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TARRAWONGA COAL MINE

BIODIVERSITY MANAGEMENT PLAN

16 August 2022

Document History

Edition	Rev.	Comments	Date
2	2	Revision to align with MCCM approved BMP and incorporate DAWE comments	30 June 2017
2	3	Revision to address Leard Forest RBS Stage 2 report	28 February 2018
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2	8	Revision to incorporate DPE comments	16 August 2022



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EXECUTIVE SUMMARY

The Biodiversity Management Plan (BMP) for the Tarrawonga Coal Mine (TCM) has been submitted to the New South Wales (NSW) Department of Planning, Industry and Environment (DPIE) (formerly Department of Planning and Environment [DP&E]) on a progressive basis and has been approved progressively. The BMP approved by DPIE on 13 April 2015 was approved for management of biodiversity at the TCM (i.e. Stage 1 BMP).

This revision of the BMP (i.e. Stage 2) provides a consolidated plan for the management of flora and fauna at the TCM and 'Willeroi West' offset area (located approximately 25 kilometres north-east of the TCM). This revision of the BMP also incorporates:

- the approved *TCM Threatened Fauna Implementation Plan* in accordance with Condition 50(c) of Schedule 3 to Project Approval (PA) 11_0047; and
- the approved *TCM Box-Gum Woodland Endangered Ecological Community Implementation Plan* in accordance with Condition 48(d) of Schedule 3 to PA 11_0047.

This BMP was finalised following consultation with stakeholders; the former New South Wales (NSW) Office of Environment and Heritage (OEH) now the Biodiversity Conservation Division (BCD), North West Local Land Services (NWLLS), TCM Community Consultative Committee (TCM CCC), Forestry Corporation of NSW and DoI Lands and Water Catchments and Lands (DoILWCL) and is to be approved by the former Commonwealth Department of the Environment and Energy (DoEE), now the Department of Agriculture, Water and the Environment (DAWE) and DPIE.

This revision of the BMP is required in accordance with Condition 48 (b) of Schedule 3 to PA 11_0047 and incorporates:

- The requirements of the *Leard Forest Regional Biodiversity Strategy Stage 2 – Strategy Report* (Umwelt, 2017) Tables 2.1-2.4;
- Addressing recommendations from *TCM Independent Biodiversity Audit 2017* (ERM, 2018) as required by Condition 50 of Schedule 3 to PA 11_0047; and
- Addressing recommendations from *TCM Independent EPBC Audit 2020* (ERM, 2020) as required in accordance with Condition 33 of EPBC Act approval for EPBC 2011/5923.

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1 INTRODUCTION

1.1 BACKGROUND

The Tarrawonga Coal Mine (TCM) is an open cut coal mining operation located approximately 42 kilometres (km) north of Gunnedah and 15 km north-east of Boggabri in the Gunnedah Basin, New South Wales (NSW) (**Figure 1** and **Figure 2**). The TCM is owned by Tarrawonga Coal Pty Ltd (TCPL), which was a joint venture with Boggabri Coal Pty Limited (a wholly owned subsidiary of Idemitsu Australia Resources Pty Ltd) but is now wholly owned by Whitehaven Coal Limited (Whitehaven).

The TCM commenced operations in 2006 and an extension to the mine (i.e. the Tarrawonga Coal Project) was approved in January 2013; NSW Project Approval (PA) 11_0047 under the NSW *Environmental Planning and Assessment Act, 1979* (EP&A Act) by the Planning Assessment Commission under delegation of the Minister for Planning and Infrastructure. The Tarrawonga Coal Project was granted approval under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) on 11 March 2013 (Commonwealth Approval Decision 2011/5923).

The purpose of this Biodiversity Management Plan (BMP) is to provide a consolidated plan for the management of flora and fauna within the TCM and 'Willeroi West' offset area, located approximately 25 km north-east of the TCM (**Figure 3**). This BMP addresses the relevant key requirements outlined in the NSW PA 11_0047, as modified, and the requirements for the Offset Management Plan specified in the EPBC Act approval for EPBC 2011/5923.

In accordance with Condition 16 of Schedule 2 to PA 11_0047, the BMP for the TCM has been submitted to the Department of Planning, Industry and Environment (DPIE) (formerly Department of Planning and Environment [DP&E]) on a progressive basis and has been approved progressively. The BMP approved by DPIE on 13 April 2015 was approved for management of biodiversity at the TCM. This BMP is for management of flora and fauna within the TCM and 'Willeroi West' offset area, located approximately 25 kilometres (km) north-east of the TCM. Upon its approval, this BMP will supersede any BMP previously approved for the TCM.

This revision of the BMP is required in accordance with Condition 48 (b) of Schedule 3 to PA 11_0047 and incorporates:

- The requirements of the *Leard Forest Regional Biodiversity Strategy Stage 2 – Strategy Report* (Umwelt, 2017) Tables 2.1-2.4;
- Addressing recommendations from *TCM Independent Biodiversity Audit 2017* (ERM, 2018) as required by Condition 50 of Schedule 3 to PA 11_0047; and
- Addressing recommendations from *TCM Independent EPBC Audit 2020* (ERM, 2020) as required in accordance with Condition 33 of EPBC Act approval for EPBC 2011/5923.

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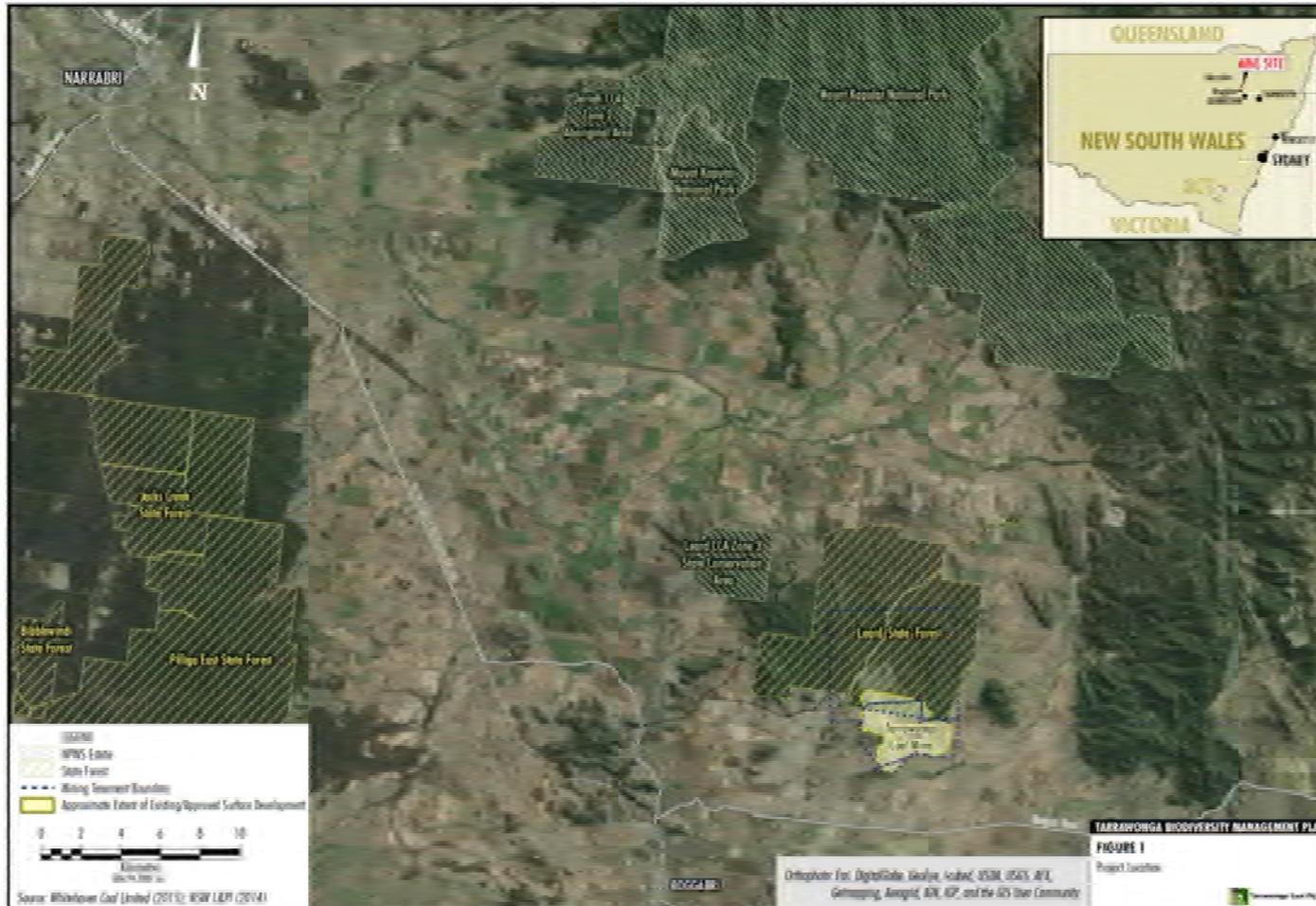


Figure 1: Project Location

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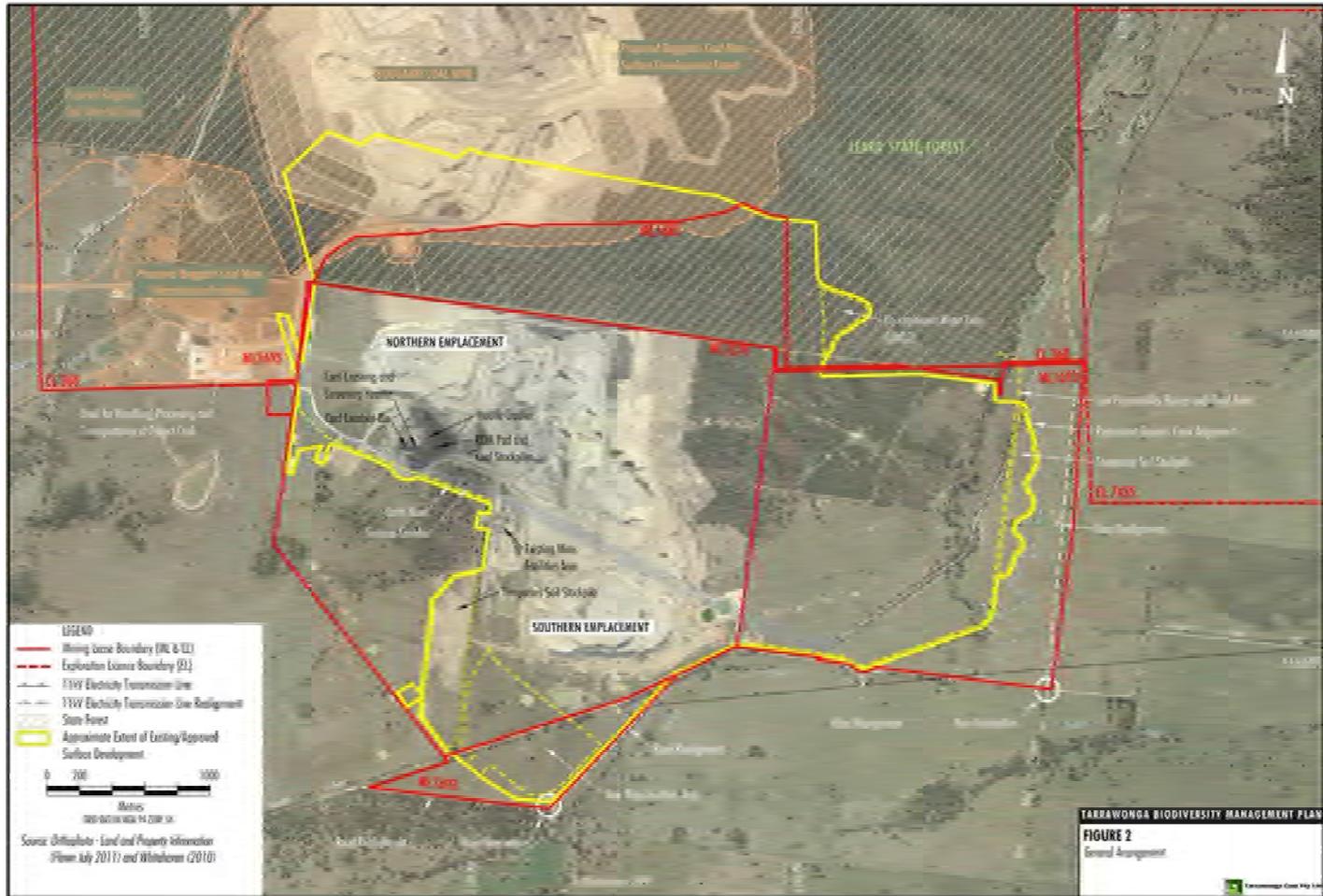


Figure 2: General Arrangement



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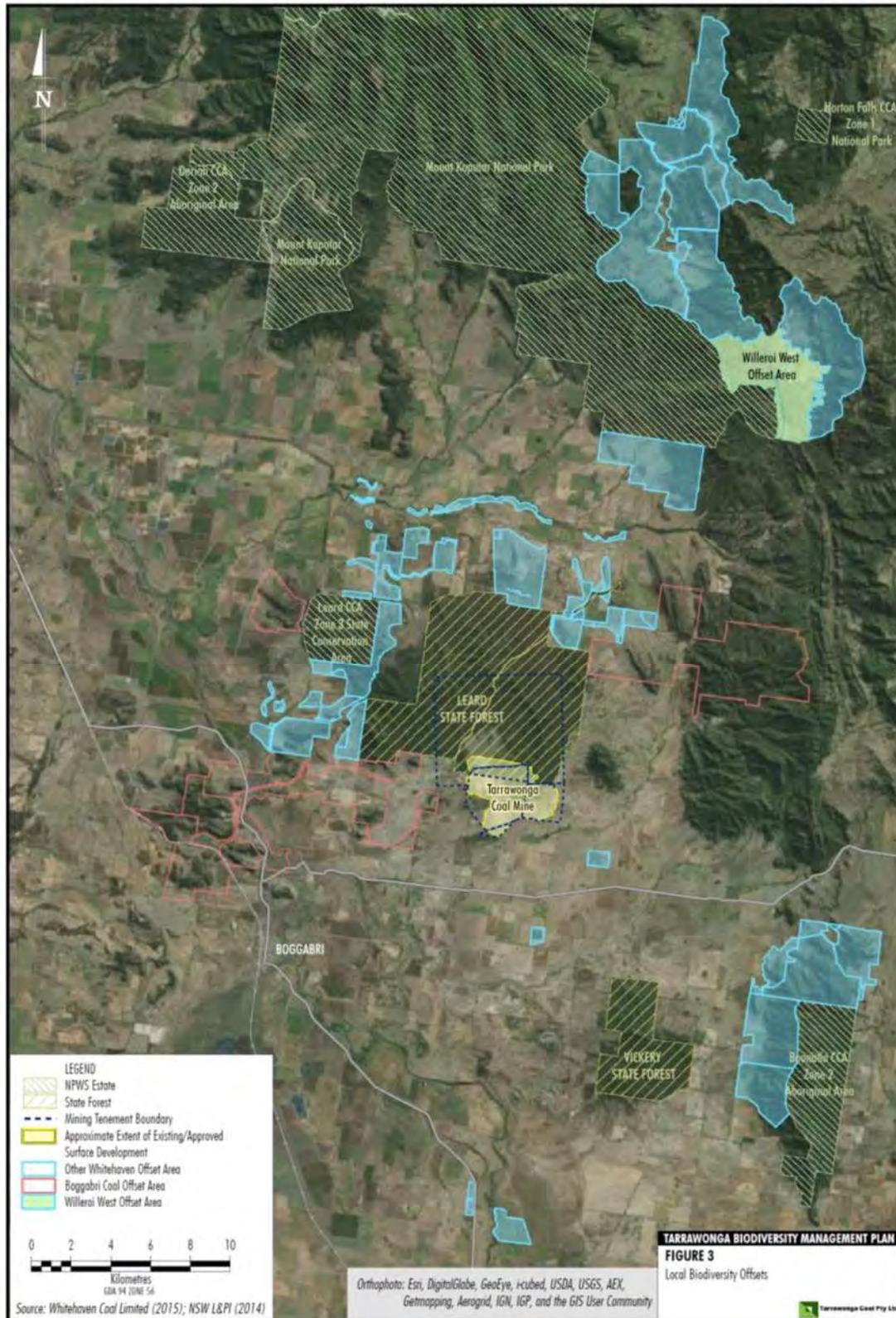


Figure 3: Local Biodiversity Offsets

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1.2 STRUCTURE OF THE BIODIVERSITY MANAGEMENT PLAN

This BMP is divided into two parts. Part A of this BMP describes the management of flora and fauna at the mine site and Part B of this BMP describes the management of flora and fauna within the offset area. The structure of this plan is as follows:

Section 2	Requirements for this BMP.
Section 3	Description of the Existing Environment Relevant to the Mine Site.
Section 4	Description of the Management Actions to be Undertaken at the Mine Site.
Section 5	Description of the Existing Environment Relevant to the Offset Area.
Section 6	Description of the Management Actions to be Undertaken within the Offset Area.
Section 7	Description of Potential Risks and Contingency Measures.
Section 8	Description of Reporting and Review Requirements.

The following are appended to this BMP:

Appendix A	Land Disturbance Protocol
Appendix B	Reconciliation of the BMP against the TCM Threatened Fauna Implementation Plan and the TCM Box-Gum Woodland Endangered Ecological Community Implementation Plan
Appendix C	Offset Area - Vegetation Descriptions
Appendix D	Offset Area Risk Assessment
Appendix E	Willeroi West Flora and Fauna Monitoring - Survey Co-ordinates
Appendix F	Willeroi West Baseline Condition Report

1.3 CONSULTATION

DPIE approved the *Leard Forest Regional Biodiversity Strategy Stage 2 – Strategy Report* (Umwelt, 2017) on 1 September 2017 requiring the BMP to be revised to demonstrate consistency with the findings of the regional strategy and submit prior to the end of February 2018. Extensive consultation was undertaken through the development of the *Leard Forest Regional Biodiversity Strategy Stage 2 – Strategy Report* (Umwelt, 2017) with the following organisations consulted:

- DPIE;
- Umwelt;
- Boggabri Coal;
- Whitehaven Coal;
- NSW Division of Resources and Geoscience (DRG);
- North West Local Land Services (NWLLS) (formerly the Namoi Catchment Management Authority [Namoi CMA]);
- Narrabri Shire Council;
- Forestry Corporation of NSW; and

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- BTM Mine Community Consultative Committee (CCC) that involves Maules Creek CCC, Boggabri CCC and TCM CCC.

Aspects of the BMP “Part A” relating the TCM mine site management were widely consulted during the recent Mining Operations Plan (MOP) development; with the following organisations consulted:

- DPIE;
- Forestry Corporation of NSW;
- Department of Industry – Land and Water (formerly NSW Office of Water);
- NWLLS; and
- Narrabri Shire Council.

Aspects of the BMP “Part B” relating the Whitehaven offset management were widely consulted during 2018; with the following organisations consulted:

- DPIE;
- Forests NSW;
- Department of Industry – Land and Water;
- NWLLS; and
- TCM CCC.

1.4 RESPONSIBILITIES

TCM (including Whitehaven Group Rehabilitation team) will be responsible for managing, monitoring and implementing the management activities in this BMP relevant to the Tarrawonga Mine Site. Whitehaven (Group Environment team) are responsible for managing, monitoring and implementing the management activities specific to the Willeroi West Biodiversity Offset Area. In accordance with Condition 13(f) of the Approval Decision EPBC 2011/5923; **Table 1-1** outlines the Whitehaven Group Environment team positions and contractors involved with implementing the Offset management activities in this BMP (at the time of writing).

Table 1-1: Details of all parties responsible for management, monitoring and implementing the management activities associated with the Offset Area

Area	Organisation*	Position*	Status*	Responsibilities*
Willeroi West Biodiversity Offset Area	Whitehaven	Group Manager - Environment & Approvals	Employee	Obtain and provide adequate resources for the Group Superintendent - Biodiversity to implement the BMP.
	Whitehaven	Group Superintendent - Biodiversity	Employee	To authorise this BMP and undertake associated compliance and reporting requirements. Implement the overall biodiversity strategy on the offset area; coordinate and supervise biodiversity management and monitoring activities on the offset area.

