equipment) and single tine will be the preferred method, with planting to be conducted within the ripped line. This method minimises the proportion of the site that is disturbed and exposed to the potential for further weed infestation and erosion. Ripping several weeks prior to planting will allow water from any subsequent rainfall to penetrate the rip line prior to planting and the build-up of moisture prior to planting may be advantageous for the seedlings. Ripping well in advance of planting also aids in the elimination of air pockets around seedling roots at the time of planting (Rawlings *et al*. 2010), thus aiding survival rates of seedlings.

In sloping areas of the site, rip lines will be designed to follow the contours of the site as ripping down slope is likely to form erosion channels and resulting in failed rehabilitation. In order to achieve maximum effect, ripping will be avoided in saturated soils as the preference is for moisture levels to be such that the soil and sub-soil layers are allowed to shatter and provide cracks in which seedling roots can penetrate. Ripping saturated soil is likely to have a slicing effect that will create channels in the soil profile and provide limited fracturing into which the roots of developing seedlings can penetrate. Operating a tractor or similar piece of heavy equipment on wet areas will be avoided as this will also result in excessive soil compaction.

Tubestock will be propagated in a local nursery using local provenance seed where possible. It is intended that ‘Hiko’ cells (or similar) be used as this method results in good root structure, and allows for large numbers of seedlings to be planted in short time periods. Alternatively 50mm forestry tubes may be used; however it is considered that this method will be too labour intensive and time consuming for the large scale of the areas that are to be planted.

Direct Seeding

Direct seeding may be used during the OMP implementation. It is likely that direct seeding will be the preferred method of establishing native vegetation within the existing mine rehabilitation

areas that currently exhibit a high density of exotic grass species. Detailed descriptions of the works proposed within the mine rehabilitation areas will be described within the MOP.

Direct seeding trials may be undertaken throughout the remainder of the offset and conservation areas, particularly in areas where weed density is currently low (as ripping of weed infested areas is likely to result in increased weed density). Depending on the outcomes of the direct seeding trials, this method may be implemented on a broader scale during later stages of the OMP.

Depending on the scale of the areas involved, direct seeding will involve either hand broadcasting or machinery application of a local provenance native seed mix directly on to prepared ground. Preparation of the seed bed will be the key to the success of this method. Ground preparation will involve contour ripping and/or scarification, with seeding to be timed to occur when it is considered that there is a high likelihood of rainfall following seeding.

Brush Matting

Eucalypt and pioneer species respond well to this technique and brush matting may also be trialled as a method for establishing groundcover species for which seed collection can be extremely difficult. This technique will source seed bearing cuttings from vegetation within the offset and conservation areas for spreading between planted tubestock or around remnant vegetation. The seeds naturally drop off and germinate while the dry leaves fall off and provide mulch, with the branches aiding sun and wind protection. This technique can also assist in improving the soil condition of a site through the addition of organic matter and aid in erosion control and water penetration through reducing run-off (Rawlings *et al*. 2010). Species that are considered suitable for brush matting are nominated in **Appendix 2**.

3.5 Grazing Management

Grazing by domestic stock occurred across the majority of offset and conservation areas, until the last few years. Strategic grazing is an accepted method of weed and fire management and promoting diversity of native vegetation. Continual grazing encourages weed infestation and degrades native vegetation (Barlow 1998).

As recorded within the Baseline Ecological Study (Umwelt, 2013), the exotic grasslands within the Thomas Mitchell Drive On-site Offset Area contain a high proportion of coolatai grass (up to 90 per cent of the ground cover), with this species also recorded within areas of the derived native grasslands around Mount Arthur. While small infestations of coolatai grass within areas of native grassland will be managed via herbicide application, it may be beneficial to utilise strategic grazing to manage dense infestations within areas of exotic grassland.

Given the relatively low weed densities across the remainder of the site (State 1 and the majority of State 2 areas) it is considered that grazing (crash grazing or frequent rotational grazing) is unlikely to provide ecological benefits at this stage. This is primarily due to the inability to control what species cattle will preferentially graze over a large area. Given that weed species such as African boxthorn, cotton bush and St John's Wort are the more prevalent weeds across the remainder of the offset and conservation areas, it is considered unlikely that

cattle will preferentially graze these weeds to an extent that reduces their overall density. Ongoing monitoring is required in order to determine the ecological effects of long term exclusion of cattle from the biodiversity offset areas, including changes in weed density.