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	Whitehaven	Biodiversity & Field Officers	Employee	Support the Group Superintendent - Biodiversity and supervise biodiversity management and monitoring activities on the offset area.
	Pest Management Consultant/ Contractor	Scientists & Field Technicians	Contractors	Undertake biodiversity management activities as directed by the Group Superintendent - Biodiversity and Biodiversity/Field Officers for feral and pest animal monitoring and management/control.
	Land Management & Weed Spraying Contactor	Field Operators & Technicians	Employee	Undertake biodiversity management activities as directed by the Group Superintendent - Biodiversity and Biodiversity/Field Officers for weed spraying, habitat augmentation, threatened species, revegetation ground preparation and other minor earthworks and waste/infrastructure removal plus tree planting and maintenance activities.
	Fire & Ecological Burn Contractor	Fire Fighters & Controlled Burn Practitioners	Employee	Undertake biodiversity management activities as directed by the Group Superintendent - Biodiversity and Biodiversity/Field Officers for fire management planning, hazard reduction management and ecological burn implementation.
	Ecological Consultant	Ecologists	Employee	Undertake monitoring as directed by the Group Superintendent - Biodiversity and Biodiversity/Field Officers for threatened species and ecological communities assessment and flora/fauna surveys.

* The above information is provided for the purpose of complying with EPBC Approval 2011/5923 Condition 13 f and was correct at the time of submission. Whitehaven reserves the right to vary who and what role/responsibilities are required at any time based on ongoing performance, compliance and commercial aspects that change as required. Therefore, role and responsibilities will vary overtime in between BMP updates and this does not restrict or limit what actual roles and responsibilities for Offset management & monitoring that Whitehaven may implement on the ground in the future.

1.5 RELATIONSHIP WITH OTHER MANAGEMENT PLANS

Offset Management Plan

This BMP addresses the requirements for an Offset Management Plan under Condition 12 of EPBC Act approval for EPBC 2011/5923 (**Section 2.2**).

Mine Site Rehabilitation Plan

The Mine Site Rehabilitation Plan (Mine Operations Plan) describes management of the post-mine landforms in accordance with Condition 64, Schedule 3 of the NSW PA 11_0047. This BMP describes some aspects relevant to rehabilitation such as collection and propagation of seed from felled vegetation (**Section 4.4**) as well as salvaging and reusing material from the site for habitat enhancement (**Section 4.3**).

Goonbri Creek Management Plan

As advised to DAWE for Conditions 19 and 20 in the approved Mine Site Rehabilitation Management Plan; DPIE have accepted that Condition 35b of PA 11_0047 (MOD 1) is yet to be triggered as mining has not to date advanced as far towards Goonbri Creek as was predicted in the Projects Environmental Assessment.

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Farm Management Plan

A Farm Management Plan was prepared in 2016 in accordance with the TCM Statement of Commitments (Appendix 4 to NSW PA 11_0047). As described in **Section 4.1**, the preparation of the Farm Management Plan adopts various measures to manage the specific Whitehaven-owned properties to optimise both farming and biodiversity outcomes.

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2 REQUIREMENTS FOR THE BIODIVERSITY MANAGEMENT PLAN

The NSW PA 11_0047 and EPBC Act approval for EPBC 2011/5923 have informed the structure and scope of this BMP. The relevant conditions of NSW PA 11_0047 are listed in **Section 2.1** and the relevant conditions of the EPBC Act approval for EPBC 2011/5923 are listed in **Section 2.2**.

2.1 RELEVANT STATE APPROVAL CONDITIONS

The conditions of NSW PA 11_0047 relevant to biodiversity management are detailed in **Table 2-1**, together with a reference to where these conditions are addressed in this BMP.

Table 2-1: Project Approval 11_0047 Requirements

Condition Number	Condition	Relevant BMP Section									
SCHEDULE 3: ENVIRONMENTAL PERFORMANCE CONDITIONS											
Biodiversity Offset Strategy											
40	<p><i>The Proponent shall implement the biodiversity offset strategy described in the EA, summarised in Table 14 and shown conceptually in Appendix 7, to the satisfaction of the Director-General.</i></p> <p><i>Table 14: Summary of the biodiversity offset strategy</i></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Area</th> <th style="text-align: center;">Offset Type</th> <th style="text-align: center;">Minimum Size (hectares)</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;"><i>Willeroi Offset Area</i></td> <td><i>Existing native vegetation to be enhanced, and additional native vegetation to be established with the restoration of at least 193 ha of Box-Gum Woodland EEC, as listed under the BC Act</i></td> <td style="text-align: center;">1,660</td> </tr> <tr> <td style="text-align: center;"><i>Rehabilitation Area</i></td> <td><i>Native woodland vegetation communities to be re-established, focused on Box-Gum Woodland EEC</i></td> <td style="text-align: center;">752</td> </tr> </tbody> </table> <p><i>Note: For the purposes of this approval Box-Gum Woodland refers to the EEC listed as White Box Yellow Box Blakely's Red Gum Woodland under the BC Act, and the CEEC listed as White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grasslands under the EPBC Act, or similar EEC as may be updated from time to time.</i></p>	Area	Offset Type	Minimum Size (hectares)	<i>Willeroi Offset Area</i>	<i>Existing native vegetation to be enhanced, and additional native vegetation to be established with the restoration of at least 193 ha of Box-Gum Woodland EEC, as listed under the BC Act</i>	1,660	<i>Rehabilitation Area</i>	<i>Native woodland vegetation communities to be re-established, focused on Box-Gum Woodland EEC</i>	752	Sections 5 and 6
Area	Offset Type	Minimum Size (hectares)									
<i>Willeroi Offset Area</i>	<i>Existing native vegetation to be enhanced, and additional native vegetation to be established with the restoration of at least 193 ha of Box-Gum Woodland EEC, as listed under the BC Act</i>	1,660									
<i>Rehabilitation Area</i>	<i>Native woodland vegetation communities to be re-established, focused on Box-Gum Woodland EEC</i>	752									
Threatened Species											
43	<p><i>For the White Box – Yellow Box – Blakely's Red Gum Grassy Woodland Endangered Ecological Community the Proponent shall:</i></p> <p><i>(d) incorporate the approved implementation plan into the revised Biodiversity Management Plan, required under condition 48.</i></p>	Section 2.4									
44	<p><i>For all threatened species on site, the Proponent shall ensure that the Biodiversity Offset Strategy and Rehabilitation Strategy are focused on protection, rehabilitation and long-term maintenance of viable stands of suitable habitat for these species.</i></p>	Section 2.4									

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**Table 2-1 (Continued)
Project Approval 11_0047 Requirements**

Condition Number	Condition	Relevant BMP Section
SCHEDULE 3: ENVIRONMENTAL PERFORMANCE CONDITIONS		
Threatened Species (Continued)		
45	<p><i>The Proponent shall:</i></p> <p>(a) <i>investigate, in consultation with OEH and the Namoi CMA, all factors likely to enhance or impede the effective long term provision of suitable habitat(s) for the following species: Speckled Warbler, Brown Treecreeper, Grey-crowned Babbler, Hooded Robin, Varied Sittella, Turquoise Parrot, Masked Owl, Yellow-bellied Sheath Tail Bat and Squirrel Glider;</i></p> <p>(c) <i>incorporate the approved implementation plan into the revised Biodiversity Management Plan, required under condition 48.</i></p>	Section 2.4
Long Term Security of Offset		
46	<p><i>The Proponent shall make suitable arrangements to provide appropriate long-term security for the offset areas</i></p> <p>(a) <i>for the Willeroi Offset Area the long-term security shall be provided by way of:</i></p> <ul style="list-style-type: none"> • <i>the Proponent entering into a conservation agreement or agreements pursuant to section 69B of the National Parks and Wildlife Act 1974, recording the obligations assumed by the Proponent under the conditions of this approval in relation to these offset areas, and registering the agreement(s) pursuant to section 69F of the National Parks and Wildlife Act 1974 ; or</i> • <i>a tenure of higher conservation status such as a National Park, or Nature Reserve, under the National Parks and Wildlife Act 1974,</i> <ul style="list-style-type: none"> • <i>The conservation agreement(s) must be registered by the end of December 2013 unless agreed otherwise by the Director-General after consultation with OEH. The conservation agreements must remain in force in perpetuity; and</i> <p>(b) <i>by the end of December 2030 unless otherwise agreed by the Director-General, for the woodland to be established in the Rehabilitation Area, as identified in Table 14, to the satisfaction of the Director-General.</i></p> <p><i>Note: The Department acknowledges that the Proponent is investigating the potential to transfer part or all of the Willeroi Offset Area directly to the national park estate, and accepts that interim conservation measures may be implemented prior to this transfer.</i></p>	Section 6.2.1
Biodiversity Management Plan		
47	<p><i>The Proponent shall prepare and implement a Biodiversity Management Plan for the project to the satisfaction of the Director-General. This plan must:</i></p> <p>(a) <i>be prepared in consultation with OEH, SEWPaC, Forests NSW, the CCC, DPI Catchments and Lands and the Namoi CMA, and be submitted to the Director-General for approval by the end of May 2013;</i></p>	Section 1.3



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**Table 2-1 (Continued)
Project Approval 11_0047 Requirements**

Condition Number	Condition	Relevant BMP Section
SCHEDULE 3: ENVIRONMENTAL PERFORMANCE CONDITIONS		
Biodiversity Management Plan (Continued)		
47 (Cont.)	(a) <i>describe the short, medium, and long term measures that would be implemented to:</i> <ul style="list-style-type: none"> • <i>manage the remnant vegetation and habitat on the site and in the offset area; and</i> • <i>implement the biodiversity offset strategy, including detailed performance and completion criteria;</i> 	Sections 4 and 6
	(c) <i>include detailed performance and completion criteria for evaluating the performance of the biodiversity offset strategy, and triggering remedial action (if necessary);</i>	Section 6.12
	(d) <i>include a detailed description of the measures that would be implemented for:</i> <ul style="list-style-type: none"> • <i>enhancing the quality of existing vegetation and fauna habitat;</i> 	Sections 4.1 and 6
	<ul style="list-style-type: none"> • <i>restoring native vegetation and fauna habitat on the biodiversity offset area and rehabilitation area through focusing on assisted natural regeneration, targeted vegetation establishment and the introduction of naturally scarce fauna habitat features;</i> 	Sections 4.2 and 6
	<ul style="list-style-type: none"> • <i>maximising the salvage of resources within the approved disturbance area – including vegetative, top and sub soils and cultural heritage resources – for beneficial reuse in the enhancement of the biodiversity offset area or rehabilitation area;</i> 	Section 4.3
	<ul style="list-style-type: none"> • <i>collecting and propagating seed;</i> 	Sections 4.4 and 6.4
	<ul style="list-style-type: none"> • <i>minimising the impacts on fauna on site, including undertaking pre-clearance surveys;</i> 	Section 4.5
	<ul style="list-style-type: none"> • <i>managing any potential conflicts between the proposed restoration works in the biodiversity offset area and any Aboriginal heritage values (both cultural and archaeological);</i> 	Section 6.6
	<ul style="list-style-type: none"> • <i>managing salinity;</i> 	Section 4.6
	<ul style="list-style-type: none"> • <i>controlling weeds and feral pests;</i> 	Sections 4.7, 6.7 and 6.8
	<ul style="list-style-type: none"> • <i>controlling erosion;</i> 	Sections 4.8 and 6.9
	<ul style="list-style-type: none"> • <i>controlling access; and</i> 	Sections 4.9 and 6.10
	<ul style="list-style-type: none"> • <i>managing bushfire risk;</i> 	Sections 4.10 and 6.11
	(e) <i>include a seasonally-based program to monitor and report on the effectiveness of these measures, and progress against the detailed performance and completion criteria;</i>	Sections 4.11 and 6.13
	(f) <i>identify the potential risks to the successful implementation of the biodiversity offset strategy, and include a description of the contingency measures that would be implemented to mitigate against these risks; and</i>	Section 7

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**Table 2-1 (Continued)
Project Approval 11_0047 Requirements**

Condition Number	Condition	Relevant BMP Section
SCHEDULE 3: ENVIRONMENTAL PERFORMANCE CONDITIONS		
Biodiversity Management Plan (Continued)		
47 (Cont.)	<p>(g) <i>include details of who would be responsible for monitoring, reviewing, and implementing the plan.</i></p> <p><i>Note: The Biodiversity Management Plan and Rehabilitation Management Plan need to be substantially integrated for achieving biodiversity objectives for the rehabilitated mine-site.</i></p>	Section 1.4
48	<p><i>The Proponent shall review and if necessary revise the Biodiversity Management Plan within 6 months of the completion of Stage 2 of the Leard Forest Mining Precinct Regional Biodiversity Strategy, to the satisfaction of the Director-General. The review/revision must:</i></p> <p>(a) <i>be prepared in consultation with OEH, SEWPaC, Forests NSW, the CCC, DPI Catchments and Lands and the Namoi CMA;</i></p> <p>(b) <i>be consistent with the findings of Leard Forest Mining Precinct Regional Biodiversity Strategy; and</i></p> <p>(c) <i>include any implementation plans arising from the studies required under conditions 434543 and 45 of this approval.</i></p>	Section 8.3
Conservation Bond		
49	<p><i>By the end of May 2013, the Proponent shall lodge a Conservation and Biodiversity Bond with the Department to ensure that the biodiversity offset strategy is implemented in accordance with the performance and completion criteria of the Biodiversity Management Plan. The sum of the bond shall be determined by:</i></p> <p>(a) <i>calculating the full cost of implementing the biodiversity offset strategy (other than land acquisition costs); and</i></p> <p>(b) <i>employing a suitably qualified quantity surveyor to verify the calculated costs, to the satisfaction of the Director-General.</i></p> <p><i>If the offset strategy is completed generally in accordance with the completion criteria in the Biodiversity Management Plan to the satisfaction of the Director-General, the Director-General will release the bond.</i></p> <p><i>If the offset strategy is not completed generally in accordance with the completion criteria in the Biodiversity Management Plan, the Director-General will call in all, or part of, the conservation bond, and arrange for the satisfactory completion of the relevant works.</i></p> <p><i>With the agreement of the Director-General, this bond may be combined with rehabilitation security deposit administered by DRE.</i></p> <p><i>Notes:</i></p> <ul style="list-style-type: none"> • <i>Alternative funding arrangements for long term management of the Biodiversity Offset Strategy, such as provision of capital and management funding as agreed by OEH as part of a Biobanking Agreement or transfer to conservation reserve estate can be used to reduce the liability of the conservation and biodiversity bond.</i> • <i>The sum of the bond may be reviewed in conjunction with any revision to the biodiversity offset strategy.</i> 	Section 6.2.2

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2.2 RELEVANT COMMONWEALTH APPROVAL CONDITIONS

The Commonwealth Minister for the Environment granted EPBC Act approval for EPBC 2011/5923 for the TCM on 11 March 2013. The conditions that are relevant to this BMP are presented in **Table 2-2**.

Table 2-2: Approval Decision EPBC 2011/5923 Requirements

Condition Number	Requirement	Relevant BMP Section
6	<p><i>The person taking the action must register a legally binding conservation covenant over offset areas of no less than:</i></p> <ul style="list-style-type: none"> a. <i>1055 ha of an equivalent or better quality of habitat for the regent honeyeater;</i> b. <i>397 ha of an equivalent or better quality of habitat for the swift parrot;</i> c. <i>1355 ha of an equivalent or better quality of habitat for the greater long-eared bat; and</i> d. <i>232 ha of an equivalent or better quality of the White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland ecological community.</i> <p><i>Note: Offset areas described in condition 6 do not necessarily need to be separate if the same areas can meet the listing criteria for the EPBC listed threatened species or communities as defined in the EPBC listing advice for that threatened species or community and meet the requirements of condition 6.</i></p>	Sections 5.4, 5.6 and 6.2.1
10	<p><i>The mechanism/s for registering a legally binding covenant must provide protection for the offset areas in perpetuity and be registered by 31 March 2021 or as otherwise approved by the Minister in writing.</i></p> <p><i>Evidence of registration must be provided to the Department within one month of registration of each legally binding covenant..</i></p> <p><i>The approval holder must report on progress meeting this requirement in each annual compliance report required under condition 32 and as otherwise requested by the Department.</i></p>	Section 6.2.1
12	<p><i>The person taking the action must submit to the Minister for approval an Offset management plan for all of the offset areas, specified in condition 6, within 12 months of the date of this approval. The approved Offset management plan must be implemented.</i></p> <p><i>Note: for consistency, the proponent may develop a Biodiversity Management plan that includes the requirements set for managing offsets and set out in these conditions, to align with the requirements of the NSW state government Project Approval dated 22 January 2013 (application number 11_0047) and this approval.</i></p>	Section 1.5
13	<p><i>The Offset management plan must include, but not be limited to, the following:</i></p> <ul style="list-style-type: none"> a) <i>a text description and map which clearly defines the location and boundaries of the offset areas. This must be accompanied by the offset attributes and shapefiles;</i> 	Section 5 and Figure 8



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**Table 2-2 (Continued)
Approval Decision EPBC 2011/5923 Requirements**

Condition Number	Requirement	Relevant BMP Section
13 (Cont.)	<p>b) <i>a description of the methodology and results of surveys measuring the baseline ecological conditions in the offset areas. This must be consistent with the State and Transition Model and include but not be limited to:</i></p> <p style="margin-left: 20px;">i. <i>the extent and condition of all vegetation communities, including a description of the structure, floristics and tree age class representation of each community;</i></p>	Sections 5.3 and 5.4, Figures 8 and Figure 9, Appendix C and F
	ii. <i>the extent and condition class of all areas of the White Box—Yellow Box—Blakely's Red Gum Grassy Woodland and Derived Native Grassland ecological community;</i>	Section 5.4, Figure 9
	iii. <i>surveys targeting the regent honeyeater, swift parrot and greater long-eared bat;</i>	Sections 5.6 and 6.13.2
	iv. <i>the extent and quality of all areas of habitat for the regent honeyeater, swift parrot and greater long-eared bat;</i>	Appendix F, Table 5.4 and Figure 12, Figure 13 and Figure 14
	v. <i>the location of all survey sites (including co-ordinates);</i>	Appendix E
	vi. <i>photo reference points at survey sites.</i>	Section 6.13
	c) <i>clearly defined ecological management objectives for the offset areas;</i>	Section 6.1, 6.12
	d) <i>detailed description of all ecological management activities proposed to be undertaken, including maps and/or diagrams showing areas to be managed and the timing of the proposed activities;</i>	Section 6
	<p>e) <i>details of ongoing ecological monitoring programs, performance criteria, targets and provisions for adaptive management, including but not limited to:</i></p> <p style="margin-left: 20px;">i. <i>a set of measurable ecological indicators for detecting changes to the White Box—Yellow Box—Blakely's Red Gum Grassy Woodland and Derived Native Grassland ecological community, including those that may be ascribed to ongoing water stress;</i></p>	Section 6.12 and section 6.13
	ii. <i>a monitoring plan to assess the success of the management activities measured against the baseline condition. The monitoring must be statistically robust and able to quantify change in the condition of the White Box—Yellow Box—Blakely's Red Gum Grassy Woodland and Derived Native Grassland ecological community and habitat for the regent honeyeater, swift parrot and greater long-eared bat.</i> <i>This should include the use of control sites and periodic ecological surveys to be undertaken by a qualified ecologist;</i>	Section 6.13.1
	iii. <i>a list of performance criteria based on the ecological management objectives for the White Box—Yellow Box—Blakely's Red Gum Grassy Woodland and Derived Native Grassland ecological community and habitat for the regent honeyeater, swift parrot and greater long-eared bat;</i>	Section 6.12
	iv. <i>measures to exclude weeds from all offset areas for the period covered by this approval;</i>	Sections 6.7 and 6.13.3
	v. <i>a description of the potential risks to successful management against the performance criteria, and a description of the contingency measures that would be implemented to mitigate against these risks;</i>	Section 7

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**Table 2-2 (Continued)
Approval Decision EPBC 2011/5923 Requirements**

Condition Number	Requirement	Relevant BMP Section
13 (Cont.)	<i>vi. a process by which to report to the department the progress of management activities undertaken in the offset areas and the outcome of those activities, including identifying any need for improved management and activities to undertake such improvement.</i>	Section 8.2.2
	<i>f) details of all parties responsible for management, monitoring and implementing the management activities, including their position or status as a separate contractor.</i>	Section 1.4
	<i>g) details of the funding requirements for the ongoing management activities, including an estimate of the costs of the activities and details of the parties responsible for funding the activities.</i>	Section 6.2.2
14	<i>Unless otherwise agreed to in writing by the department, the baseline surveys for threatened species must be conducted in accordance with the department's Survey Guidelines for Australia's Threatened Birds and the Survey Guidelines for Australia's Threatened Bats. Subsequent monitoring must be carried out annually at the same time of year as the baseline surveys, unless otherwise agreed to in writing by the department.</i>	Section 6.13.2

2.3 TCM ENVIRONMENTAL ASSESSMENT 2011 STATEMENT OF COMMITMENTS

In accordance with the TCMs Statement of Commitments, this BMP addresses the following biodiversity aspects:

- adopting land clearing strategies to minimise impacts on fauna (refer **Section 4.5** and **Appendix A**);
- salvaging and re-using material from the site for habitat enhancement (refer **Section 4.3**);
- revegetation and habitat creation along the low flow channel of the permanent Goonbri Creek alignment (refer **Section 4.2**);
- revegetation within the Goonbri Creek enhancement area (refer **Section 4.2**);
- implementing a nest box program (refer **Section 4.1, 4.3** and **6.5.3**);
- enhancing farm dams (refer **Section 4.1**);
- controlling feral animals (refer **Section 4.7**);
- managing grazing and agricultural practices on Whitehaven-owned land (refer **Section 4.1**);
- managing artificial lighting (refer **Section 4.5**); and
- limiting vehicle speed limits (refer **Section 4.5**).

In addition, Schedule 5 of NSW PA 11_0047 provides detail of the BMP reporting, auditing and review requirements. Compliance with these requirements is described in **Section 8** of this BMP.

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2.4 THREATENED SPECIES AND BOX GUM WOODLAND IMPLEMENTATION PLANS

The *TCM Threatened Fauna Implementation Plan* (Whitehaven, 2015a) and *TCM Box-Gum Woodland Endangered Ecological Community Implementation Plan* (Whitehaven, 2015b) have been prepared by Whitehaven in accordance with Conditions 43 and 45 of Schedule 3 to PA 11_0047. These implementation plans were approved by DPIE on the 14 January 2015.

The *TCM Threatened Fauna Implementation Plan* (Whitehaven, 2015a) was developed to maximise the likely prospects for the provision of suitable habitats for threatened fauna on the offset area and on the post mining landform (including threatened species referred to in Condition 44 of Schedule 3 to PA 11_0047). The implementation plan requires 15 individual actions relating to the Biodiversity Offset Strategy.

The *TCM Box-Gum Woodland Endangered Ecological Community Implementation Plan* (Whitehaven, 2015b) was developed to maximise the prospects for rehabilitation and regeneration of the White Box – Yellow Box – Blakely’s Red Gum Grassy Woodland and Derived Native Grassland (Box-Gum Woodland) (currently listed as a Critically Endangered Ecology Community [CEEC] under the EPBC Act and the NSW *Biodiversity Conservation Act 2016* [BC Act]) on the offset area and the mine site. Box-Gum Woodland was previously listed as an Endangered Ecological Community (EEC) under the BC Act and is referred to as such in older reports and plans such as the *TCM Box-Gum Woodland Endangered Ecological Community Implementation Plan* (Whitehaven, 2015b) and RBS-2 (Umwelt, 2017). The implementation plan requires 39 individual actions relating to the Biodiversity Offset Strategy.

The approved implementation plans are incorporated into this BMP. **Appendix B** provides the individual actions of the implementation plans together with a reference to where the individual actions are addressed in this BMP.

2.5 LEARD FOREST MINING PRECINCT REGIONAL BIODIVERSITY STRATEGY

The requirements of the *Leard Forest Regional Biodiversity Strategy Stage 2 – Strategy Report* (RBS - 2) (Umwelt, 2017) Tables 2.1-2.4 have been incorporated into this updated BMP (see **Table 2-3**). The RBS-2 has the primary purpose to provide a strategic framework for the management and implementation of the biodiversity offset programs already established by the Leard Forest Mining Precinct (Boggabri Coal, Tarrawonga Coal and Maules Creek Coal Mines) and to provide guidance for co-ordinated management with other land managers within the precinct area.

Table 2-3: Leard Forest Regional Biodiversity Strategy Stage 2 – Strategy Report (Umwelt, 2017) Requirements

Table Number	Section Number	Requirement	Relevant BMP Section
Strategic Focus Area 1 - Enhance the quality of habitats and landscapes at the OFFSET sites for White Box – Yellow Box – Blakely’s Red Gum Woodland EEC and CEEC			
2.1	1.1	<i>Natural regeneration is promoted through management of threatening processes including:</i> <ul style="list-style-type: none"> • <i>the management of weeds (refer to Strategic Focus Area 3);</i> • <i>the management of pest animals (refer to Strategic Focus Area 3) and</i> • <i>livestock restriction (where appropriate, in conjunction with strategic grazing).</i> 	6.7, 6.8 & 6.10
2.1	1.1	<i>Natural regeneration management options (such as thinning, slashing, controlled burning) can be undertaken to promote canopy species regeneration in dense grasslands and cypress pine regrowth areas.</i>	6.5.2 & 6.11

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Table 2-3 (Continued)
Leard Forest Regional Biodiversity Strategy Stage 2 – Strategy Report (Umwelt, 2017)
Requirements

Table Number	Section Number	Requirement	Relevant BMP Section
		<i>Methods and results of this should be communicated and made available for future similar regeneration efforts in the region.</i>	
2.1	1.2	<i>Seed collection, management and storage should be undertaken in consideration of the Florabank Guidelines (www.florabank.org.au).</i>	4.4 & 6.4
2.2	1.2	<i>The completion of an Annual Summary Report should be undertaken following each collection event. This should include records of species, qualities, dates and locations as per the Florabank Guideline 4 (www.florabank.org.au).</i>	6.4
2.1	1.3	<i>When restoring areas of White Box – Yellow Box – Blakely's Red Gum Woodland EEC and CEEC, active revegetation should be undertaken generally in accordance with A Guide to Managing Box Gum Grassy Woodlands (Rawlings et al. 2010).</i>	6.5.1
2.1	1.3	<i>Direct seeding and/or tubestock planting should be undertaken in areas where natural regeneration is unlikely to occur (such as low-diversity derived native grassland, pasture and cultivated land) and where natural regeneration areas require supplementary actions (as per TARPs in Table 2.4).</i>	6.5.1
2.1	1.3	<i>Seed and tubestock used in revegetation should include a variety of grasses, low shrubs, mid-sized shrubs and trees, characteristic of White Box – Yellow Box – Blakely's Red Gum Woodland EEC and CEEC (as per the NSW Final Determination and Commonwealth Listing Advice for the communities), to create structurally diverse habitat.</i>	6.5.1
2.2	1.1	<p><i>Monitoring of regenerating White Box – Yellow Box – Blakely's Red Gum Woodland EEC and CEEC should be undertaken annually and across Offset sites. It is recommended that the season for the monitoring sites is rotated every year to assess the community during different seasons. For example:</i></p> <ul style="list-style-type: none"> • <i>half of the monitoring sites surveyed in autumn (to maximise the detection of native perennials); and</i> • <i>half of the monitoring sites surveyed in spring (to identify the extent of exotic annuals in the community).</i> 	6.13.1
2.2	1.1	<p><i>Monitoring should be undertaken in accordance with BioBanking Assessment Methodology (BBAM) (2014) or Biodiversity Assessment Method (BAM), whichever is determined to be the most appropriate through consultation with OEH, to analyse trends against benchmark data by:</i></p> <ul style="list-style-type: none"> • <i>undertaking plot and transect surveys;</i> • <i>undertaking at least the minimum number of plots and transects per vegetation zone; and</i> • <i>photographic monitoring at permanent monitoring points conducted using a consistent methodology across the Offset sites.</i> 	6.13.1
2.2	1.1	<i>During monitoring surveys, specific notes should be taken on any dense or emerging stands of exotic plant species, such as Coolatai grass (<i>Hyparrhenia hirta</i>) and invasive native species such as white cypress pine (<i>Callitris glaucophylla</i>) or black cypress pine (<i>Callitris endlicheri</i>), that may result in the suppression of native understorey species establishment.</i>	6.13.1

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Table 2-3 (Continued)
Leard Forest Regional Biodiversity Strategy Stage 2 – Strategy Report (Umwelt, 2017)
Requirements

Table Number	Section Number	Requirement	Relevant BMP Section
2.2	1.1	<i>Monitoring should be undertaken within the Offset sites at least annually for the first five years and then every two years until preliminary completion criteria (refer to Table 2.3) are met.</i>	6.13.1
2.2	1.1	<i>For the BTM Complex, monitoring results should be outlined in a consistent summary report template to allow for the comparison of results and a consistent understanding of the condition of naturally regenerating White Box – Yellow Box – Blakely's Red Gum Woodland EEC and CEEC broadly across the Offset sites.</i>	7.2.3
2.2	1.2	<i>The completion of an Annual Summary Report should be undertaken following each collection event. This should include records of species, qualities, dates and locations as per the Florabank Guideline 4 (www.florabank.org.au).</i>	7.2.3
2.2	1.3	<p><i>Monitoring of revegetated White Box – Yellow Box – Blakely's Red Gum Woodland EEC and CEEC should be undertaken annually and across the BTM Complex Offset sites. It is recommended that the season for the monitoring sites is rotated every year to assess the community during different seasons. For example:</i></p> <ul style="list-style-type: none"> • <i>half of the monitoring sites surveyed in autumn (to maximise the detection of native perennials); and</i> • <i>half of the monitoring sites surveyed in spring (to identify the extent of exotic annuals in the community).</i> 	6.13.1
2.2	1.3	<p><i>Monitoring should be undertaken in accordance with BioBanking Assessment Methodology (BBAM) (2014) or Biodiversity Assessment Method (BAM) (in prep.), whichever is determined to be the most appropriate through consultation with OEHL, to analyse trends against benchmark data by:</i></p> <ul style="list-style-type: none"> • <i>undertaking plot and transect surveys;</i> • <i>undertaking at least the minimum number of plots and transects per vegetation zone; and</i> • <i>photographic monitoring at permanent monitoring points conducted using a consistent methodology across the Offset sites.</i> 	6.13.1
2.2	1.3	<i>During monitoring surveys, specific notes should be taken on any dense or emerging stands of exotic plant species, such as Coolatai grass (<i>Hyparrhenia hirta</i>) and invasive native species such as white cypress pine (<i>Callitris glaucophylla</i>) or black cypress pine (<i>Callitris endlicheri</i>), that may result in the suppression of native understorey species establishment.</i>	6.13.1
2.2	1.3	<i>Monitoring should be undertaken within the Offset sites at least annually for the first five years and then every two years until preliminary completion criteria (refer to Table 2.3) are met.</i>	6.13.1
2.2	1.3	<i>For the BTM Complex, monitoring results should be outlined in a consistent summary report template to allow for the comparison of results and a consistent understanding of the condition of actively revegetated White Box – Yellow Box – Blakely's Red Gum Woodland EEC and CEEC broadly across the Offset sites.</i>	7.2.3

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Table 2-3 (Continued)
Leard Forest Regional Biodiversity Strategy Stage 2 – Strategy Report (Umwelt, 2017)
Requirements

Table Number	Section Number	Requirement	Relevant BMP Section
Strategic Focus Area 2 – Provide ongoing management and enhancement of existing habitats at the OFFSET sites for threatened species			
2.1	2.1	<p><i>Salvage of habitat resources should be undertaken within the approved disturbance area for re-use in the areas surrounding the disturbance areas, rehabilitation areas and the offset sites. This will include the salvage of one or more of the following habitat features where they are available and of suitable structural integrity:</i></p> <ul style="list-style-type: none"> • <i>fallen timber;</i> • <i>arboreal hollows;</i> • <i>hollow logs; and</i> • <i>bush rock.</i> 	4.3 & 6.5.3
2.2	2.1	<p><i>Salvaged arboreal hollows located within areas surrounding the disturbance areas, rehabilitation areas and the Offset sites should be monitored for their use and condition in conjunction with other annual fauna monitoring.</i></p>	4.11
2.2	2.1	<p><i>Monitoring techniques may include the use of remote camera surveys targeting areas where salvaged hollows and fallen timber is installed into habitat. Detailed monitoring techniques are to be outlined in the relevant management plans.</i></p>	4.11
2.1	2.2	<p><i>Habitat augmentation, using salvaged resources or nest boxes, should be undertaken in habitats identified as having low habitat resources.</i></p>	4.1, 4.5 & 6.5.3
2.1	2.2	<p><i>Where nest boxes are to be installed:</i></p> <ul style="list-style-type: none"> • <i>they are to be made from high quality and durable materials that, ideally, provide for a long lifespan.</i> • <i>designs should be targeted to the hollow-dependent threatened species known to occur in the locality of the offset site such as woodland birds, arboreal mammals and micro-bats.</i> 	6.5.3
2.1	2.2	<p><i>The total number of hollows (existing hollows and nest boxes combined) at the offset sites should be at least the same as the number of hollows with signs of use (nesting material, feathers, fur, scratches, etc) and of suitable dimensions for species occupancy (suitable entrance size and a hollow chamber extending into the branch/trunk) removed from the impact site.</i></p>	6.5.3
2.1	2.2	<p><i>It is expected that the installation of nest boxes would be staged over time to mirror the regeneration of the woodland and the species that are utilising each site.</i></p>	4.1, 4.5 & 6.5.3
2.1	2.3	<p><i>Where Offset sites share common boundaries fencing should not be restrictive to fauna movement or connectivity between habitats. The need for fencing between contiguous Offset sites that are managed in the same way should be investigated and wherever possible removed/avoided.</i></p>	6.2.3

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Table 2-3 (Continued)
Leard Forest Regional Biodiversity Strategy Stage 2 – Strategy Report (Umwelt, 2017)
Requirements

Table Number	Section Number	Requirement	Relevant BMP Section
2.1	2.3	<i>Alternatives to barbed-wire fencing should be used, where appropriate, to avoid obstructing the flight paths of birds, bats and gliders. Any new fencing, where fence lines do not currently exist, should be installed in a way to avoid, or minimise clearing of any native trees or shrubs, where appropriate (Note: clearing/maintenance may still be required in accordance with relevant legislation such as the Native Vegetation Act 2003 or Rural Fires Act 1997).</i>	6.2.3
2.2	2.1	<i>Salvaged arboreal hollows located within areas surrounding the disturbance areas, rehabilitation areas and the Offset sites should be monitored for their use and condition in conjunction with other annual fauna monitoring.</i>	6.13.2
2.2	2.1	<i>Monitoring techniques may include the use of remote camera surveys targeting areas where salvaged hollows and fallen timber is installed into habitat. Detailed monitoring techniques are to be outlined in the relevant management plans.</i>	6.13.2
2.2	2.2	<i>An assessment of the number of nest boxes required should be undertaken (the total number of hollows (existing hollows and nest boxes combined) at the Offset sites should be at least the same as the number of hollows with signs of use (nesting material, feathers, fur, scratches, etc) and of suitable dimensions for species occupancy (suitable entrance size and a hollow chamber extending into the branch/trunk) removed from the impact site).</i>	6.13.2
2.2	2.2	<i>Nest boxes installed within the Offset sites should be monitored for their signs of use and condition at consistent times of the year (preferably spring) across the Offset sites targeting species type based on nest box design.</i>	6.13.2
2.2	2.2	<i>Signs of use monitoring may be undertaken using a pole camera that allows viewing of the inhabitants of the boxes as well as a view of the condition of the top of the boxes from the ground with minimal disturbance to the fauna occupying the boxes. Detailed monitoring techniques are to be outlined in the relevant management plans.</i>	6.13.2
2.2	2.2	<i>Monitoring results of next box usage should be reported in the relevant Annual Summary Report.</i>	7.2.3
2.2	2.3	<i>Ongoing monitoring and site inspections should note any damage or disrepair of fences to be communicated to the Environmental Representative of the relevant mine site.</i>	6.2.3
2.2	2.3	<i>If, during the course of monitoring, the use of barbed-wire fencing is found to be restrictive or damaging to local wildlife (e.g. gliders/bats caught in fencing), this is to be communicated to the Environmental Representative of the relevant site and ecologically-friendly alternatives are to be investigated.</i>	6.2.3

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Table 2-3 (Continued)
Leard Forest Regional Biodiversity Strategy Stage 2 – Strategy Report (Umwelt, 2017)
Requirements

Table Number	Section Number	Requirement	Relevant BMP Section
Strategic Focus Area 3 - Promote a consistent and coordinated approach to weed management and pest animal control			
2.1	3.1	<i>Weed management and pest control conditions and trends are to be communicated across the BTM Complex and should include: review monitoring reports for up-to-date information on weeds and pests discussing and prioritising weed and pest animal prevention, control methods and target species across the BTM Complex for the following year; and liaise with local land managers and stakeholders on control measures and schedules.</i>	4.7, 6.7 & 6.8
2.1	3.1	<i>Develop a feedback loop to alert the BTM Complex of any new or emerging weeds or pest animal species recorded to be occurring on any of the OFFSET sites.</i>	6.7 & 6.8
2.1	3.1	<i>Public communication on pest animal records may be reported through FeralScan (www.feralscan.org.au).</i>	Not Required
2.2	3.1	<i>Key messages on weed control and pest prevention should be available to employees via toolbox talks and inductions to raise awareness of biodiversity issues in the region (e.g. weed spread prevention through the washing of vehicles and equipment).</i>	4.11
2.1	3.2	<i>Weed control should be undertaken in consideration of the control recommendations outlined in: NSW Weeds Control Handbook (8th Edition) (DPI 2018); Narrabri Shire Council Weed Management Plans (http://www.narrabri.nsw.gov.au/weeds-management-plans-1115.html); resources on the NSW WeedWise website (http://weeds.dpi.nsw.gov.au/).</i>	4.7 & 6.7
2.1	3.2	<i>Adopt best-practice active and adaptive management of the density of invasive native plants such as white cypress pine (<i>Callitris glaucophylla</i>) and black cypress pine (<i>Callitris endlicheri</i>) such as ecological thinning, targeted grazing and prescribed fire as per the recommendations set out in <i>Actively Managing for Better Ecological Outcomes for the Brigalow and Nandewar State Conservation Areas</i> (NRC 2014).</i>	6.5.2
2.1	3.2	<i>Adopt best-practice management of Coolatai grass (<i>Hyparrhenia hirta</i>) which threatens to suppress the native understorey of Box-Gum Woodlands as per the recommendations set out in the Department of Primary Industries NSW WeedWise Website - http://weeds.dpi.nsw.gov.au/Weeds/Details/179</i>	6.7
2.1	3.2	<i>Undertake a coordinated approach to weed monitoring across the Offset sites for consistent reporting and data analysis.</i>	6.7
2.2	3.2	<i>Weed occurrences in the Offset sites will be identified as part of the annual flora surveys, but also opportunistically recorded during any other Offset site inspections to examine the effectiveness of control measures.</i>	4.7 & 6.13.1
2.2	3.2	<i>For major weed infestations or newly recorded species, the location, size, density and species should be recorded and communicated to Environmental Representative of the relevant site.</i>	4.7 & 6.7

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Table 2-3 (Continued)
Leard Forest Regional Biodiversity Strategy Stage 2 – Strategy Report (Umwelt, 2017)
Requirements

Table Number	Section Number	Requirement	Relevant BMP Section
2.2	3.2	<i>During monitoring surveys, specific notes should be taken on any dense or emerging stands of exotic plant species, such as Coolatai grass (<i>Hyparrhenia hirta</i>) and invasive native species such as white cypress pine (<i>Callitris glaucophylla</i>) or black cypress pine (<i>Callitris endlicheri</i>), that may result in the suppression of native species establishment, within White Box – Yellow Box – Blakely's Red Gum Woodland EEC and CEEC.</i>	6.13.1
2.2	3.2	<i>For the BTM Complex, monitoring results should be outlined in a consistent summary report template to allow for the comparison of results and a consistent understanding of the key weed issues in a broad regional context.</i>	4.7 & 6.13.3
2.1	3.3	<i>Pest animal control should be undertaken in consideration of the control recommendations outlined in the Department of Primary Industries Vertebrate Pest Control Manual (DPI 2014).</i>	4.7 & 6.8
2.1	3.3	<i>Control strategies may include the destruction of burrows, shooting, trapping and baiting and should be undertaken following the NSW Codes of Practices (COPs) and Standard Operating Procedures (SOPs) (http://www.dpi.nsw.gov.au/agriculture/pests-weeds/vertebrate-pests/publications/model-codes-of-practice)</i>	4.7 & 6.8
2.1	3.3	<i>A coordinated approach to pest animal monitoring should be undertaken across the Offset sites for consistent reporting and data analysis.</i>	6.8
2.2	3.3	<i>Observations of pest animals should be undertaken as part of the annual fauna monitoring, but also opportunistically recorded during any other Offset site inspections.</i>	4.7 & 6.13.2
2.2	3.3	<i>Monitoring of pest animals should be undertaken prior to and following the application of control measures to examine the effectiveness of these measures.</i>	4.7 & 6.13.4
2.2	3.3	<i>Monitoring for pest animals should consider the recommendations in the Department of Primary Industries Monitoring Techniques for Vertebrate Pests (http://www.dpi.nsw.gov.au/agriculture/pests-weeds/vertebrate-pests/publications/monitoring-techniques).</i>	4.7 & 6.13.4
2.2	3.3	<i>For significant pest animal occurrences or observed pest animal damage, the date, location, activity, density and pest animal species should be recorded and communicated to the Environmental Representative of the relevant site.</i>	4.7 & 6.13.4
2.2	3.3	<i>For the BTM Complex, monitoring results should be outlined in a consistent summary report template to allow for the comparison of results and a consistent understanding of the key pest animal issues in a broad regional context.</i>	7.2.3
Strategic Focus Area 4 – Promote a consistent and coordinated approach to fire management for biodiversity			
2.1	4.1	<i>The accessibility of fire trails and access tracks should be regularly maintained within the Offset sites in accordance with relevant legislation such as the Native Vegetation Act 2003 or Rural Fires Act 1997.</i>	6.11