Prior to the commencement of controlled grazing, a suitably qualified agronomist (or similar) will be engaged to undertake a survey of the area to determine both the maximum sustainable carrying capacity and timing of grazing activities to minimise potential impacts to native vegetation and maximise weed management benefits. A formalised grazing management program will be developed prior to the use of stock for the approval of DoE and DP&E, which will include requirements for protection of native vegetation (i.e. installation of temporary fencing where required), details of the expected benefit of grazing, monitoring and assessment methodologies as well as a Trigger Action Response Plan (TARP) to determine the timing for removal/introduction of stock or undertaking remediation works. The grazing management program will be trialled prior to full implementation.

If managed grazing is implemented, stock will be excluded from planned revegetation areas prior to revegetation works commencing, however may remain in adjacent areas as a weed management tool if required. In such cases fencing may be erected to protect revegetation areas; however, it is anticipated that such fencing will be temporary and will be removed once the areas adjacent to revegetation areas are no longer used for grazing. Such fencing may also be erected to prevent cattle from areas that are currently exhibiting good rates of natural regeneration (e.g. the riparian zone of Saddler's Creek and areas of open woodland) (refer to **Plate 3.1**).

It is considered that the removal of cattle from these areas will assist the rate of natural regeneration, thus reducing the need for active revegetation works in future years. As shown in **Plate 3.2**, cattle access to areas that are exhibiting potential for natural regeneration can significantly hinder the rate of regeneration in these areas through trampling and scratching/rubbing.

3.6 Fencing and Access Control

The existing fencing within the offset and conservation areas ranges in condition from excellent to poor. As outlined in **Table 2.1**, detailed mapping of existing fencing that displays the location and condition of current fence lines is scheduled to occur in year 1 of the OMP.

In areas where cattle are retained as a weed management tool (if required), fencing requirements will be determined by the final dimensions of areas being revegetated (e.g. in areas where clumps of revegetation are to be used patches of 50m by 50m may be fenced). Temporary fencing will be installed around the perimeter of revegetation areas adjacent to active grazing paddocks and it is anticipated that this will be in the form of electric fencing using tape or braid. In order to reduce the risk of injury to native fauna, existing fencing within the boundaries of the offset and conservation areas may be removed in areas where it is providing no benefit to revegetation outcomes through stock exclusion.

Any future permanent fencing erected within, or on the boundary of the offset and conservation areas will use plain wire, to ensure minimal impact on native fauna species. As part of the

ongoing monitoring program, if plain wire fencing to exclude stock is found to be inadequate, additional measures that pose minimal impact to native fauna (e.g. electric fencing, barbed wire) will be investigated and implemented.

Signage will be erected at all access points to the offset and conservation areas to alert people that the site is being revegetated and that entry is prohibited unless approved by approved by HVEC.

The necessity for cultural features within offset areas, such as fencing, vehicle trails, cattle yards, farm sheds and residential dwellings, will be assessed and, where determined to be redundant, will be scheduled for decommissioning and removal.

Plate 3.1: Protection from stock will allow areas of natural regeneration to develop further, thus reducing the requirement of active revegetation works

Plate 3.2: Control of stock access to areas of natural regeneration is required to allow these areas to recover

3.7 Erosion Control

There are several locations within the offset and conservation areas that display signs of moderate to significant erosion. Significant erosion is particularly evident along several sections of Saddler's Creek with stock access to the creek having contributed to further erosion (refer to **Plates 3.3** and **3.4**). Due to the presence of established native vegetation and natural regeneration that is occurring in the areas adjacent to the creek, it is not considered necessary to undertake reshaping of the creek banks at this stage.

It is considered that the current high rates of natural regeneration will benefit from protection from stock and enable these seedlings to reach maturity. Therefore, livestock are currently excluded from the creek (with the exception of maintaining one existing stock crossing for stock transfer).

As part of the monitoring program for the offset and conservation areas (refer to **Section 5.0**), the occurrence and or status of erosion areas will be assessed to determine the requirement and scope for ongoing control works.

3.8 Feral Fauna Management

The presence of feral pigs, dogs, cats, goats and foxes has been recorded within the offset and conservation areas. It is considered that control of feral fauna is critical for the success of planned revegetation/regeneration works as these animals have the ability to destroy young seedlings, both through grazing and trampling, while also displacing and preying upon native fauna.

Fencing of the regeneration/revegetation areas may assist in excluding some larger feral species, however it will not exclude all feral species from these areas. Emphasis will therefore be placed on the continued implementation of HVEC's current control/management actions for feral fauna species.

A combination of baiting (i.e. using 1080 poison) and trapping is to be implemented within the conservation and offset areas, with the scheduling of feral fauna management actions determined by evidence of the presence of these populations.

3.9 Bushfire Management

Bushfire management (including hazard reduction activities such as the installation of fire breaks, fuel load assessment and management and controlled burns) will be undertaken as required and in accordance with the Mt Arthur Coal *Bushfire Prevention Procedure*. The *Bushfire Prevention Procedure* will be consulted in all matters relating to bushfire issues within the offset and conservation areas.