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Table 2-3 (Continued)
Leard Forest Regional Biodiversity Strategy Stage 2 – Strategy Report (Umwelt, 2017)
Requirements

Table Number	Section Number	Requirement	Relevant BMP Section
2.1	4.1	<i>A fuel load assessment and an assessment of the feasibility of completing fuel load reduction should be undertaken as identified on a risk basis or as recommended by the Rural Fire Service (RFS).</i>	6.11
2.1	4.1	<i>Fuel reduction in the form of strategic grazing should be trialled in appropriate management zones within the Offset sites. The timing of any fuel reduction strategies should be determined based on fuel loads, vegetation maturity and weather/seasonal conditions; however, it should generally be undertaken in autumn to encourage native species recruitment.</i>	6.11
2.1	4.2	<i>Control burns should consider the recommendations outlined in Section 9 of A Guide to Managing Box Gum Grassy Woodlands (Rawlings et al. 2010).</i>	6.11
2.1	4.2	<i>Control burns should avoid burning trees containing hollow resources, where possible, to minimise impacts on roosting and nesting availability in the landscape.</i>	6.11
2.1	4.2	<i>If controlled burning is undertaken, implement mosaic burning to reduce the extent of any negative outcomes, provide refuge for wildlife and promote structural and species diversity.</i>	6.11
2.2	4.1	<i>Monitoring of fuel levels will take place as part of the overall annual inspection of the Offset sites but also as identified on a risk basis or as recommended by the RFS.</i>	6.11
2.2	4.1	<i>The accessibility and functionality of fire trails and access tracks should be regularly monitored within the Offset sites.</i>	6.11
2.2	4.2	<i>If fuel reduction is undertaken in the form of controlled burning, additional flora monitoring points will be required to assess the impacts of control measures on native vegetation communities (particularly within White Box – Yellow Box – Blakely's Red Gum Woodland EEC and CEEC).</i>	6.11 & 6.13
2.2	4.2	<i>In habitat restoration areas and regeneration/revegetation zones, monitoring will be required to record the response to a fire event and guide the need for potential active and adaptive management.</i>	6.11 & 6.13
Strategic Focus Area 5 – Enhance the connectivity of habitats through corridor establishment and management			
2.1	5.1	<i>Offset sites and conservation areas should be managed to improve habitat connectivity and corridor function using management actions techniques such as:</i> <ul style="list-style-type: none"> • <i>targeted revegetation including supplementary tubestock planting and seeding</i> • <i>targeted weed and pest management and</i> • <i>habitat augmentation with nest boxes and salvaged habitat resources..</i> 	6.5.1

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Table 2-3 (Continued)
Leard Forest Regional Biodiversity Strategy Stage 2 – Strategy Report (Umwelt, 2017)
Requirements

Table Number	Section Number	Requirement	Relevant BMP Section
2.1	5.1	<p><i>Enhancement efforts should be focused to improve habitat connectivity within and between existing Offset areas in the region. These broad areas of BTM complex managed land include:</i></p> <ul style="list-style-type: none"> • <i>land south of Mount Kaputar National Park linking Offset areas east of Leard State Forest,</i> • <i>land south of Leard State Forest linking areas to Boonalla Aboriginal Area and Vickery State Forest,</i> <p><i>land west and northwest of Leard State Forest linking to Pilliga East..</i></p>	6.5.1
2.1	5.2	<p><i>Where possible, mine rehabilitation should focus on providing habitat connectivity across the BTM Complex between areas of existing native vegetation to provide the best possible habitat linkages across the wider regional landscape.</i></p>	4.2
2.1	5.2	<p><i>Disturbed areas around the Leard State Forest are to be revegetated to contain vegetation communities, habitat and landforms characteristic of:</i></p> <ul style="list-style-type: none"> • <i>Leard State Forest;</i> • <i>White Box – Yellow Box – Blakely’s Red Gum Woodland EEC and CEEC and</i> • <i>habitat for threatened species.</i> 	4.2
2.1	5.2	<p><i>Rehabilitation of White Box – Yellow Box – Blakely’s Red Gum Woodland EEC and CEEC is to be consistent with the National Recovery Plan for White Box-Yellow Box-Blakely’s Red Gum Grassy Woodland and Derived Native Grassland (DECCW 2010) and A Guide to Managing Box Gum Grassy Woodlands (Rawlings et al. 2010).</i></p>	4.2
2.1	5.2	<p><i>Progressive disturbance limits for White Box – Yellow Box – Blakely’s Red Gum Woodland EEC and CEEC for the years 5, 10, 15 and 21 at the Boggabri and Maules Creek projects are to be assured by clearing marking the limits of disturbance with no stockpiling, equipment or machinery occurring beyond each staged boundary.</i></p>	4.5
2.1	5.2	<p><i>Specifically, for the Boggabri and Maules Creek Coal Mines vegetated buffer corridor:</i></p> <ul style="list-style-type: none"> • <i>The mines should consult each other regarding clearing limits to ensure an appropriate vegetated buffer from the east and west of the project areas is maintained, and</i> • <i>The mines should coordinate weed and pest animal control measures, habitat augmentation, fencing and signage, and ecological monitoring within the vegetated buffer corridor.</i> 	Not Required
2.2	5.1	<p><i>Monitoring undertaken as part of other ecological monitoring at the Offset sites should consider the connected landscapes and corridors in the locality and region by including survey techniques to demonstrate fauna movement across these areas such as:</i></p> <ul style="list-style-type: none"> • <i>remote camera surveys; and</i> • <i>radio tracking and/or woodland bird banding;</i> 	6.13.2

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Table 2-3 (Continued)
Leard Forest Regional Biodiversity Strategy Stage 2 – Strategy Report (Umwelt, 2017)
Requirements

Table Number	Section Number	Requirement	Relevant BMP Section
2.2	5.2	<p><i>The success of mine rehabilitation will be monitored against the specific criteria outlined in the Rehabilitation Management Plans (RMPs). These techniques may include:</i></p> <ul style="list-style-type: none"> • <i>Landscape Function Analysis;</i> • <i>weed, pest animal and edge effects monitoring;</i> • <i>targeted floristic surveys to be compared to reference sites in Leard State Forest and/or Offset sites, and/or</i> • <i>targeted fauna monitoring.</i> 	4.11
2.2	5.2	<p><i>For the BTM Complex, monitoring results should be outlined in a consistent summary report template to allow for the comparison of results and an understanding of the overall success of mine rehabilitation in the area.</i></p>	4.11
2.2	5.2	<p><i>Monitoring of the vegetated buffer corridor should be undertaken cooperatively between the Boggabri and Maules Creek Coal Mines and may include:</i></p> <ul style="list-style-type: none"> • <i>weed, pest animal and edge effects monitoring;</i> • <i>targeted floristic surveys to be compared to reference sites in Leard State Forest and/or Offsets sites, and/or</i> • <i>targeted fauna monitoring including techniques such as inspection cameras for nest box monitoring, salvaged resource monitoring and remote camera surveys. Use of the corridor by woodland birds and micro-bats would indicate some effectiveness as a movement corridor</i> 	Not Required

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2.6 OTHER RELEVANT PLANS AND GUIDELINES

The following plans and guidelines were given effect through the preparation of this BMP:

- *National Recovery Plan for White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland* (Department of Environment, Climate Change and Water [DECCW], 2011);
- threatened species recovery plans (Menkhorst *et al.*, 1999; Saunders and Tzaros, 2011);
- *Namoi Catchment Action Plan 2010 – 2020* (Namoi CMA, 2011);
- *A Guide to Managing Box-Gum Grassy Woodlands* (Rawlings *et al.*, 2010);
- draft *Maules Creek Coal Mine Biodiversity Management Plan* (Whitehaven, 2020);
- *Boggabri Coal Mine Biodiversity Management Plan* (Boggabri Coal Pty Ltd, 2018);
- various weed management techniques published by DPI Agriculture (e.g. *NSW Weed Control Handbook* [DPI, 2018] and *North West Regional Strategic Weed Management Plan 2017 – 2022* (North West Local Land Services, 2017));
- various feral animal control and monitoring techniques published by DPI Agriculture (e.g. *Vertebrate Pest Control Manual* [DPI, 2014a]);
- draft *Hunter Valley Coal Mines Best Practice Guidelines for Biodiversity Offset Management Plans* (Department of Planning and Infrastructure [DP&I], 2014); and
- scientific literature pertaining to rehabilitation and restoration (e.g. Noss, 1990; Prober and Thiele, 2005; Gibson-Roy, *et al.*, 2010; Tongway and Ludwig, 2011; Goldin and Brookhouse, 2014).

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PART A
MINE SITE MANAGEMENT OF FLORA AND FAUNA

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3 EXISTING ENVIRONMENT RELEVANT TO THE MINE SITE

A number of reserved areas are located in the region, including Leard State Forest, the Leard State Conservation Area, the Vickery State Forest (located approximately 10 km to the south-east) and Mount Kaputar National Park (located approximately 18 km to the north-east).

The project is situated on the southern boundary of Leard State Forest comprising Mining Lease (ML) 1579, 1685 and 1693. The Leard State Forest is a Zone 4 community conservation area and covers a total area of 7,472 hectares (ha) (NSW Brigalow and Nandewar Community Conservation Area Act, 2005) (TCPL, 2012). The access arrangement between Forestry Corporation of NSW and Tarrawonga Coal Mine is limited to ML1685 (**Figure 2**). Any proposed activities TCM wish to undertake within CL368, held by Boggabri Coal, will be negotiated with Boggabri Coal and Forestry Corporation of NSW.

3.1 FLORA

Vegetation Communities

Six vegetation communities have been mapped as occurring at the TCM (**Figure 4**). Of the vegetation communities mapped, five were identified as native vegetation communities (**Table 3-1**) and one as an anthropogenic community (cleared farmland) (TCPL, 2012).

As part of the approved activities at the TCM, approximately 397 ha of native vegetation (**Table 3 1**) will be cleared. Approximately 145 ha of this area is located within the Leard State Forest, which equates to approximately 1.9% of its total area (TCPL, 2012).

Table 3-1: Native Vegetation Communities at the Mine Site

Community Number	Community Name	Area (ha) ¹
1	White Cypress Pine - Narrow-leaved Ironbark ± White Box Shrubby Open Forest	278
2	White Box - White Cypress Pine Shrubby Woodland	46
3	White Box - White Cypress Pine Grassy Woodland	13
4	Pilliga Box - Poplar Box - White Cypress Pine Grassy Open Woodland	45
5	Bracteata Honey Myrtle Low Riparian Forest	15
TOTAL		397

Source: FloraSearch (2011).

¹ Excludes cleared land with introduced grasses.

Threatened Ecological Communities

One threatened ecological vegetation community is known to occur at the TCM, being Box-Gum Woodland CEEC (TCPL, 2012).

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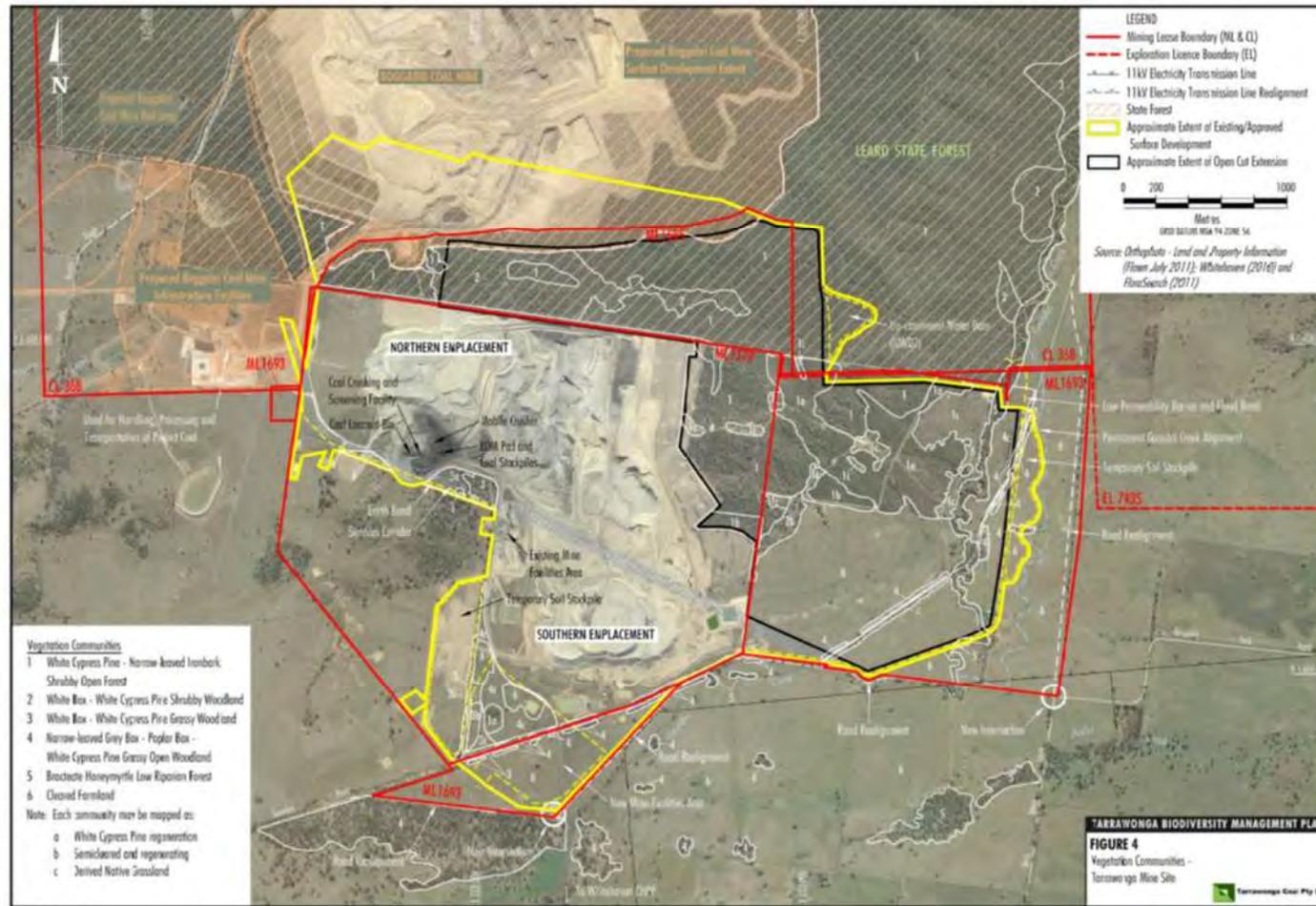


Figure 4: Vegetation Communities – Tarrawonga Mine Site

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The remnants of Box-Gum Woodland CEEC at the TCM have been considerably disturbed and degraded by past land use practices including clearing of trees and shrubs, cropping and heavy grazing by domestic animals. Approximately 13 ha of Box-Gum Woodland CEEC will be cleared for the TCM (Table 3-2).

Table 3-2: Box-Gum Woodland CEEC at the Mine Site

Community Number	Community Name	Area (ha)
3	White Box - White Cypress Pine Grassy Woodland	5
3a	White Cypress Pine Regeneration	3
3b	White Box - White Cypress Pine Regeneration	2
3c	Derived Native Grassland	3
TOTAL		13

Source: FloraSearch (2011)

Threatened Flora

While no threatened flora species were identified by TCM during previous environmental assessments (TCPL, 2012); during pre-clearing assessments in 2016 *Tylophora linearis* (conservation status under NSW BC Act is Vulnerable and Commonwealth EPBC Act is Endangered) was identified and notification provided to the former Commonwealth DoEE and former NSW OEH on 15th February 2016 and an assessment of significance was undertaken and provided to the former DoEE on 11th April 2016. The significance of impact assessment concluded that the Tarrawonga Mine would not have a significant impact on *Tylophora linearis* across the full extent of occurrence of the species and would not reduce the area of occupancy as only 33 individuals were found in 2016; however the species as an area of occupation of 74,000 km² in NSW. No other threatened flora species have been recorded, and no threatened flora populations listed under the BC Act were considered relevant to TCM (TCPL, 2012).

Introduced Flora and Priority Weeds

TCM will manage weeds if found onsite in accordance with the MOP/RMP and the NSW *Biosecurity Act 2015*. The *Biosecurity Act 2015* introduced the “General Biosecurity Duty” (GBD) which requires all land managers and users to ensure as far as is reasonably practicable, that biosecurity risks are prevented, eliminated or minimised. In addition to TCM’s GBD responsibility; weed management will be implemented aligned with the *North West Regional Strategic Weed Management Plan (NWRSWMP) 2017 – 2022* (North West Local Land Services, 2017) and weed control measures will be guided by published control measures (e.g. DPI, 2014). The NWRSWMP introduces a risk management approach (based on the weed invasion curve stages of prevention, eradication, containment and asset protection) to prioritise weeds for management based on those weeds that are “State Level Determined Priority Weeds for the North West Local Land Services Region” and additional “Regional Priority Weeds”. The following list outlines the known priority weeds recorded in the TCM Project Boundary and their status as Weeds of National Significance (WONS) (TCPL, 2012):

- African Boxthorn (*Lycium ferocissimum*) (WONS);
- Prickly Pear (*Opuntia stricta*) (WONS); and

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Groundwater Dependent Flora

One vegetation community (Community 5 – Bracteata Honey Myrtle Low Riparian Forest) that is considered groundwater dependant occurs along the 3 km long portion of Goonbri Creek that is located within the proposed open cut extension as per the *TCM Environmental Assessment* (TCPL, 2012) and project approval. Approximately 15 ha of the community was proposed to be cleared during mining operations (TCPL, 2012). As advised to DAWE for Conditions 19 and 20 in the approved Mine Site Rehabilitation Management Plan; DPIE have accepted that Condition 35b of PA 11_0047 is yet to be triggered as mining has not to date advanced as far towards Goonbri Creek as was predicted in the Projects Environmental Assessment.

3.2 FAUNA

A total of 190 vertebrate fauna species were recorded by Cenwest Environmental Services in 2011 at the TCM and immediate surrounds, including 181 native species (comprising one fish, 11 amphibians, 25 reptiles, 120 bird species and 24 mammal species), as well as nine introduced species. Goonbri Creek only recorded 1 species, which was exotic.

Fauna Habitat

Six broad fauna habitat types were identified at the TCM (TCPL, 2012) (**Figure 5**):

- Dry Sclerophyll Forest Habitat - The upper slopes, and an area south of ML 1693, contain dry sclerophyll forest habitat in reasonably mature formation, although it has previously been cleared and/or logged.
- Dry Sclerophyll Forest Habitat (Cypress Monoculture Regrowth) - The dry sclerophyll forest habitat grades into this habitat type further down the slopes. It is dominated by White Cypress Pine (*Callitris glaucophylla*) with less habitat complexity than the dry sclerophyll forest habitat.
- Grassy Woodland Habitat - A small area of this habitat type occurs near the existing mine facilities area.
- Riparian/Floodplain Habitat - This habitat type occurs along the upper sections of Goonbri Creek at the TCM, to the north of ML 1693, and along other creeks in the locality.
- Grassland Habitat - Agricultural land dominates the plains to the south and south-east where there has been almost a complete removal of tree and shrub cover. These lands mainly comprise introduced grassland habitat but some less-cultivated areas contain derived native grassland.
- Farm Dams - A number of farm dams are located at the TCM and the immediate surrounds. These provide habitat resources for a range of vertebrate species.