Plate 3.3: Restricting stock access to creeks and riparian areas will reduce the potential for erosion and improve the quality of the creek

Plate 3.4: Areas of erosion will be monitored in order to determine if intervention is required

4.0 Habitat Augmentation

Habitat augmentation is the process of installing habitat features for a range of fauna species in previously disturbed or degraded areas. Habitat augmentation is not considered to be essential within the conservation and offset areas, as there are currently large of areas of woodland that are considered to be structurally and floristically diverse. However there are large areas of grassland within the Thomas Mitchell Off-site Offset Areas that would benefit from the addition of habitat, in the form of logs sourced from the project disturbance area. Where appropriate, a proportion of felled trees will be scattered throughout grassland areas that are considered to be lacking in habitat features. Fallen timber is considered to be particularly important in open areas fringing grassland, as it provides valuable foraging perches for species such as the hooded robin (southern form) (*Melanodryas cucullata cucullata*), where they forage in the grasslands, then return regularly to woodland areas for cover. In order to ensure an adequate density of such habitat is maintained, signage will be erected at all entry points to the site stating that the collection of firewood is prohibited within the offset area.

As recorded in the Baseline Ecological Study (Umwelt, 2013) mature hollow bearing trees were observed as occurring throughout the conservation and offset areas. These trees contained hollows ranging in size from small (25 to 50mm in diameter) to large (100 to 300mm in diameter). Moderate amounts of terrestrial habitat (leaf litter, rocky areas, low vegetation and fallen timber) were also observed. These habitat structures provide protection and foraging resources for small terrestrial mammals, such as antechinus, and reptiles.

5.0 Monitoring and Adaptive Management

Scheduling of land management activities, including maintenance of revegetation/regeneration areas will be responsive to the results of monitoring of these areas. The monitoring program for the biodiversity offset and conservation areas is detailed within BMP, and is summarised below:

- initial establishment inspections are to be undertaken within three months of completion of revegetation works to establish whether there are any early indicators as to whether revegetation is likely to succeed or fail (e.g. weed density, presence of erosion, high mortality of tubestock etc.). Based on the outcomes of these inspections, appropriate management actions (where required) will be implemented to facilitate the success of the revegetation works;
- permanent vegetation monitoring plots will be established within revegetation areas and appropriate benchmark sites within corresponding vegetation communities. Vegetation community assessment will be conducted on a rotational basis at the monitoring sites. Once five assessments have been undertaken at a site, the monitoring frequency will be reviewed and may be modified if data analysis shows ecological development is trending successfully towards completion criteria. Vegetation monitoring is detailed in the Rehabilitation and Ecological Monitoring Procedure. The resulting data will be compared to previous results to identify changes to the revegetation between each monitoring period, and to track the progress of the revegetation towards the target self-sustaining community and State. The monitoring report will recommend what management actions are to be implemented in areas that are not progressing towards self-sustaining native vegetation communities;
- regeneration areas will be monitored within three to six months of regeneration and then 18 months later to determine the progress of the regeneration towards the goal of self-sustaining target native vegetation communities. Monitoring will be used to identify what management activities such as weed management, managed grazing or augmentation with target species are required within regeneration areas. Monitoring of regeneration areas will initially undertake the form of walk through surveys, when the areas approach maturity, permanent vegetation plots will be installed in these areas, and will be monitored in accordance with the requirements outlined above; and
- HVEC will record the details of each revegetation area so that they are available for later interpretation of revegetation monitoring results. This will assist in the continual improvement of revegetation methods.

TARPS have been developed, based on the outcomes of the monitoring programs, to prevent the occurrence of or remediate impacts related to the following potential issues:

- erosion;
- revegetation failure;
- weed infestation;
- excessive feral and native fauna leading to damage to native vegetation;
- potential damage to native flora or the occurrence of erosion due to grazing by stock for weed management purposes (if required);
- increase in bushfire fuel load levels; and

- other land management issues such as unauthorised access.

The abovementioned TARPS are included in **Section 3.4** of the BMP.

6.0 Responsibilities

Specific roles and accountabilities for employees and contractors in relation to the OMP are outlined in **Table 6.1** below.

Table 6.1: Roles and responsibilities for implementing actions within OMP

Role	Accountabilities for this Document
General Manager – Opencut Operations	• ensure that sufficient resources are allocated for the implementation of this OMP.
Manager Health, Safety and Environment (HSE) - Execution	• ensure that sufficient time and resources are allocated to allow for the implementation of the ecological management strategies outlined within this OMP; • provide that sufficient resources and time are allocated to implement the OMP monitoring programs; • ensure that the results of the OMP monitoring programs are utilised to refine completion criteria as well as to evaluate the effectiveness of rehabilitation/revegetation practices so as to facilitate continual improvement; • periodically review progress against completion criteria; • ensure all internal and external reporting requirements are met; • ensure that personnel involved in the carrying out and monitoring the OMP activities are appropriately qualified, licensed and experienced to undertake the task; and • ensure that the OMP is reviewed and updated in accordance with the review schedule.
Environment Superintendent - Execution	• coordinate the implementation of the management strategies outlined in the OMP and associated documents; • manage and maintain the ecological monitoring programs in accordance with this plan; • ensure that all monitoring records are effectively maintained on site in accordance with the EMS; • conduct periodic environmental inspections of offset and conservation areas to identify and address any potential management issues; • ensure any potential or actual biodiversity or offset issue, including incidents and non conformances is reported to the HSE Manager - Execution; • coordinate the implementation of corrective actions and evaluate their effectiveness; and • participate in the ongoing review of this OMP.

7.0 Review of Management Strategy

As part of the adaptive management process, this OMP will be reviewed at least every three years. However, a review of the OMP may be required prior to this timing in the event of any significant changes to the implementation schedule or methodology as identified from the monitoring program. Reviews of the OMP will reflect any changes in the priority revegetation/regeneration areas that may arise due unforeseen land management issues that affect the ability of HVEC to implement the proposed revegetation/regeneration works and will take into account outcomes of the annual EPBC compliance report described in Section 9.0 of the BMP or any audit described in Section 10.0 of the BMP. Any significant revisions that alter the scope or intent of this document will be submitted for approval by the relevant regulatory authority. The review process will be conducted in accordance with the requirements of relevant government agencies.

8.0 References

Barlow, T (1998). Grassy Guidelines. *How to manage native grasslands and grassy woodlands on your property*.

Hunter Eco (2013). Mt Arthur Coal Open Cut Modification. Prepared for Mt Arthur Coal.

Munro, N & Lindenmayer, D (2011). *Planting for Wildlife*, CSIRO Publishing.

Rawlings, K (2010). *A guide to Managing Box Gum Grassy Woodlands/Kimberlie Rawlings, David Freudenberger and David Carr*. Department of the Environment, Water, Heritage and the Arts (DEWHA), Canberra, A.C.T.

Umwelt (Australia) Pty Limited (2011). *Preliminary Documentation for DSEWPC. Prepared for Mount Arthur Coal*.

Umwelt (Australia) Pty Limited (2013). *Draft Baseline Ecological Study of Mt Arthur Coal Biodiversity Offset and Conservation Areas*.

Appendix 1

DoE and DP&E Approval Conditions

Table 1: DoE Project Approval (EPBC 2011/5866) conditions that are addressed within this OMP

Approval Condition	Details	Where Approval Condition is addressed within the OMP
7e (i)	Details of management actions that will improve the condition of a minimum of 707.7 ha within the conservation and offset areas and 299.2 ha regeneration area to 'State 1' consistent with the state and transition model for Box Gum Grassy Woodland (Rawlings et al, 2010) and listing advice for the White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland Ecological Community.	Sections 1.0, 2.0 and 3.0 BMP (Sections 4.0, 5.0 and 6.0)
7e (ii)	Management schedules for all conservation and offset areas, the regeneration area and the rehabilitation corridors identifying targeted actions for specific areas to protect and enhance the extent and condition of habitat values of the offset areas, a map showing the areas to be managed.	Sections 2.0 and 3.0
7e (iii)	Type of actions for each conservation and offset area, the regeneration area and the rehabilitation corridors and the details of methods to be used.	Sections 2.0 and 3.0
7e (iv)	Timing of management actions for each area.	Sections 2.0 and 3.0
7e (v)	Performance criteria for each action.	Section 2.3 BMP (Section 3.3)
7e (vi)	A detailed monitoring plan for each action including but not limited to control sites, periodic ecological surveys to be undertaken by a qualified ecologist, as agreed to in writing by the Minister, and consistent with the survey guidelines for nationally threatened species and communities, to assess the success of the management actions measured against identified milestones and objectives.	Section 5.0 BMP (Section 8.0)
7e (vii)	Contingency measures to be implemented if performance criteria are not met.	Section 5.0 BMP (Section 3.3)
7e (viii)	A process to report to the Department the progress of management actions undertaken in the conservation and offset areas, regeneration area and rehabilitation corridors and the outcome of those actions, including identifying any need for improved management and actions to undertake such improvement.	Section 7.0 BMP (Section 9.0)
7e (ix)	Details of the various parties responsible for management, monitoring and implementing the management activities, including their position or status as a separate contractor.	Section 6.0 BMP (Section 1.6)