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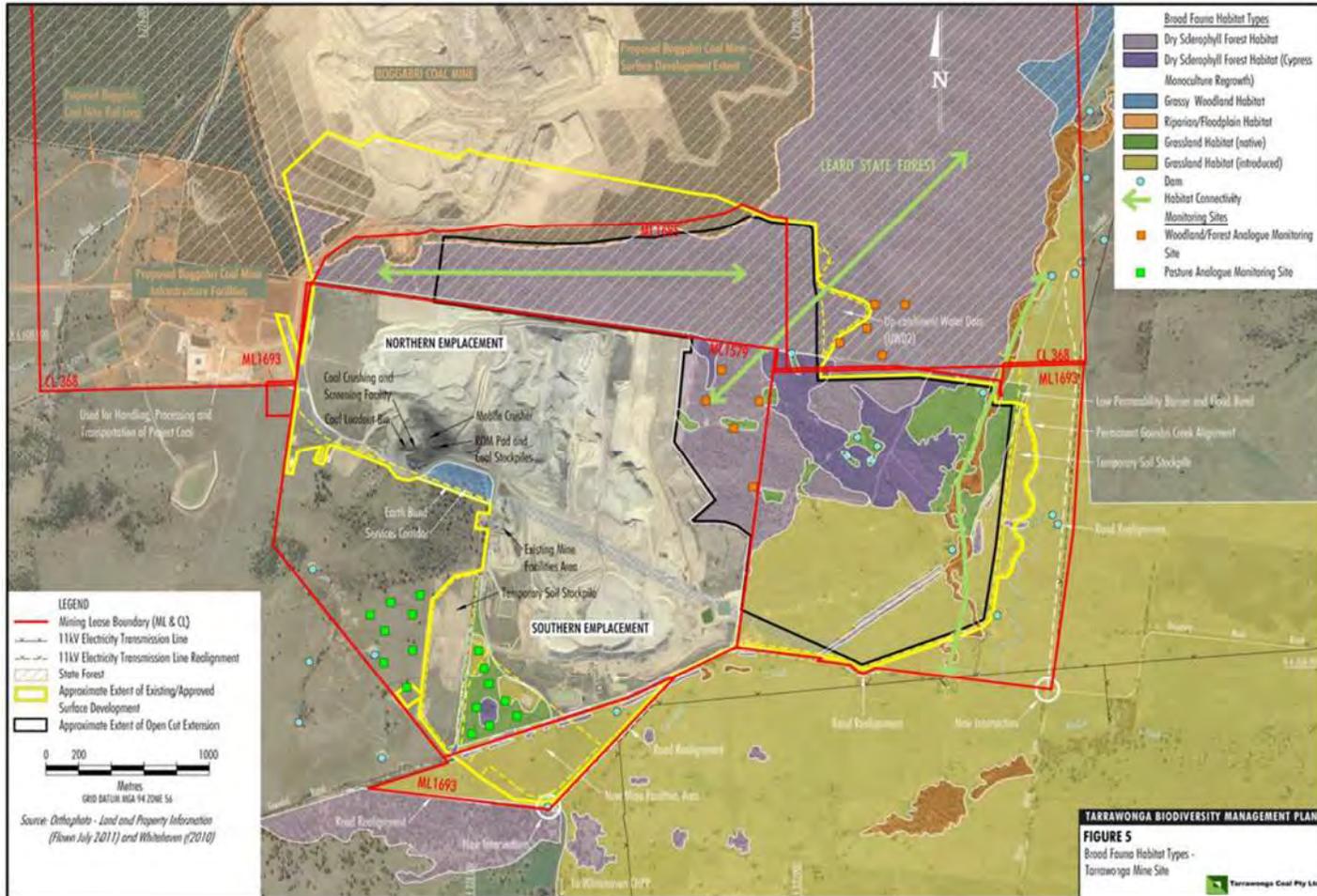


Figure 5: Broad Fauna Habitat Types – Tarrawonga Mine Site

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Threatened Ecological Communities

The Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Darling River EEC (Lowland Catchment of the Darling River EEC) is listed under the NSW *Fisheries Management Act, 1994* and includes “all native fish and aquatic invertebrates within all natural creeks, rivers, streams and associated lagoons, billabongs, lakes, anabranches, flow diversions to anabranches and floodplains of the Darling River within NSW” (TCPL, 2012).

The Namoi River catchment is included in the listing of the Lowland Catchment of the Darling River EEC. Goonbri Creek is the nearest watercourse to the TCM; the lower reaches traverse the TCM as an incised channel owing to the existence of a low landscape gradient (TCPL, 2012).

Threatened Fauna

Nine threatened fauna species listed under the BC Act have been recorded at the TCM. These comprise seven birds, one glider and one bat (**Figure 6**) (TCPL, 2012):

- Turquoise Parrot (*Neophema pulchella*);
- Masked Owl (*Tyto novaehollandiae*);
- Brown Treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*);
- Speckled Warbler (*Pyrrholaemus sagittatus*);
- Hooded Robin (south-eastern form) (*Melanodryas cucullata cucullata*);
- Grey-crowned Babbler (eastern subspecies) (*Pomatostomus temporalis temporalis*);
- Varied Sittella (*Daphoenositta chrysoptera*);
- Squirrel Glider (*Petaurus norfolcensis*); and
- Yellow-bellied Sheath-tail-bat (*Saccolaimus flaviventris*).

The Black-chinned Honeyeater (eastern subspecies) (*Melithreptus gularis gularis*) was also recorded in the immediate surrounds during the surveys. All of these species, and eleven other threatened vertebrate fauna species, have been previously recorded within Leard State Forest, namely, the Spotted Harrier (*Circus assimilis*), Little Eagle (*Hieraaetus morphnoides*), Little Lorikeet (*Glossopsitta pusilla*), Barking Owl (*Ninox connivens*), Painted Honeyeater (*Grantiella picta*), Diamond Firetail (*Stagonopleura guttata*), Koala (*Phascolarctos cinereus*), Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*), South-eastern Long-eared Bat (*Nyctophilus corbeni*), Large-eared Pied Bat (*Chalinolobus dwyeri*) and Eastern Cave Bat (*Vespadelus troughtoni*) (TCPL, 2012).

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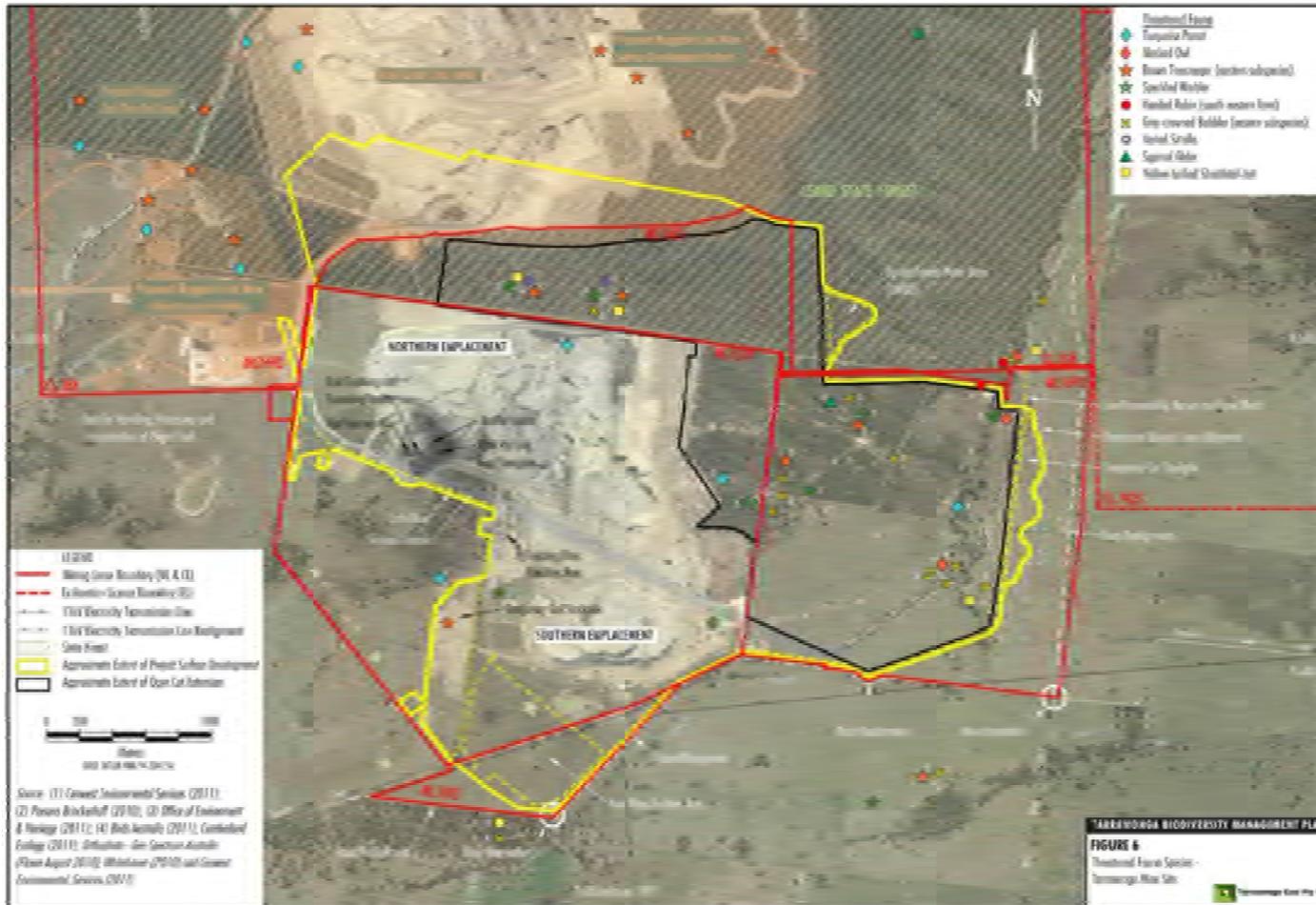


Figure 6: Threatened Fauna Species – Tarrawonga Mine Site

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There are also potential habitat resources at the TCM for an additional nine threatened fauna species listed under the BC Act: the Grey Falcon (*Falco hypoleucos*), Square-tailed Kite (*Lophoictinia isura*), Glossy Black-cockatoo (*Calyptorhynchus lathami*), Swift Parrot (*Lathamus discolor*), Superb Parrot (*Polytelis swainsonii*), Regent Honeyeater (*Anthochaera phrygia*), Spotted tailed Quoll (*Dasyurus maculatus*), Eastern False Pipistrelle (*Falsistrellus tasmaniensis*) and Little Pied Bat (*Chalinolobus picatus*). The Square-tailed Kite was recently recorded flying over the Leard State Forest to the north of the TCM. For some of these species the limited habitat resources present at the TCM are unlikely to be sufficient to support a resident population (TCPL, 2012).

No threatened fauna species listed under the EPBC Act have been recorded at the TCM. The South eastern Long-eared Bat and Large-eared Pied Bat are listed as 'Vulnerable' under the EPBC Act and are known from within Leard State Forest (mainly towards the north). The Swift Parrot, Superb Parrot, Regent Honeyeater and Spotted-tailed Quoll are also listed under the EPBC Act, but there have been no recorded local sightings of these species (TCPL, 2012).

Migratory Species

Two migratory species were located during the survey, the Rainbow Bee-eater (*Merops ornatus*) and White-throated Needletail (*Hirundapus caudacutus*). A number of other migratory species are known to occur in the wider area (TCPL, 2012).

Introduced Fauna

TCM will implement feral animal management in accordance with the MOP/RMP throughout the life of the operation as required based on seasonal conditions that determine the abundance of feral animal species and locations. Feral animal management will be implemented in accordance with the NSW *Biosecurity Act 2015* and aligned with relevant industry guidelines and codes of practice (i.e. Local Land Service Pest Control Orders). Nine introduced species were recorded during the survey. These included one fish (*Gambusia holbrooki*), one bird (Common Starling [*Sturnus vulgaris*]), and seven mammal species (Red Fox [*Vulpes vulpes*]; Brown Hare [*Lepus capensis*]; Rabbit [*Oryctolagus cuniculus*]; Black Rat [*Rattus rattus*]; House Mouse [*Mus musculus*]; Feral Pig [*Sus scrofa*]; and Feral Cat [*Felis catus*]) (TCPL, 2012).

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4 MANAGEMENT OF BIODIVERSITY AT THE MINE SITE

This section describes the management measures that will be implemented by TCPL to manage remnant vegetation, maintenance and completed rehabilitation and farm management areas of the TCM. This section also includes performance and completion criteria which will be used to determine whether the objectives for biodiversity management have been met.

4.1 ENHANCING THE QUALITY OF EXISTING VEGETATION AND FAUNA HABITAT

Aim

To maintain or improve the quality of the existing vegetation and fauna habitat at the TCM and outside of the TCM disturbance limits (**Figure 4** and **Figure 5**).

Management Strategies

- A Farm Management Plan was prepared in 2016 by TCPL to maintain or enhance agricultural production of non-operational project related land including the enhancement of farm dams. This plan encompasses all non-operational project related land outside of ML 1579, ML 1693 and ML 1685. The Farm Management Plan incorporates the requirements of Condition 66 of the project approval and those commitments made in the *TCM Environmental Assessment* (TCPL, 2012).
- The salvage and reuse of hollow tree trunks and branches will be placed on rehabilitated areas to provide fauna habitat in addition to other habitat augmentation strategies including nest boxes targeting those areas with low habitat resources such as rehabilitation areas but staged over time to mirror the condition of the regenerating vegetation (consistent with RBS-2 Table 2.1 Point 2.2 (Umwelt, 2017)). (**Section 4.3**)
- Implement weed control measures (**Section 4.7**) to prevent the establishment and spread of weeds throughout the mining tenement.

Performance/Completion Criteria

- The progress and effects of measures to enhance the quality of existing vegetation and fauna habitat will be monitored and reported annually as part of the TCM Annual Review.

4.2 RESTORING NATIVE VEGETATION AND FAUNA HABITAT

Aim

To restore native vegetation and fauna habitat on the rehabilitation area through assisted natural regeneration, targeted vegetation establishment and introduction of naturally scarce fauna habitat features. TCPL will revegetate the completed landform with flora species characteristic of the local area.

Management Strategies

- Ecosystem establishment within the rehabilitation area will be undertaken in Mining Operations Plan (MOP) approved as the Rehabilitation Management Plan (MOP). The MOP sets performance indicators and completion criteria for mine rehabilitation.
- The disturbance areas will be progressively rehabilitated and revegetated to either native bushland and/or agricultural land. The native bushland revegetation will provide habitat

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connectivity with the BTM Complex (in particular Boggabri Coal's southern rehabilitation area) and wider regional landscape linkages (consistent with RBS-2 Table 2.1 Point 5.2 (Umwelt, 2017)) to contain vegetation communities, habitat and landforms characteristic of:

- Leard State Forest;
 - White Box – Yellow Box – Blakely's Red Gum Woodland CEEC; and
 - habitat for threatened species.
- Rehabilitation of White Box – Yellow Box – Blakely's Red Gum Woodland CEEC is to be consistent with the *National Recovery Plan for White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland* (DECCW 2010) and *A Guide to Managing Box Gum Grassy Woodlands* (Rawlings et al. 2010) such as improving soil structure and health, minimising erosion and managing species composition to improve woodland condition.
 - Target revegetation communities for the TCM Woodland Rehabilitation Areas will be White Box grassy woodland (BVT 226 and PCT 1383) and Narrow-leaved Ironbark - cypress pine - White Box shrubby open forest (BVT 316 and PCT 592) that will be undertaken in accordance with TCM MOP (Amendment F, August 2020) as per the staged implementation of rehabilitation leading to the final rehabilitation presented in Plan 4 outlining the location of the 752ha of Woodland Rehabilitation and excerpt shown below in **Figure 7**.

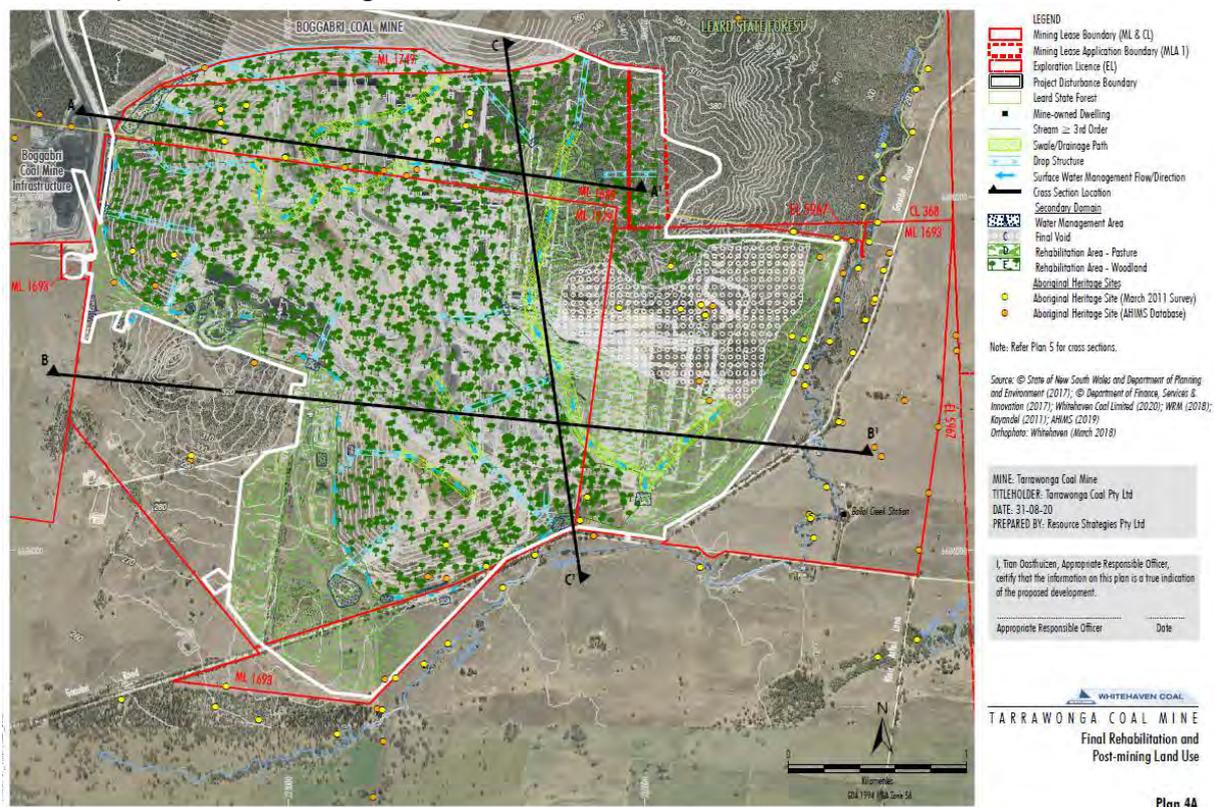


Figure 7: Final Rehabilitation and Post Mining Land Use Plan 4 (taken from Tarrawonga Coal Mine Mining Operations Plan – Amendment F, August 2020)

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- A Goonbri Creek Management Plan will not be developed and implemented as the Alluvium area will no longer be mined.
- The use of supplementary habitat measures to provide suitable habitat, including the use of naturally scarce fauna habitat features will be undertaken by TCM.
- Implement weed control measures (**Section 4.7**) to prevent the establishment and spread of weeds throughout the mining tenement.

Pre-clearance surveys, including for likely threatened flora species, will be undertaken prior to clearing activities by a suitably qualified ecologist. If new threatened species are found DPIE and DAWE will be notified and consulted on potential mitigation options prior to clearing. These surveys will follow the Land Disturbance Protocol (**Appendix A**).

Performance/Completion Criteria

- Both the Mine Site Rehabilitation Plan and the Rehabilitation Management Plan provides the details in regard to the performance measures for rehabilitation of disturbed areas (**Table 4-1**).
- Native vegetation species associations in particular species characterising the Box-Gum Woodland CEEC will be planted in accordance with Table 12 from the TCM MOP (Amendment F, August 2020) that includes a range of species such as grasses, herbs, forbs, low shrubs, mid-sized shrubs and trees such as White Box, Yellow Box and Blakely’s Red Gum.
- Minimum tree height and girth standards for selected indicator species of the vegetation association are within the range of analogue site benchmarks at 1, 5 and 15 years.
- Canopy cover is within the range of analogue sites for the vegetation association at 1, 5 and 15 years.
- Species are setting viable seed, flowering or otherwise reproducing.
- Vegetation develops and maintains a litter layer evidenced by a consistent mass and depth of litter over subsequent seasons.
- Rehabilitation of 752 ha of the woodland/forest post-mine landform.
- Short to mid-term (1, 5 and 15 years) performance criteria for height, girth and canopy cover are described in the Rehabilitation Management Plan, along with contingency measures if the performance criteria are not reached.
- Long-term performance criteria are provided in **Table 4-1**.

Table 4-1: Performance Criteria for Restoration of Native Vegetation and Fauna Habitat

Timing	Performance Criteria
Long-term (greater than 17 years)	The final landform and revegetation program will provide for approximately 752 ha of native woodland/forest areas, including the planting of species characteristic of the local vegetation communities.