Table 2: DP&E Project Approval Conditions that are addressed within this OMP

Approval Condition	Details	Where Approval Condition is addressed within the OMP
38 (Schedule 3)	The proponent shall ensure the offset strategy and/or rehabilitation strategy is focused on the re-establishment of: a) significant and/or threatened plant communities, including: • Upper Hunter White Box – Ironbark Grassy Woodland; • Central Hunter Box – Ironbark Woodland; • Central Ironbark – Spotted Gum – Grey Box Forest; • Narrabeen Footslopes Slaty Box Woodland; • Hunter Floodplain Red Gum Woodland Complex; • White Box Yellow Box Blakely's Red Gum Woodland; and • Hunter Lowlands Red Gum Forest; and b) significant and/or threatened plant species including: • River Red Gum (*Eucalyptus camaldulensis*); • Pine Donkey Orchid (Diuris tricolor); • Tiger Orchid (*Cymbidium canaliculatum*); • Weeping Myall (*Acacia pendula*); and c) habitat for significant and/or threatened animal species.	Section 1.3
40 (c) (Schedule 3)	(i) a description of the short, medium, and long term measures that would be implemented to: • implement the offset strategy; and • manage the remnant vegetation and habitat on the site and in the offset areas;	Section 3.0 BMP (Sections 5.0 and 6.0)
	(ii) detailed performance and completion criteria for the implementation of the offset strategy;	Section 1.4 BMP (Section 3)

Approval Condition	Details	Where Approval Condition is addressed within the OMP
	(iii) a detailed description of the measures that would be implemented over the next 3 years, including the procedures to be implemented for:	
	• implementing revegetation and regeneration within the disturbance areas and offset areas, including establishment of canopy, sub-canopy (if relevant), understorey and ground strata;	Sections 2.0 and 3.0 BMP (Section 5.1)
	• protecting vegetation and soil outside the disturbance areas;	Section 3.0 BMP (Section 5.2)
	• rehabilitating creeks and drainage lines on the site, both inside and outside the disturbance areas (such as White's Creek Diversion), to ensure no net loss of aquatic habitat;	Section 3.7 BMP (Sections 3.1, 3.4 and 8.4)
	• managing salinity;	BMP (Sections 3.4 and 6.4)
	• conserving and reusing topsoil;	BMP (Section 6.4)
	• undertaking pre-clearance surveys;	BMP (Sections 5.2 and 6.2)
	• managing impacts on fauna;	BMP (Sections 5.2 and 6.5)
	• landscaping the site and along public roads (including Thomas Mitchell Drive, Denman Road, Edderton Road and Roxburgh Road) to minimise visual and lighting impacts;	BMP (Section 6.8)
	• collecting and propagating seed;	Section 3.3 BMP (Section 5.2)
	• salvaging and reusing material from the site for habitat enhancement;	Section 4.0 BMP (Section 6.4)
	• salvaging, transplanting and/or propagating threatened flora and native grassland, in accordance with the *Guidelines for the Translocation of Threatened Plants in Australia* (Vallee *et al*., 2004);	BMP (Section 6.4)
	• controlling weeds and feral pests;	Sections 3.2 and 3.8 BMP (Section 5.2)
	• managing grazing and agriculture;	Section 3.5 BMP (Section 5.2)
	• controlling access; and	Section 3.6 BMP (Section 5.2)
	• bushfire management;	Section 3.9 BMP (Section 5.2)
	(iv) a program to monitor the effectiveness of these measures, and progress against the performance and completion criteria;	Section 5.0 BMP (Section 8.0)
	(v) a description of the potential risks to successful revegetation, and a description of the contingency measures that would be implemented to mitigate these risks; and	Section 5.0 BMP (Sections 1.5 and 3.4)

Approval Condition	Details	Where Approval Condition is addressed within the OMP
	(vi) details of who would be responsible for monitoring, reviewing, and implementing the plan.	Section 6.0 BMP (Section 1.6)

Appendix 2

Flora Species to be used in Revegetation

The following tables display the plant species and species composition for each vegetation community described in **Table 1.6** of the main report. This list has been designed as a guide for direct seeding and/or tubestock propagation. The proportion column provides a target per cent proportion for each stratum, which is intended to be used for ordering seeds or tube stock.

This list is not a complete species list of each vegetation community. Species have been selected based on their ability to be used in revegetation, such as success in direct seeding or nursery propagation. Flora species for each vegetation community have been selected from the Baseline Ecological Study of Mt Arthur Coal Biodiversity Offset and Conservation Areas (Umwelt 2013), vegetation surveys undertaken at Mt Arthur Coal and Vegetation of the Central Hunter (Peake 2006).

Due to seasonal variability affecting flowering and fruiting abundance, it is not considered realistic for the direct seeding mix or tube stock composition to include all of the species displayed in these tables, however the species composition for revegetation should be selected from the species displayed here.

The following abbreviations or symbols are used in the lists:

BR Species suitable for brush-matting;

subsp. subspecies; and

var. variety;

Common names used follow Harden (1992, 1993, 2000 & 2002) where available, and draw on other sources.

Table 1: Tables Numbers for each Vegetation Community Revegetation Guide

Table Number	Planned Revegetation Community
Table 2	Central Hunter Box – Ironbark Woodland
Table 3	Central Hunter Ironbark – Spotted Gum – Grey Box Forest
Table 4	Hunter Floodplain Red Gum Woodland Complex

Table 2: Central Hunter Box Ironbark Woodland revegetation guide

Family/Subfamily	Scientific Name	Common Name	Stratum	Proportion (per cent)
Myrtaceae	*Eucalyptus albens* x *moluccana* or *Eucalyptus albens*	grey/white box hybrid or white box	canopy	60, BR
Myrtaceae	*Angophora floribunda*	rough-barked apple	canopy	5, BR
Myrtaceae	*Eucalyptus blakelyi*	Blakelys red gum	canopy	5, BR
Myrtaceae	*Eucalyptus crebra*	narrow-leaved ironbark	canopy	25, BR
Myrtaceae	*Eucalyptus moluccana*	grey box	canopy	5, BR
Casuarinaceae	*Allocasuarina luehmannii*	bulloak	mid-storey	40, BR
Fabaceae (Mimosoideae)	*Acacia implexa*	hickory wattle	mid-storey	30, BR
Sterculiaceae	*Brachychiton populneus* subsp. *populneus*	kurrajong	mid-storey	30
Asteraceae	*Cassinia quinquefaria*	sifton bush	shrub	5
Chenopodiaceae	*Maireana microphylla*	-	shrub	5
Fabaceae (Mimosoideae)	*Acacia decora*	western silver wattle	shrub	10, BR
Fabaceae (Mimosoideae)	*Acacia falcata*	-	shrub	5, BR
Fabaceae (Mimosoideae)	*Acacia paradoxa*	kangaroo thorn	shrub	5, BR
Fabaceae (Mimosoideae)	*Acacia salicina*	cooba	shrub	10, BR
Myoporaceae	*Myoporum montanum*	western boobialla	shrub	10
Oleaceae	*Notelaea microcarpa* var. *microcarpa*	native olive	shrub	20
Pittosporaceae	*Bursaria spinosa* subsp. *spinosa*	blackthorn	shrub	20, BR
Solanaceae	*Solanum brownii*	violet nightshade	shrub	5, BR
Solanaceae	*Solanum cinereum*	narrawa burr	shrub	5, BR
Acanthaceae	*Rostellularia adscendens*	-	ground	1
Asteraceae	*Calotis lappulacea*	yellow burr-daisy	ground	5, BR
Asteraceae	*Chrysocephalum apiculatum*	yellow buttons	ground	5, BR
Asteraceae	*Vittadinia cuneata*	fuzzweed	ground	1, BR
Asteraceae	*Vittadinia muelleri*	fuzzweed	ground	1, BR