Source: TCPL (2012).

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4.3 MAXIMISING THE SALVAGE OF RESOURCES

Aim

To maximise the salvage of resources within the approved disturbance area, including vegetative, top and sub soils and cultural heritage resources, for beneficial reuse in the rehabilitation area.

Management Strategies

Selective Soil Stripping

- Soil resource management will be undertaken in accordance with measures provided in the Rehabilitation Management Plan.
- Identify and quantify potential soil resources for rehabilitation.
- Depth for soil stripping for the disturbance area are as follows:
 - Because Goonabri Creek diversion will not proceed; the majority of the cleared creek flats will now not be salvaged.
 - Sub-sections of the vegetated areas in the north of the TCM site have soil conditions that allow a cut of 0.25 m (approximately 30 ha total).
 - Due to major subsoil constraints, a cutting depth of 0.10 m is recommended elsewhere in the remaining TCM disturbance areas (approximately 405 ha). These soils could be used for woodland/forest rehabilitation (McKenzie Soil Management, 2011).
 - In addition to the high quality soil resources described above, large volumes of other soils could be used in rehabilitation without amelioration to provide conditions suitable for the native woodland/forest. This additional soil could be obtained from the Class 3 Agricultural Suitability areas that are not Stratic Rudosols to a depth of approximately 1 m.
- Areas of disturbance will be stripped progressively to reduce potential erosion and sediment degeneration, and to minimise the extent of topsoil stockpiles and the period of soil storage.
- Areas of disturbance requiring soil stripping will be clearly defined following vegetation clearing.
- Stripped soil will either be directly re-emplaced in rehabilitation areas or stockpiled for future reuse. Preference will be given to placing subsoils and topsoil (in reverse stripping order) directly onto re-contoured areas.
- Subsoils and topsoils will be characterised prior to re-spreading to determine the type and application rates for any required soil ameliorants (e.g. lime, gypsum, fertiliser and organics) to maximise the availability of soil reserves for rehabilitation works.
- Erosion and sediment control measures will be installed prior to the commencement of soil stripping and rehabilitation activities. Erosion control measures, including the management of soil stockpiles, are outlined in **Section 4.8**.

Vegetation and Habitat Salvaging

- Hollow-bearing trees, hollow-bearing logs, ground woody debris, and rocks will be salvaged for reuse in rehabilitation areas (consistent with RBS-2 Table 2.1 Point 2.1 (Umwelt, 2017)). Such

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materials vary in quality and quantity among different parts of the TCM. Whilst some woody materials provide a valuable habitat resource for native fauna, others are not suitable for salvage because they are structurally unsound and/or decayed to the extent that they may not survive felling, translocation and replacement on the recipient site.

- The following method will be applied during both Stage 1 and 2 clearing, to rationalise the salvage of habitat resources to ensure that key habitat resources are retained and utilised in rehabilitation (where appropriate).

i. Quantifying the Habitat Resource for Replication at Recipient Sites

Prior to clearing, 20 x 50 m plots will be surveyed in each vegetation type to quantify the habitat resource.

The number of plots per vegetation type will be commensurate with the area of clearing to be undertaken.

Within these plots the following information will be recorded as a minimum:

- photographs;
- Global Positioning System (GPS) location;
- numbers of tree hollows showing signs of use;
- size class of tree hollows;
- species of trees;
- percentage cover of bush rocks; and
- length of fallen logs (>200 millimetres [mm] diameter).

This data will be used to inform the types and densities of resources to be relocated to recipient sites.

ii. Selection Criteria for Salvage Material

Prior to clearing, suitable salvage items will be identified, recorded, flagged with marking tape, and/or marked with a large (>1 m) "S" using spray paint on side of a tree after cultural heritage considerations. The following criteria will be applied as part of the selection process:

Hollow trees will be considered for salvage based on structural integrity, number and size of hollows. Hollows to be salvaged will include a range of diameter sizes. Ideally, hollows should be in trunks or solid living branches to maximise the chance that they would survive the felling process. Trees will be favoured if single stemmed to ensure that they would remain intact during felling. Stags (dead trees) will be selected if they appear solid and have good hollows in the trunk.

Trees and fallen logs without hollows. It is also intended that a number of trees without hollows, or large logs in good condition, will be collected for retention in addition to those marked by ecologists during pre-clearing. As these trees/logs do not require identification by ecologists, they can be selected at random during clearing and stock-piled to provide additional habitat features in rehabilitated land.

Large flat or creviced rocks (>500 mm width) that appear solid enough to survive translocation will be considered for translocation to rehabilitation or offset sites. In areas

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where few hollow trees or logs are present, most of the habitat features are likely to be marked for collection. In areas where hollows and logs were abundant, only those with significant value as habitat features (as described above) will be marked for retention as habitat. All habitat features selected for salvage will be fully itemised within the Habitat Resource Recovery Inventory.

- All cleared vegetation, with the exception where practicable of areas that have Cypress Pine as the dominant species, not retained for habitat augmentation is mulched on site and mixed into topsoil as a soil conditioner.
- The ground-layer vegetation and low shrubs will be incorporated into the topsoil when it is stripped to assist rehabilitation by increasing the seed bank and organic matter within the stockpiled soil.

Salvaging of Cultural Heritage Resources

- Refer to the Cultural Heritage Management Plan for procedures for the salvage of known sites and management of new sites found within the disturbance footprint.
- Personnel conducting pre-clearing inspections will complete inductions that include identification of potential artefacts, particularly culturally modified trees; and be supported by advice from appropriately experienced and qualified archaeologists.
- Seed collection strategies (refer **Section 4.4**) will incorporate consideration of traditional plants used by the Aboriginal community to facilitate reintroduction into rehabilitation areas.
- The BTM Aboriginal Heritage Conservation Strategy has been developed by TCM, Boggabri Coal and MCC. This strategy aims to enhance and conserve Aboriginal cultural heritage values (both cultural & archaeological) and provide for their long term protection and management. The Strategy has not yet been approved by DPIE.

Performance/Completion Criteria

- The progress and effects of salvaging and reusing habitat resources are monitored annually.
- Topsoils and subsoils are mapped and soil resources for Agricultural and Woodland land-uses are selectively stripped and managed.
- Habitat features (hollow-bearing logs, felled timber and large rocks) are salvaged during pre-stripping operations and relocated for habitat rehabilitation purposes.
- Photographic evidence and documentation of salvaging resources and reusing in the rehabilitation area for beneficial reuse is to be monitored and reported annually as part of the Biodiversity Monitoring Program.

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4.4 COLLECTING AND PROPAGATING SEED

Aim

To maintain the biodiversity values of the site through seed collection and propagation and to ensure that the areas of revegetation are genetically comparable with those in the surrounding woodland areas. WHC coordinates routine seed assessment programs designed to identify on a seasonal basis the life cycle stage and development of native plants across a range of Biodiversity Offsets Areas (BOAs) to identify what, where, when and how to target appropriate resources to collect seed for future revegetation programs (maximum 4 occasions per year limited by health and safety considerations, resources, accessibility, weather and/or ground conditions).

Management Strategies

WHC coordinates routine seed assessment programs designed to identify on a seasonal basis the life cycle stage and development of native plants across a range of BOAs to identify what, where, when and how to target appropriate resources to collect seed for future revegetation programs. The format of the seed assessments ensures that timely and prioritised seed collection is implemented and that reporting includes spatial information required by seed collection contractors to undertake the required works. Seed collection will be based on seed assessment results and/or from other opportunistic observations, but the collection and propagation will only be undertaken as required depending on the revegetation needs.

Seed collection and propagation will take place as summarised below:

- TCM will seek written authority from FCNSW prior to the collection of seed outside of the boundary of ML1685 and within Leard State Forest.
- Seed collection, management and storage will be undertaken in consideration of Florabank guidelines (<http://www.florabank.org.au/>) (consistent with RBS-2 Table 2.1 Point 1.2 (Umwelt, 2017)) including records of species, qualities, dates and locations at the time of each collection. Seed collection will be based on seed assessment results and/or from other opportunistic observations, but the collection and propagation will only be undertaken as required depending on the revegetation needs.
- Currently accepted best practice, as described in Rawlings *et al.* (2010) for local provenance seed collection includes:
 - Collection of seed from several source sites with similar rainfall, soil, altitude, aspect and slope position to the revegetation site to ensure they are most adapted to the landscape and environmental conditions.
 - Collection of seed from between 20-50 plants of each species for genetic diversity; and
 - Collection of seed from plants spaced approximately three plant-heights apart to prevent collection of too many closely related seeds.
- Revegetation by seedlings of the scale required will be undertaken by nurseries that can effectively collect commercial quantities of seed, propagate and grow the seed and harden the seedlings.
- Orders will be placed in advance of revegetation works to meet the demand for tubestock. The likely time frames for plants to reach transplantable sizes will vary depending on the species and method of propagation (e.g. most species require one season to be of sufficient size, but other species such as *Xanthorrhoea*, *Callitris* and *Bursaria* can take two or more years).

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- If TCM organises propagation onsite; records will include the relevant information in accordance with Florabank guidelines.

Performance/Completion Criteria

- Seed collection records, including location of plantings and success rates (where available), are reported on in the Annual Summary Report.
- Seed is collected over a range of sites across the locality to adequately capture local variations within the offset sites and disturbance areas.
- Monitoring of plant flowering and seeding cycles by the seed collectors and their establishment of a comprehensive database and detailed strategy.

4.5 MINIMISING THE IMPACT ON FAUNA

Aim

To minimise the impacts on fauna at the TCM, including undertaking pre-clearance surveys.

Management Strategies

- The Disturbance Limit Approach (Ecoplanning, 2021) outlines the progressive disturbance limits for White Box – Yellow Box – Blakely’s Red Gum Woodland CEEC and for other Matters of National Environmental Significance (as required by EPBC Approval 2011/5923 Condition 3) for the years 5, 10, 15 and 17 at TCM. Each years clearing areas will mark the limits of disturbance with no stockpiling, equipment or machinery occurring beyond each staged boundary (consistent with RBS-2 Table 2.1 Point 5.1 (Umwelt, 2017)).
- Some potential impacts have been avoided/reduced through refinement of the mine design, and other impacts are likely to be mitigated by progressive rehabilitation as well as local habitat restoration, management and supplementation strategies.
- Residual impacts will be addressed by the long-term conservation and enhancement of significant areas of fauna habitats in the offset area that can be enhanced by appropriate management and/or the creation of significant areas of fauna habitat resulting from the revegetation programme.
- Progressive backfilling of the open cut mine voids instead of only out-of-pit dumping to avoid additional native vegetation clearance.
- Land clearance for the TCM will be undertaken progressively, and the area cleared at any particular time would be no greater than that required to accommodate the mine’s needs for the following twelve months.
- Areas requiring clearing will be clearly delineated, purpose of which to be communicated to relevant ecologists and machinery operators, and would be restricted to the minimum area necessary to undertake the approved activities.
- The areas requiring clearing must be demarcated according to the following boundary marking protocol. Pegs and/or flagging tape must be used to demarcate areas to be cleared and, along boundaries such as extents of approved disturbance or mining leases continuous demarcation such as bunting must be used to demarcate the area to be cleared.

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- Clearing will be subject to a pre-clearance survey by an appropriately qualified ecologist to ensure clearing activities are managed to minimise impacts on fauna. The Land Disturbance Protocol will be implemented for clearing activities in accordance with **Appendix A** of this BMP.
- A two stage clearing approach will be employed to minimise impacts on possible fauna in identified habitat trees, with these trees retained for a minimum period overnight prior to commencing 2nd stage clearing. Stage 2 habitat trees will be shaken prior to felling. Where possible trees will be lowered slowly to the ground. Felled trees will be inspected for fauna and retained overnight to provide time for remaining fauna to vacate hollows, should they be identified.
- Removal of vegetation will be restricted to a clearing window of 15 February to 30 April – this includes all contiguous vegetation within project boundary, inside and outside of the Leard State Forest.
- Clearing will cease when temperature exceeds 35°C (averaged over a 15 minute period),
- Under exceptional circumstances minor removal of vegetation may be undertaken outside the 15 February to 30 April period with the prior written consent of the Secretary including identifying specific mitigation measures for breeding/ nesting of target fauna species recorded or likely to occur.
- Suitably trained or qualified person(s) will be present during the felling of identified hollow bearing trees to provide assistance with the identification, and if necessary, rescue and care of any injured fauna.
- The species, number and condition of fauna identified during clearing activities will be recorded.
- Updated maps/plans, pre-determined habitat for the release of fauna, habitat features present in the site and recommended clearing procedures will be submitted to the TCM Environmental Officer and shall be recorded and signed off in the Land Disturbance Protocol (**Appendix A**) form.
- Translocation of fauna will not be undertaken unless appropriate licences, including agreed translocation strategy, have been obtained from DPIE. Although unlikely, if a Koala is found, it will be left to move away from the clearance area on its own accord.
- DPIE were consulted over the Fauna Radio-tracking Program (Cumberland Ecology, 2017) which was prepared ahead of fauna captured during pre-clearing/clearing activities in 2017 for both the TCM and Maules Creek Coal Mines. The Whitehaven Fauna Radio tracking Program methodology considered the following:
 - objectives of tracking program (movements from point of release, etc.);
 - duration of tracking at each session (one week, a few days);
 - lag time between release and then tracking (immediate tracking or wait overnight);
 - appropriate frequency of tracking (i.e. months, weeks, etc.);
 - types/sizes of radio collars required and costs per unit;
 - likely numbers and types required at each pre-clearing/clearing stage;
 - types of radio receivers and costs; and
 - potential requirement to construct radio towers in addition to the use of hand-held receivers in order to facilitate tracking over a large distance.
 - The initial years of pre-clearing and clearing survey information for MCCM and Tarrawonga Coal Mines (such as capture rates and types of fauna captured) were used to determine that the Yellow-bellied Sheathtail Bat (*Saccolaimus flaviventris*) and the Gould's Wattled Bat (*Chalinolobus gouldii*) were the most suitable species for use in the radio-tracking program

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although other species can be considered for radio-tracking if determined to be healthy and that the transmitter can be humanely attached in accordance with an Animal Research Approval.

- Ongoing radio-tracking programs will be considered to be implemented on an annual basis depending on the area to be cleared, the habitat type and predicted native fauna species to occur. Small annual clearing areas or habitats low in potential target species (i.e. microbats) will not be efficient or effective to undertake radio tracking in those years.
- The salvage of identified woody debris will be transferred directly to an area that has been prepared to the post mining landform, or alternatively stockpiled for later use in the rehabilitation.
- The salvage and reuse of hollow tree trunks and branches will be placed on rehabilitated areas to provide fauna habitat in addition to other habitat augmentation strategies including nest boxes targeting those areas with low habitat resources such as rehabilitation areas but staged over time to mirror the condition of the regenerating vegetation (consistent with RBS-2 Table 2.1 Point 2.2 (Umwelt, 2017)).
- Pre-clearance surveys of ancillary infrastructure areas (e.g. water management structures, monitoring equipment areas) for threatened flora species will be undertaken. Relocation (if practicable) of ancillary infrastructure areas (e.g. water management structures, monitoring equipment) should be considered to avoid any threatened species.
- Feral animal and weed control shall be undertaken in accordance with **Section 4.7**.
- The use of pesticides and herbicides will be limited in native habitat.
- Adequate noise and dust management, controlling the use of artificial lighting and fire management will also assist in minimising the impact on fauna at the TCM.
- The on-site speed limit of 60 km/hr will continue to be applied to new haul roads and internal roads.
- Firewood collection will not be permitted.

Performance/Completion Criteria

- 100% of the White Box – Yellow Box – Blakely’s Red Gum Woodland CEEC across the relevant vegetation zones in each offset site show evidence of occupation or presence of at least 80% of the native fauna species comparative to approved benchmark or monitoring reference sites.
- Targeted fauna monitoring of nest boxes indicates that the nest box program has provided habitat for native fauna species in the locality as outlined in **Table 4-2**.
- The rehabilitated habitat in mine rehabilitation and the vegetated buffer corridor provides a wildlife corridor linking habitats from conservation areas in the east, linking Leard State Forest and to west towards the Namoi River.
- Documenting and reporting in accordance with the Land Disturbance Protocol to verify that clearing has been undertaken in accordance with the measures described above and Appendix A.
- The species, number and condition of fauna identified during clearing activities would be recorded and a summary provided in the TCM Annual Review.

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4.6 MANAGING SALINITY

Aim

To prevent impacts on biodiversity values from soil and water salinity.

Management Strategies

- Overburden and interburden will be characterised prior to emplacement in waste dumps to ensure the final outer surfaces of the overburden emplacements (and structures such as drainage elements) are constructed with suitable non-sodic or low sodicity material where possible.
- Any sodic materials that may be exposed or near-surface will be ameliorated as required (e.g. treated with gypsum) to minimise dispersion.
- Conduct soil and inter/over burden testing for salinity and sodicity in landform establishment areas. Any material identified as being saline/sodic shall be treated in-pit or in emplacement areas.
- Water quality monitoring of sites will be conducted as described in the most recent version of the Water Management Plan.
- Site soil management protocols will be implemented and periodically reviewed.

Performance/Completion Criteria

- Soil tested for chemical properties, including salinity.
- Salinity down the soil profile is within the range of analogue sites at year 5.
- Rehabilitation completion criteria is met.
- No unregulated discharge of saline water from the TCM.

4.7 CONTROLLING WEEDS AND FERAL ANIMALS

Aim

Promote natural regeneration by reducing weeds so that cover does not comprise of more than 20% of any strata in native vegetation communities consistent with RBS-2 Table 2.1 Point 1.1 and Table 2.3 Point 3.2 (Umwelt, 2017) by implementing measures to exclude Weeds of National Significance [WONS]) and NSW biosecurity priority weeds (formerly noxious weeds). Reduce feral animal species and populations at the TCM and adjoining land consistent with RBS-2 Table 2.3 Point 3.3 (Umwelt, 2017). If new feral animals or weeds are found during monitoring those new feral animals and weeds will also be managed in accordance with this BMP.

Management Strategies

Weed Control

- TCM will ensure that the priority (formerly noxious) weed control strategies are undertaken onsite (as required) and will consider the *NSW Weed Control Handbook* (DPI, 2018), resources on the

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NSW WeedWise website (<http://weeds.dpi.nsw.gov.au/>) and local weed management plans published by the Narrabri Shire Council (2014) (consistent with RBS-2 Table 2.1 Point 3.2 (Umwelt, 2017)).

- Weed occurrences will be identified as part of the annual flora monitoring, but also opportunistically during any other site inspections to examine the effectiveness of the control measures (consistent with RBS-2 Table 2.2 Point 3.2 (Umwelt, 2017)).
- Mechanical removal and/or the application of approved herbicides in areas identified as being affected by weeds (in accordance with the Pesticides Act 1999).
- Appropriate herbicide application methods (spot-spraying, basal spraying, stem injection or cut and paint methods) will be used to minimise the amount of herbicide used. The method of application will be determined on a case by case basis and is not limited to the above methods.
- Follow-up site inspections to evaluate the effectiveness of weed control programs.
- Follow-up weed control in previously treated areas where weed management has been sub optimal.
- Minimise the potential for seed and organic matter transport to or from the rehabilitation area by ensuring all plant and equipment involved in pre-stripping and final rehabilitation works (topsoiling, revegetation and monitoring) are weed free (via inspection of vehicles and plants).
- Focused weed management/suppression measures will be undertaken on stockpiles, roadsides and disturbance areas.
- Regular liaison with local landholders and relevant government agencies to monitor the spread and management of weeds within the local area.

Feral Animal Control

- TCM will ensure that when feral animal control strategies are undertaken onsite (as required) will consider the Department of Primary Industries Vertebrate Pest Control Manual (DPI 2014) and follow the NSW Codes of Practices (COPs) and Standard Operating Procedures (SOPs) (<http://www.dpi.nsw.gov.au/agriculture/pests-weeds/vertebrate-pests/publications/model-codes-of-practice>) (consistent with RBS-2 Table 2.1 Point 3.3 (Umwelt, 2017)).
- Observations of pest animals will be undertaken as part of the annual fauna monitoring, but also opportunistically during any other site inspections to examine the effectiveness of the control measures. Any significant pest animal occurrences or observed pest animal damage (the date, location, activity, density and pest animal species) will be reported to TCM (consistent with RBS-2 Table 2.2 Point 3.3 (Umwelt, 2017)).
- Feral animal monitoring and control results will be reported in the BTM Joint Annual Biodiversity Summary Report to allow for the comparison of results and a consistent understanding of the key pest animal issues in a broad regional context (consistent with RBS-2 Table 2.2 Point 3.3 (Umwelt, 2017)).