Family/Subfamily	Scientific Name	Common Name	Stratum	Proportion (per cent)
Campanulaceae	*Wahlenbergia communis*	tufted bluebell	ground	1
Campanulaceae	*Wahlenbergia gracilis*	Australian bluebell	ground	1
Chenopodiaceae	*Einadia nutans*	saltbush	ground	1
Convolvulaceae	*Dichondra repens*	kidney weed	ground	5
Fabaceae (Faboideae)	*Desmodium brachypodum*	large tick-trefoil	ground	1
Fabaceae (Faboideae)	*Glycine tabacina*	-	ground	2
Fabaceae (Faboideae)	*Hardenbergia violacea*	false sarsaparilla	ground	1
Lomandraceae	*Lomandra filiformis* subsp. *filiformis*	wattle matt-rush	ground	5
Lomandraceae	*Lomandra multiflora* subsp. *multiflora*	many-flowered mat-rush	ground	5
Malvaceae	*Sida corrugata*	sida	ground	1, BR
Myoporaceae	*Eremophila debilis*	amulla	ground	5
Phormiaceae	*Dianella caerulea*	blue-flax-lily	ground	1
Poaceae	*Aristida ramosa*	purple wiregrass	ground	5, BR
Poaceae	*Austrostipa scabra*	speargrass	ground	5, BR
Poaceae	*Austrostipa verticillata*	slender bamboo grass	ground	1, BR
Poaceae	*Bothriochloa decipiens* var. *decipiens*	pitted bluegrass	ground	5, BR
Poaceae	*Bothriochloa macra*	red grass	ground	5, BR
Poaceae	*Chloris ventricosa*	tall chloris	ground	1, BR
Poaceae	*Cymbopogon refractus*	barbed wire grass	ground	5, BR
Poaceae	*Dichanthium sericeum* subsp. *sericeum*	Queensland bluegrass	ground	2, BR
Poaceae	*Dichelachne micrantha*	shorthair plumegrass	ground	2, BR
Poaceae	*Eragrostis leptostachya*	Paddock lovegrass	ground	5, BR
Poaceae	*Microlaena stipoides* var. *stipoides*	weeping grass	ground	5, BR
Poaceae	*Panicum effusum*	two-colour panic	ground	2, BR
Poaceae	*Rytidosperma fulvum*	wallaby grass	ground	5, BR
Poaceae	*Sporobolus creber*	slender rats tail grass	ground	5, BR
Pteridaceae	*Cheilanthes sieberi* subsp. *sieberi*	Poison rock fern	ground	5

Table 3: Central Hunter Ironbark – Spotted Gum – Grey Box Forest revegetation guide

Family/Subfamily	Scientific Name	Common Name	Stratum	Proportion (per cent)
Myrtaceae	*Eucalyptus crebra*	narrow-leaved ironbark	Canopy	15, BR
Myrtaceae	*Eucalyptus moluccana*	grey box	Canopy	15, BR
Myrtaceae	*Corymbia maculata*	spotted gum	Canopy	70, BR
Asteraceae	*Cassinia quinquefaria*	sifton bush	shrub	5, BR
Asteraceae	*Ozothamnus diosmifolius*	white dogwood	shrub	5, BR
Fabaceae (Faboideae)	*Daviesia ulicifolia*	gorse bitter pea	shrub	10, BR
Fabaceae (Mimosoideae)	*Acacia decora*	western silver wattle	shrub	10, BR
Fabaceae (Mimosoideae)	*Acacia falcata*	-	shrub	5, BR
Lamiaceae	*Spartothamnella juncea*	bead bush	shrub	10
Myoporaceae	*Myoporum montanum*	western boobialla	shrub	10
Oleaceae	*Notelaea microcarpa* var. *microcarpa*	native olive	shrub	15
Phyllanthaceae	*Breynia oblongifolia*	coffee bush	shrub	5
Pittosporaceae	*Bursaria spinosa* subsp. *spinosa*	blackthorn	shrub	15, BR
Rubiaceae	*Psydrax odorata*	shiny-leaved canthium	shrub	10
Acanthaceae	*Brunoniella australis*	blue trumpet	ground	2
Asteraceae	*Calotis cuneifolia*	purple burr-daisy	ground	2, BR
Asteraceae	*Calotis lappulacea*	yellow burr-daisy	ground	5, BR
Asteraceae	*Chrysocephalum apiculatum*	yellow buttons	ground	5, BR
Asteraceae	*Vittadinia cuneata*	fuzzweed	ground	2, BR
Campanulaceae	*Wahlenbergia communis*	tufted bluebell	ground	1
Chenopodiaceae	*Einadia nutans*	saltbush	ground	2
Convolvulaceae	*Dichondra repens*	kidney weed	ground	2
Fabaceae (Faboideae)	*Desmodium brachypodum*	large tick-trefoil	ground	2
Fabaceae (Faboideae)	*Desmodium gunnii*	-	ground	2
Fabaceae (Faboideae)	*Glycine tabacina*	-	ground	2