Communication

The communication of weed and feral animal management will be undertaken across the BTM Complex as a minimum as part of the Joint Annual Biodiversity Summary Report and the Biodiversity Forum (consistent with RBS-2 Table 2.1 Point 3.1 (Umwelt, 2017)) and will include:

- review monitoring reports for up-to-date information on weeds and pests;

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- discussing and prioritising weed and pest animal prevention, control methods and target species across the BTM Complex for the following year; and
- liaise with local land managers and stakeholders on control measures and schedules.

Performance/Completion Criteria

- Reduce weed and feral animal populations consistent with RBS-2 Table 2.3 Point 3.2 and 3.3.
- Weed species presence and densities are monitored and control programs implemented when population size and/or distribution increases. Control programs will be considered effective when vertebrate species populations are reducing.

4.8 CONTROLLING EROSION

Aim

To control soil erosion and sediment generation close to the source and minimise the potential for erosion to adversely affect remnant vegetation and habitat on the site (including aquatic habitats).

Management Strategies

- Erosion and sediment control plans will be developed over the life of the TCM as part of the Water Management Plan (WMP) and Land Disturbance Protocols. The WMP will describe the specific controls (including locations, function and water monitoring structure capacities) that will be used to minimise the potential for soil erosion and transport of sediment off-site. The WMP will be updated periodically to meet the particular changes to the TCM over the life of the mine. All erosion and sediment control storages will have sufficient capacity to manage disturbed area runoff in accordance with 'Blue Book'.
- Approved drainage and sediment and erosion controls will be implemented progressively, including sediment basins and contour banks.
- General soil resource management practices will include the stripping and stockpiling of soil resources prior to any mine-related disturbance for use in rehabilitation.
- Erosion and sediment control measures will be installed prior to the commencement of soil stripping and rehabilitation activities.
- Areas of disturbance will be stripped progressively, as required, to reduce potential erosion and sediment generation, and to minimise the extent of topsoil stockpiles and the period of soil storage.
- Areas of disturbance requiring soil stripping will be clearly defined following vegetation clearing.
- Native cover crops will be planted on newly rehabilitated mine landform areas as soon as possible after completing earthworks.
- New infrastructure disturbance areas (e.g. road and dam embankments) will be stabilised as soon as possible by topsoiling and seeding.
- Any long-term soil stockpiles will be managed to maintain long-term soil viability through the implementation of the following management practices:

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- Topsoil and subsoil stockpiles will be retained at a height of 3 m, with slopes no greater than 1:2 (vertical to horizontal) and a slightly roughened surface to minimise erosion.
- Topsoil stockpiles will be constructed to minimise erosion, encourage drainage, and promote revegetation.
- Where additions such as lime, gypsum and fertiliser are needed to improve the condition of cut soil, they will be applied at suitable rates.
- All topsoil and subsoil stockpiles will be given reasonable opportunity to self-regenerate; if unsuccessful they will be sown with a suitable cover crop.
- Soil stockpiles will be located in positions to avoid surface water flows.
- An inventory of soil resources (available and stripped) at the TCM will be maintained and reconciled as required with rehabilitation requirements.
- In preference to stockpiling, wherever practicable, stripped topsoil and subsoil will be directly replaced on completed sections of the final landform.

Performance/Completion Criteria

- Surface Water Management Plan is developed and implemented, including erosion and sediment control plans. Review of these plans is undertaken regularly.
- Sediment control structures are in accordance with the relevant site management plans and standards.
- Erosion and sediment control measures meet the requirements of the Landcom (2004) guideline.
- Absence of slumping and/or uncontrolled erosion.

4.9 CONTROLLING ACCESS

Aim

To prevent unauthorised access to remnant vegetation and habitat on the site through the provision of designated access roads and signage.

Management Strategies

- Maintain access roads and tracks at the TCM.
- Maintain boundary fencing.
- Maintain signage to advise not to enter the TCM.

Performance/Completion Criteria

- All fences are maintained in good working order
- Designated access roads and tracks are maintained
- Signage is installed and clearly visible.

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4.10 MANAGING BUSHFIRE RISK

Aim

To minimise the risks and hazards to biodiversity values posed by bushfires.

Management Strategies

- Clearing will not be undertaken during periods of extreme fire danger as defined by the Bureau of Meteorology.
- Controlled high intensity, short-term grazing will be employed to assist in the reduction of vegetative fuel loads on areas on which active mining operations are not occurring and appropriate fencing is available.
- All personnel and contractors will only use diesel vehicles and/or remain on defined roads or tracks.
- A fire break and fire trails shall be established and maintained around the perimeter of the mining leases 1579 and 1693. Existing fire breaks and fire trails within mining lease 1685 will be maintained. FCNSW will be notified of the location of any new fire breaks and trails within LSF.
- Prohibition of smoking at TCM.
- Firefighting equipment shall be provided on-site including water carts equipped with water cannons to provide immediate response to a bushfire onsite.
- Appropriate mine personnel will receive basic fire control training.
- Fire prevention and fuel load reduction in rehabilitated mine areas will be undertaken if required and will involve measures such as a combination of fire breaks and short periods of high intensity grazing. Controlled burns may also be used through consultation with Narrabri Shire Council and the local fire brigades.
- Controlled burns will not be undertaken whilst vegetation is establishing.
- Mosaic burning shall be prescribed to reduce potential negative impacts. FCNSW will be notified of any planned hazard reduction burns.
- FCNSW implements operational restrictions on clearing activities during periods of severe fire danger.

Performance/Completion Criteria

- Fuel load/fire security will be inspected prior to the commencement of each bushfire season.
- All fire equipment will be kept in a serviceable condition and inspected at least once every 6 months by a fire equipment service provider (3 months for mining equipment).
- Bushfire incidents will be recorded and managed via the Whitehaven incident management process. Occurrence of bushfires will be reported to the relevant authorities and discussed in the TCM Annual Review.

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4.11 MONITORING

Biodiversity monitoring requirements for TCM are presented in **Table 4-2**.

A number of reserved areas are located in the region, including Leard State Forest, the Leard State Conservation Area, the Vickery State Forest (located approximately 10 km to the south-east) and Mount Kaputar National Park (located approximately 18 km to the north-east).

The project is situated on the southern boundary of Leard State Forest comprising Mining Lease (ML) 1579, 1685 and 1693. The Leard State Forest is a Zone 4 community conservation area and covers a total area of 7,472 hectares (ha) (NSW Brigalow and Nandewar Community Conservation Area Act, 2005) (TCPL, 2012). The access arrangement between Forestry Corporation of NSW and Tarrawonga Coal Mine is limited to ML1685 (**Figure 2**). Any proposed activities TCM wish to undertake within CL368, held by Boggabri Coal, will be negotiated with Boggabri Coal and Forestry Corporation of NSW.

Rehabilitation monitoring described in the Mining Operations Plan (MOP Section 8 Amendment F August 2020) will be undertaken in accordance with the BioBanking Assessment Methodology (BBAM) (OEH 2014) to analyse the success against the specific criteria outlined in the MOP (which also is approved in NSW as the Rehabilitation Management Plan) (consistent with RBS-2 Table 2.2 Point 5.2 (Umwelt, 2017)). Rehabilitation monitoring may also include Landscape Function Analysis (LFA). Any constructed habitat installed within the rehabilitation areas will be monitored for their use by birds, reptiles and arboreal mammals and condition in conjunction with other annual fauna monitoring using remote camera survey to target areas where salvaged stag trees/hollows, nest boxes and fallen timber have been installed for habitat (consistent with RBS-2 Table 2.2 Point 2.1 (Umwelt, 2017)).

The communication of rehabilitation monitoring and monitoring results will be undertaken across the BTM Complex as a minimum as part of the Joint Annual Biodiversity Summary Report and the Biodiversity Forum (consistent with RBS-2 Table 2.2 Point 5.2 (Umwelt, 2017)) to allow for the comparison of results and an understanding of the overall success of mine rehabilitation in the area.

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Table 4-2: Biodiversity Monitoring Requirements

Monitoring Commitment	Source	Monitoring
Rehabilitation of Project disturbance areas, including the reinstatement of key agricultural and ecological values <ul style="list-style-type: none"> A Rehabilitation Management Plan will be developed and implemented for the TCM, including a rehabilitation monitoring program designed to track the progress of rehabilitation and revegetation. 	TCPL, 2012 - Section 7, pp. SOC1 TCPL, 2012 - Section 7, pp. SOC5	Monitoring methods for rehabilitation areas are described in the Mining Operations Plan (MOP Section 8 Amendment F August 2020) which is also described in the approved Rehabilitation Management Plan.
Flora		
Weed control <ul style="list-style-type: none"> Seasonal inspections of revegetated areas and other parts of the mining tenements to identify and demarcate areas of priority and environmental weeds Monitoring of areas of existing infestation to assess the effectiveness of management control actions Regular liaison with local landholders and relevant government agencies to monitor the spread and management of weeds within the local area Follow up site inspections to evaluate the effectiveness of weed control programs. 	TCPL, 2012 – Section 4, pp. 4-72	The weed monitoring program will be incorporated into the annual flora monitoring program as described in the approved Mining Operations Plan (MOP Section 8 Amendment F August 2020).
Flora - Rehabilitation management plan	TCPL, 2012 – Section 4, pp. 4-72	Rehabilitation monitoring is addressed in Section 8 (Rehabilitation Monitoring, Research and Reporting) of the MOP.
Fauna		
Land clearing strategies <ul style="list-style-type: none"> Suitably trained or qualified person(s) will be present during the felling of identified hollow bearing trees to provide assistance with the identification, and if necessary, rescue and care of any injured fauna. Vegetation clearance protocols will be documented in the BMP and implemented to minimise impacts on flora and fauna. <p>Key components of the vegetation clearance protocols include the clear delineation of areas to be cleared of native remnant vegetation, timing and methods to be used, pre-start clearing inspections by suitably qualified ecologist to confirm no impact on threatened species, and re-use of cleared vegetation debris in revegetation programs.</p>	TCPL, 2012 – Section 4, pp. 4-88	To be undertaken in accordance with the Land Disturbance Protocol. Database records of all fauna species identified during clearing activities is to be created.

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**Table 4-2: (Continued)
Biodiversity Monitoring Requirements**

Monitoring Commitment	Source	Monitoring
Feral animal control Follow-up site monitoring to determine the effectiveness of trapping and/or baiting programs.	TCPL, 2012 – Section 4, pp. 4-89	Feral animal monitoring program will be incorporated into the fauna monitoring program, and will utilise infra-red cameras to detect the presence or absence of feral animals. The number, location and frequency of cameras used will be determined in consultation with ecological contractors and results obtained from the monitoring.
Nest box program A nest box program will be implemented in the Leard State Forest and/or other identified locations at the TCM consistent with the RBS-2 Table 2.1 and 2.2 Points 2.1 and 2.2.	TCPL, 2012 – Section 4, pp. 4-89	The program will comprise: <ol style="list-style-type: none"> 1. consultation with FCNSW regarding any nest boxes proposed to be installed in Leard State Forest; 2. a pre-installation assessment of proposed nest box placement areas (e.g. to identify areas with low hollow abundance and with semi-mature regenerated vegetation); 3. installation of a variety of nest boxes for use by birds, arboreal mammals, and bats; 4. installation of similar types of nest boxes in groups; 5. design of nest boxes to maximise the likelihood that local, in particular threatened species, hollow-dwelling fauna will use them for shelter and breeding; 6. installation of bat boxes; seasonally based monitoring e.g. spring for nesting species, to observe target fauna usage

Source: TCPL (2012) *Tarrawonga Coal Project: Environmental Assessment*.

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4.12 RISKS AND CONTINGENCIES

Risks to Biodiversity Management

Risks that may impact on the ability of TCM to successfully implement **Section 4.1** to **Section 4.11** of this BMP may include those listed in **Table 4-3: Potential Risks to the Implementation of Section 4.1 to Section 4.11** of this BMP below.

Trigger Action Response Plan

The Trigger Action Response Plan (TARP) provides a framework to guide the management of risks to biodiversity management. A TARP includes:

- Identification of the principal contributing factors and impacts for each major risk to biodiversity management.
- Development of quantitative or qualitative monitoring tools for causes and impacts.
- Identification of upper limits or trigger values for causes and impacts that are considered to represent an unacceptable level of risk.
- Identification of appropriate responses to mitigate or remediate the causes and impacts, including a notification protocol.

The TARP provides management responses for lower (first tier) and upper (second tier) trigger values. First tier trigger values identify opportunities for closer monitoring or early intervention that may mitigate potential impacts before substantial damage to biodiversity is realised. Second tier trigger values identify when indicators have reached a threshold that requires more substantive or widespread remedial actions to remediate or mitigate rehabilitation failure.

First Tier Triggers

First tier triggers are intended to detect early indications that biodiversity management is not trending toward desired completion criteria. TCM are trialling the use of Normalised Difference Vegetation Index remote sensing techniques to establish and monitor first tier triggers to identify, on an annual basis:

- Deteriorating vegetation health in rehabilitation areas.
- Variability in total biomass and vegetation density in each strata of vegetation communities.
- Changes in soil properties without disturbance.

A statistically significant variation (i.e. beyond expected range) in monitoring results or a statistically significant overall decline in vegetation health will trigger further on-ground assessments. These assessments will be used to confirm any adverse impacts and early intervention management responses.

The effectiveness of remote sensing techniques will be evaluated against on ground assessments in its first year of use and, if adopted for ongoing use, reviewed biannually.

Second Tier Triggers

Quantitative or qualitative trigger values for key indicators have been developed for the TCM MOP (Amendment F, August 2020).

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A high-level TARP is provided in **Table 4-4: TARP for Biodiversity Management**

This TARP should be developed further once quantitative/qualitative trigger values for key indicators have been developed based on monitoring program outcomes at both rehabilitation and analogue sites.

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Table 4-3: Potential Risks to the Implementation of Section 4.1 to Section 4.11 of this BMP

Risk	Control Method	Relevant Section
Inadequate final landform design leading to an unstable landform	<ul style="list-style-type: none"> • Detailed landform design outlining drainage paths, contour drains, ridgelines and emplacements, keeping with natural landforms • Substrate preparation prior to landform being shaped 	Section 4.8
Damage to offset and rehabilitation areas as a result of bushfire and/or inappropriate fire regimes	<ul style="list-style-type: none"> • Selection of fire-tolerant species in native vegetation areas • Maintaining fire breaks by maintaining cleared easements and fence lines • Maintain fire-fighting access tracks and water sources (sediment dams) in rehabilitation areas • Monitoring fuel loads and considering mosaic back-burning programs (where appropriate) to reduce fuel loads • Maintaining sufficient viable seed for key native vegetation species to re-seed areas after bushfire events 	Section 4.10
Lack of availability of locally occurring species to be either seeded or planted in revegetation or regeneration	<ul style="list-style-type: none"> • Seed collection and propagation 	Section 4.4
Potential harm to species (both threatened and non-threatened) as part of clearing activities	<ul style="list-style-type: none"> • Clearing limited to minimum area necessary • Progressive clearing • Pre-clearance surveys • Translocation of species (with appropriate licences) 	Section 4.5
Loss of biological resources for use in rehabilitation (topsoil salvage, hollow salvage, timber and woody debris, etc.).	<ul style="list-style-type: none"> • Maximise salvage of resources during clearing and mining activities and re-use in rehabilitated areas 	Section 4.3
Poor soils/substrate material inhibiting plant establishment and growth	<ul style="list-style-type: none"> • Substrate preparation prior to landform design • Soil and overburden quality testing in rehabilitation areas 	Section 4.6

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Table 4.3 (Continued)
Potential Risks to the Implementation of Section 4.1 to Section 4.11 of this BMP

Risk	Control Method	Relevant Section
Rehabilitation failure due to prevailing weather conditions, poor soil conditions and propagation of required species	<ul style="list-style-type: none"> • Soil and overburden quality testing in rehabilitation areas • The species mix for rehabilitation areas should optimise the use of local provenance seed tolerant of the region's drought regime • Soils will be ameliorated where necessary to optimise infiltration and water holding capacity in the soil profile prior to tube stock planting and direct seeding • Monitoring following drought periods will identify areas where re-seeding and replanting is required. A contingency supply of viable seed for key native vegetation species will be maintained until relinquishment that is sufficient to re-seed rehabilitation areas in the event of a widespread rehabilitation failure • Adaptive management is to be adopted 	Section 4.6
Weed infestation within offset and rehabilitation areas leading to degradation of biodiversity values	<ul style="list-style-type: none"> • Continuous weed management/suppression • Regular monitoring 	Section 4.7

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Table 4-4: TARP for Biodiversity Management

Aspect	Element	Trigger	Action	Responsibility
Vegetation (existing and restoring)	Percentage cover Health Species diversity Recruitment	Decline in trend in vegetation condition based on proposed quadrat monitoring using biometric data	Engage ecologist to undertake investigation to determine the cause of change A site specific management report to be prepared and implemented where necessary that aligns with the Rehabilitation Management Plan. Actions may include planting of endemic species and weed control measures	Environmental Officer
	Area	Extent of clearing exceeds Conditions of Approval Clearing occurs outside of delineated areas	Environmental Officer to inform the Group Environmental Manager and General Manager DPIE and DAWE to be notified and actions discussed. Where clearing exceeds trigger value, undertake rehabilitation and revegetation of equivalent area in accordance with the Rehabilitation Management Plan	Environmental Officer
	Revegetation/restoration	Planting failure	Field reconnaissance to determine likely cause of change If required, engage ecologist to undertake additional assessments and prepare a site specific management report Revegetation/restoration works to be undertaken in alignment with recommendations from site assessment	Environmental Officer
Fauna and fauna habitat	Vertebrate species presence Invertebrate species presence Habitat structure Vertebrate pests	Loss of habitat presence Decline in trend in recorded fauna numbers and/or presence and abundance (allow for natural variation occurring in analogue sites)	Engage ecologist to undertake investigation to determine the cause of change A site specific management report to be prepared and implemented where necessary that aligns with the Rehabilitation Management Plan	Environmental Officer

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**Table 4-4 (Continued)
TARP for Biodiversity Management**

Aspect	Element	Trigger	Action	Responsibility
	Habitat augmentation – nest boxes	Loss of nest boxes or deterioration of nest boxes Feral species usage of nest boxes, including ants and feral honeybees	Replace nest boxes as soon as practical after identification of sub-standard nest boxes Condition monitoring can be completed by visual inspection from the ground and documented Where feral species are identified within nest boxes, they should be removed, or the nest box should be replaced (in the case of ants and feral honeybees)	Nest box monitoring should be completed by suitably qualified, licensed and experienced ecologist Nest box monitoring should be completed by suitably qualified, licensed and experienced ecologist
Weed control	Percentage cover Declared priority weeds presence	Increasing trend in number of exotic species and / or weed cover	Site inspection to verify. Contractor engaged to undertake weed control measures implemented as per the Rehabilitation Management Plan and BMP	Environmental Officer
Feral animals	Feral animal presence and/or abundance	Increase in number of feral animals	Contractor engaged to undertake feral animal control measures implemented as per the Rehabilitation Management Plan/this BMP	Environmental Officer
Salinity	Salinity (EC) Bare soil/salt scalds	Increasing trend in soil/water salinity levels	Site inspection and testing to verify. A site specific management report to be prepared and implemented where necessary	Environmental Officer
Erosion	Slumping/erosion	Areas of uncontrolled erosion identified	Site inspection to verify. Control measures to be implemented as per the Surface Water Management Plan	Environmental Officer

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**PART B
OFFSET AREA MANAGEMENT OF FLORA AND FAUNA**

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5 EXISTING ENVIRONMENT RELEVANT TO THE OFFSET AREAS

The biodiversity offset strategy described in Condition 40 of PA 11_0047 requires a 1,660 ha offset area to be established with existing native vegetation to be enhanced, and additional native vegetation to be established with the restoration of at least 193 ha of Box-Gum Woodland CEEC. The offset area also covers the offset requirements under EPBC Act approval for EPBC 2011/5923.

5.1 LAND TENURE

The offset area is located on the “Willeroi” property (Lot 36 DP754941, Lot 46 DP 754941, Lot 47 DP 754941 as well as part Lot 31 DP754941 and part Lot 44 DP754941) (**Figure 3**). It is owned and managed by Whitehaven.

Crown land in the form of a road reserve and crown reserve are enclosed as well as a 132 kilovolt power line which runs east-west through the “Willeroi” property have been excluded from the offset area to be secured on title using a Conservation Agreement mechanism.