Family/Subfamily	Scientific Name	Common Name	Stratum	Proportion (per cent)
Fabaceae (Faboideae)	*Hardenbergia violacea*	false sarsaparilla	ground	2
Lobeliaceae	*Pratia purpurascens*	whiteroot	ground	5
Lomandraceae	*Lomandra filiformis*	wattle matt-rush	ground	2, BR
Lomandraceae	*Lomandra multiflora* subsp. *multiflora*	many-flowered mat-rush	ground	5, BR
Malvaceae	*Sida corrugata*	sida	ground	5, BR
Myoporaceae	*Eremophila debilis*	amulla	ground	5
Phormiaceae	*Dianella revoluta* var. *revoluta*	blueberry lily	ground	2
Poaceae	*Aristida ramosa*	purple wiregrass	ground	5, BR
Poaceae	*Bothriochloa macra*	red grass	ground	5, BR
Poaceae	*Chloris ventricosa*	tall chloris	ground	5, BR
Poaceae	*Cymbopogon refractus*	barbed wire grass	ground	5, BR
Poaceae	*Microlaena stipoides* var. *stipoides*	weeping grass	ground	5, BR
Poaceae	*Rytidosperma fulvum*	wallaby grass	ground	5, BR
Poaceae	*Rytidosperma racemosum* var. *racemosum*	wallaby grass	ground	5, BR
Poaceae	*Sporobolus creber*	slender rats tail grass	ground	5, BR
Poaceae	*Themeda australis*	kangaroo grass	ground	5, BR
Solanaceae	*Solanum prinophyllum*	forest nightshade	ground	1
Pteridaceae	*Cheilanthes sieberi subsp. sieberi*	Poison rock fern	ground	1

Table 4: Hunter Floodplain Red Gum Woodland Complex revegetation guide

Family/Subfamily	Scientific Name	Common Name	Stratum	Proportion (per cent)
Casuarinaceae	*Casuarina glauca*	swamp oak	canopy	10, BR
Myrtaceae	*Angophora floribunda*	rough-barked apple	canopy	15, BR
Myrtaceae	*Eucalyptus blakelyi*	Blakelys red gum	canopy	20, BR
Myrtaceae	*Eucalyptus melliodora*	yellow box	canopy	20, BR
Myrtaceae	*Eucalyptus albens x moluccana* or *Eucalyptus albens*	grey/white box hybrid or white box	canopy	20, BR
Myrtaceae	*Eucalyptus tereticornis*	forest red gum	canopy	15, BR
Chenopodiaceae	*Maireana microphylla*	-	shrub	10
Fabaceae (Mimosoideae)	*Acacia implexa*	hickory wattle	shrub	20, BR
Fabaceae (Mimosoideae)	*Acacia salicina*	cooba	shrub	20, BR
Oleaceae	*Notelaea microcarpa* var. *microcarpa*	native olive	shrub	20
Pittosporaceae	*Bursaria spinosa* subsp. *spinosa*	blackthorn	shrub	20, BR
Solanaceae	*Solanum cinereum*	narrawa burr	shrub	10
Asteraceae	*Calotis lappulacea*	yellow burr-daisy	ground	2, BR
Asteraceae	*Chrysocephalum apiculatum*	yellow buttons	ground	5, BR
Campanulaceae	*Wahlenbergia communis*	tufted bluebell	ground	1
Campanulaceae	*Wahlenbergia gracilis*	Australian bluebell	ground	1
Chenopodiaceae	*Einadia hastata*	berry saltbush	ground	5
Convolvulaceae	*Dichondra repens*	kidney weed	ground	2
Cyperaceae	*Carex inversa*	knob sedge	ground	5, BR
Fabaceae (Faboideae)	*Glycine tabacina*	-	ground	2
Malvaceae	*Sida corrugata*	corrugated sida	ground	1, BR
Lamiaceae	*Mentha satureioides*	native pennyroyal	ground	1
Lobeliaceae	*Pratia purpurascens*	whiteroot	ground	2
Lomandraceae	*Lomandra multiflora* subsp. *multiflora*	many-flowered mat-rush	ground	1, BR
Myoporaceae	*Eremophila debilis*	amulla	ground	2
Phormiaceae	*Dianella longifolia*	blueberry lily	ground	2

Family/Subfamily	Scientific Name	Common Name	Stratum	Proportion (per cent)
Plantaginaceae	*Plantago debilis*	-	ground	2
Poaceae	*Aristida ramosa*	purple wiregrass	ground	5, BR
Poaceae	*Austrostipa verticillata*	slender bamboo grass	ground	15, BR
Poaceae	*Chloris ventricosa*	tall chloris	ground	3, BR
Poaceae	*Cynodon dactylon*	common couch	ground	5, BR
Poaceae	*Dichanthium sericeum* subsp. *sericeum*	Queensland bluegrass	ground	2, BR
Poaceae	*Digitaria diffusa*	open summer-grass	ground	2, BR
Poaceae	*Eragrostis leptostachya*	paddock lovegrass	ground	2, BR
Poaceae	*Microlaena stipoides* var. *stipoides*	weeping grass	ground	10, BR
Poaceae	*Rytidosperma fulvum*	wallaby grass	ground	10, BR
Poaceae	*Sporobolus creber*	slender rat's tail grass	ground	5, BR
Poaceae	*Themeda australis*	kangaroo grass	ground	5, BR
Pteridaceae	*Cheilanthes sieberi* subsp. *sieberi*	poison rock fern	ground	2