5.2 LAND USE HISTORY

The offset land was previously a cattle station, however, livestock have been removed since 2015 and natural regeneration processes have commenced. This is evidenced by regrowth of trees and thick (grassy) understorey. The existing ecosystem is considered to have a moderate to high resilience despite the past disturbance. In some areas weeds are absent although a number of introduced weed are present in other locations (FloraSearch, 2011) associated with historical agricultural activity.

5.3 VEGETATION COMMUNITIES

The offset area covers approximately 1,660 ha of land, and comprises of approximately 1,355 ha of existing forest/woodland and 305 ha of cleared land (with 261 ha of derived native grasslands and 44 ha of non-native grasslands). Vegetation communities in the offset area are listed in **Table 5-1** and shown on **Figure 8**.



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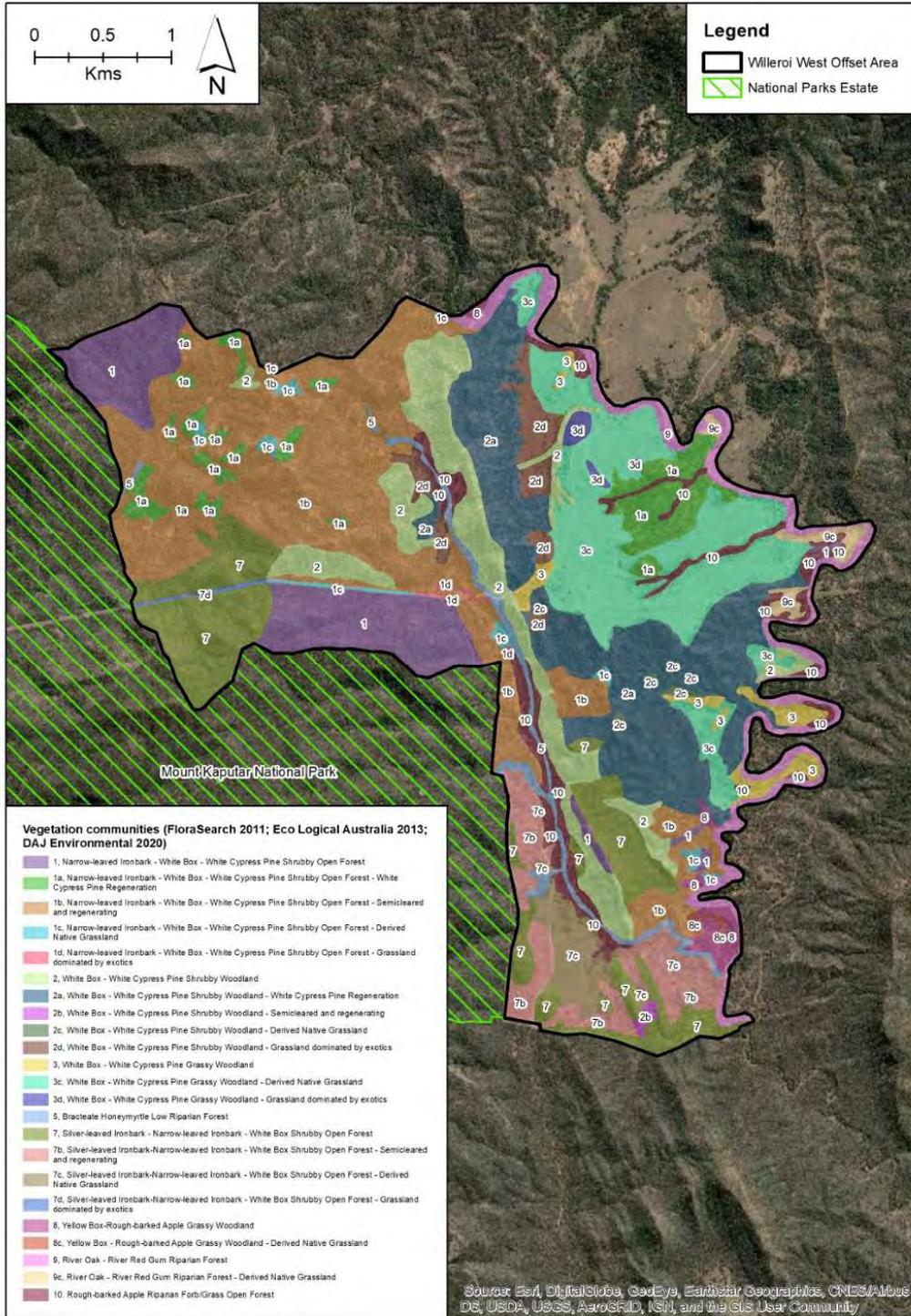


Figure 8: Vegetation Communities – Willeroi West Offset Area

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Table 5-1: Native Vegetation Communities in the Offset Area

Community Number ¹	Community Name	Area (ha) ²
1	Narrow-leaved Ironbark - White Box – White Cypress Pine Shrubby Open Forest	569.7
2	White Box - White Cypress Pine Shrubby Woodland	382
3	White Box - White Cypress Pine Grassy Woodland	216
5	Bracteata Honeymyrtle Low Riparian Forest	27.23
7	Silver-leaved Ironbark - Narrow Leaved Ironbark - White Box Shrubby Open Forest	260
8	Yellow Box – Rough-barked Apple Grassy Woodland	16
9	River Oak - River Red Gum Riparian Forest	88.46
10	Rough-barked Apple Riparian Forb/Grass Open Forest	58.76
TOTAL		1, 617.95

Source: FloraSearch (2011).

¹ Vegetation Community 6 is cleared Farmland and is not considered to be a native vegetation community

² Excludes cleared land with introduced grasses

5.4 BOX-GUM WOODLAND AND DERIVED GRASSLAND

Box-Gum Woodland CEEC was mapped in the offset area by FloraSearch (2011). Methods used by FloraSearch (2011) included field data collection (20 m x 50 m plots), data analysis and GIS mapping.

Box-Gum Woodland CEEC in the offset area is listed in

Table 5-2 and shown on **Figure 9**. The mapping of Box-Gum Woodland CEEC was undertaken by FloraSearch (2011) in a manner consistent with the State and Transition Model (**Figure 10**) described by Rawlings *et al.* (2010). Box-Gum Woodland CEEC is represented by Box-Gum Woodland in Condition Class State 1 and 2 (i.e. a total of 232 ha) (**Table 5-2; Figure 9**).

Table 5-2: Box-Gum Woodland and Derived Grassland Condition State

Vegetation Community Number	Community Name	Area (ha)
State 1		
3	White Box - White Cypress Pine Grassy Woodland	23
8	Yellow Box – Rough Barked Apple Grassy Woodland	14
State 2		
3c	Derived Native Grassland	193
8c	Derived Native Grassland	2
State 3		
3d	Grassland dominated by exotics (not conforming to Box-Gum Woodland CEEC)	-
Total Box-Gum Woodland CEEC		232

Source: FloraSearch (2011).



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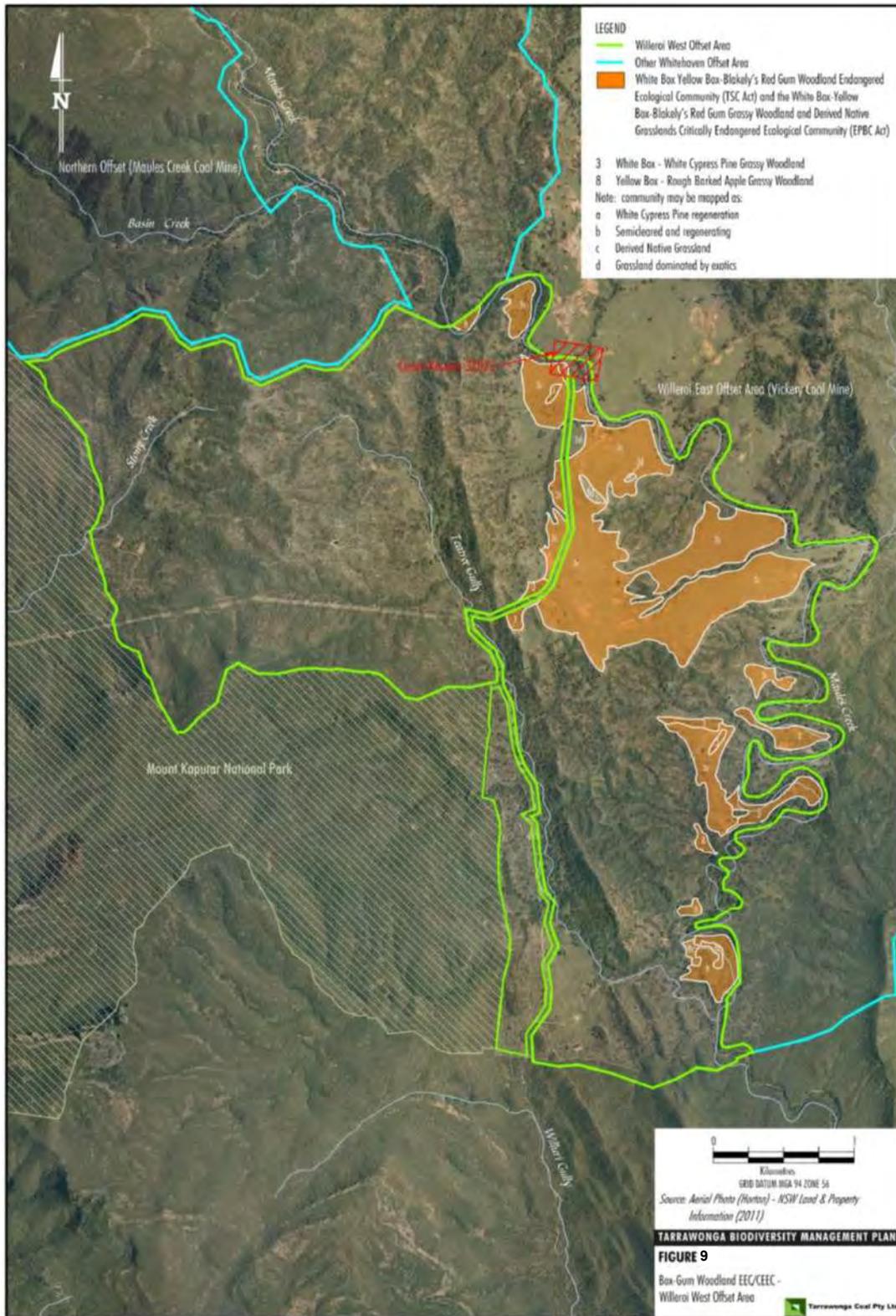


Figure 9: Box-Gum Woodland CEEC - Willeroi West Offset Area



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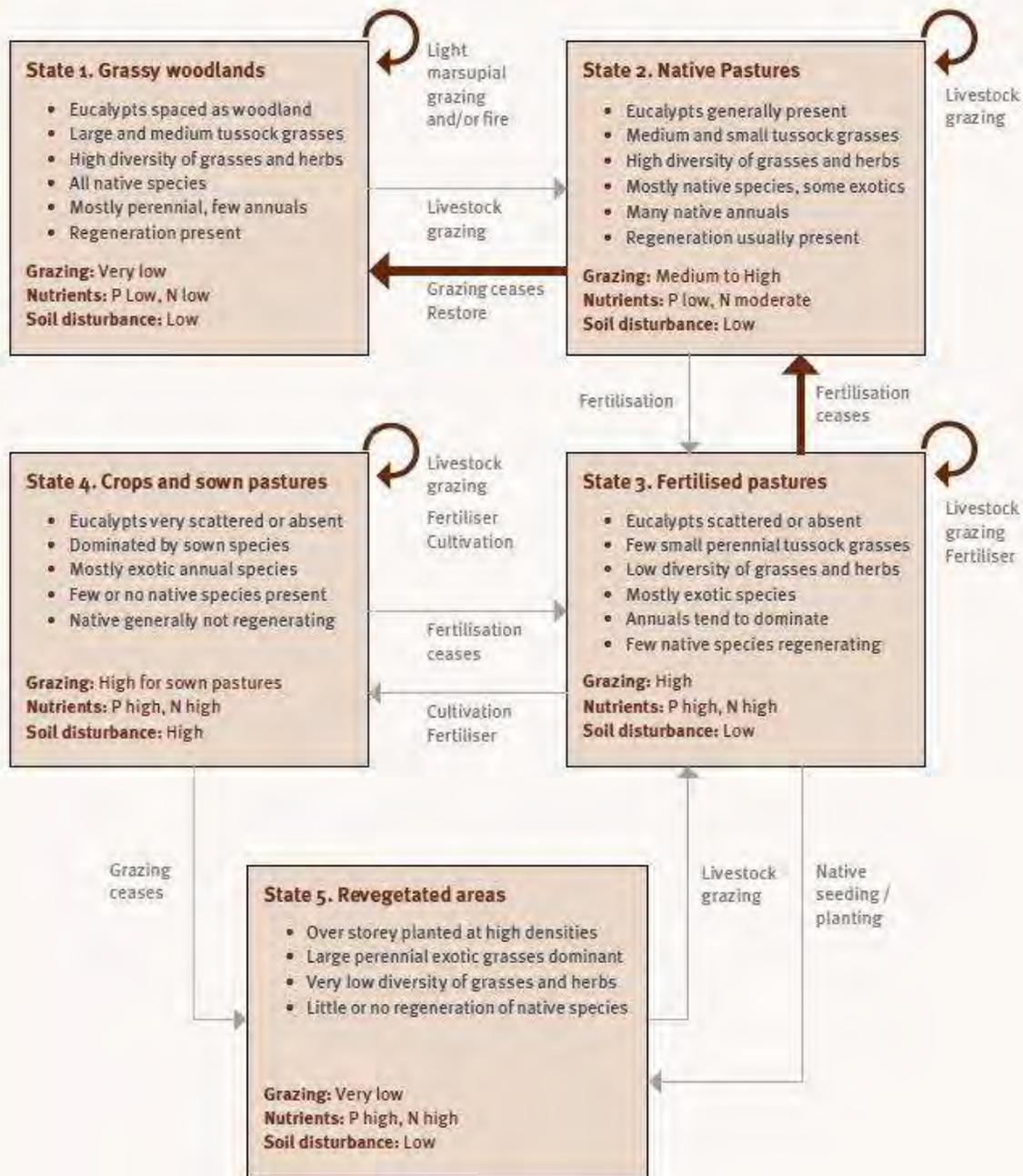


Figure 10: Box gum grassy woodland state and transition model (taken from Figure 3.1 of Rawlings *et al*, 2010)

An independent verification of the offset area was undertaken by Eco Logical Australia in November 2013 (Eco Logical Australia, 2013). The verification report concluded that the offset met the relevant EPBC 2011/5923 conditions of approval. In accordance with Condition 6(d) of the Approval Decision EPBC 2011/5923, the offset area provides for the long-term security of no less than 232 ha of Box-Gum Woodland CEEC.

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5.5 HABITAT/FEATURES

Regional Setting

The offset area is located within DPIE recognised 'high priority area', 'regional key fauna habitat' and climate change linkage as described and mapped in the *Wildlife Corridors for Climate Change – New England Tablelands and Nandewar bioregions – Landscape Selection Process, Connectivity for response to Climate Change* (DECC, 2007).

Protected Areas

The offset area is located on the south eastern boundaries of Mount Kaputar National Park (**Figure 8**). It is also bordered by other offset areas held by Whitehaven.

Broad Habitats

Six broad habitat types occur in the offset area, namely, Dry Sclerophyll Forest, Dry Sclerophyll Forest – Cypress Pine Monoculture Regrowth, Grassy Woodland, Riparian/Floodplain, Grassland (native) Grassland (introduced) (**Figure 11**).

Creeks

A number of ephemeral creek lines occur in the offset area. The most prominent are Maules Creek (approximately 13 km) and Teatree Gully (approximately 6 km).

5.6 THREATENED AND MIGRATORY SPECIES

Fauna surveys were undertaken within the offset area during July to August 2011. During the survey, a total of 142 vertebrate fauna species were identified in the study area comprising of 130 native species.

Threatened fauna species records within the offset area are shown on **Figure 11**. A total of 15 threatened fauna species were recorded in the offset area by Cenwest Environmental Services (2011) (**Table 5-3**). A further eight threatened fauna species are considered to have potential habitat in the offset area, but have not been recorded in the offset area to date.

During baseline surveys undertaken in 2017 (AMBS) a total of 151 species were found across the six fauna monitoring sites (including six amphibians, 87 birds, 36 mammals and 22 reptiles). Fifteen threatened species were identified, including eight birds, four microbats and one arboreal mammal. Eight species of invasive fauna were recorded (Common Starling, Cat, Goat, Dog, Pig, Deer, Rat and Fox) at varying frequencies across all six sites.



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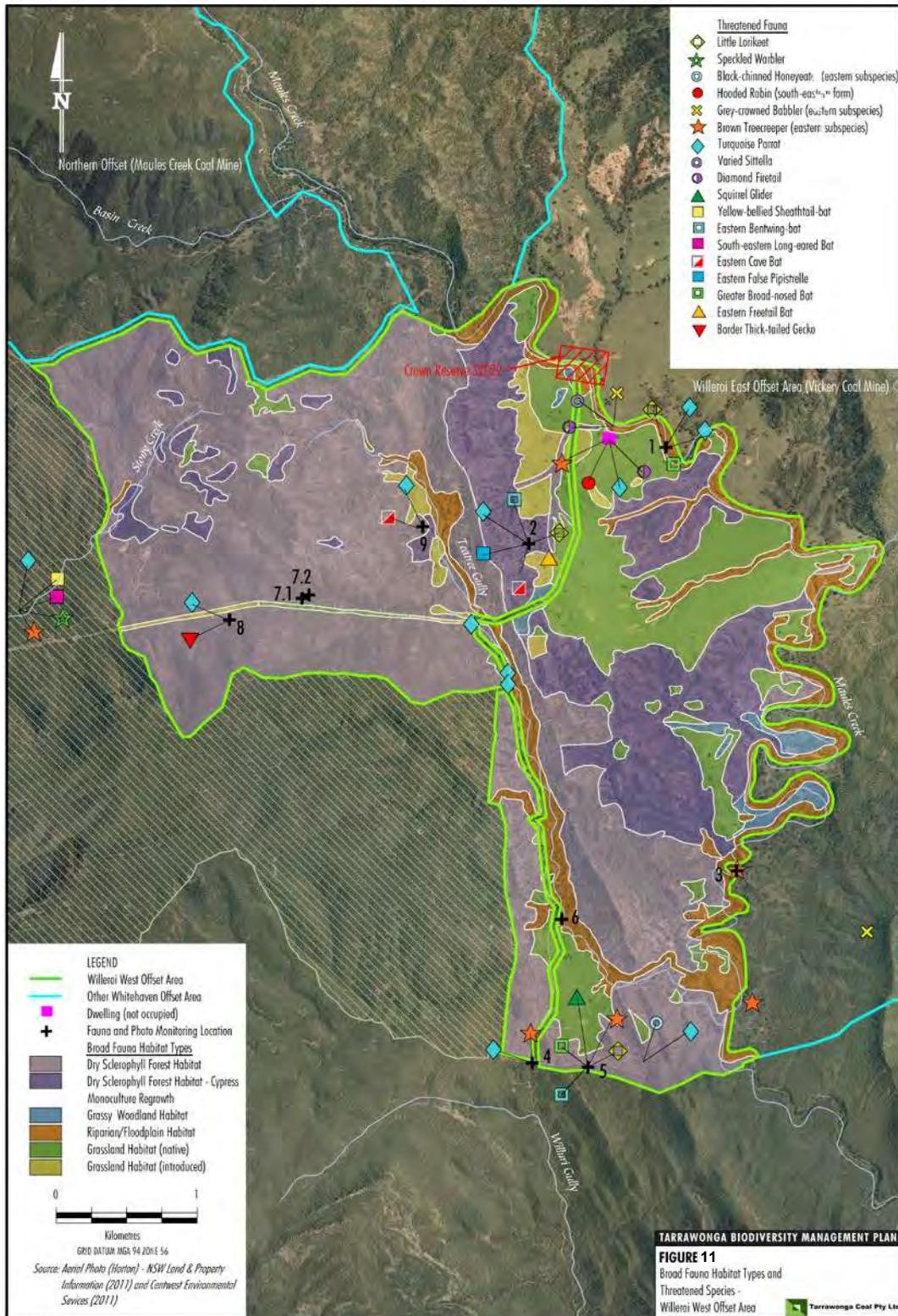


Figure 11: Broad Fauna Habitat Types and Threatened Species – Willeroi West Offset Area

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Table 5-3: Threatened Species in the Offset Area

Common Name	Scientific Name	Conservation Status ¹		Occurrence
		BC Act	EPBC Act	
Reptiles				
<i>Underwoodisaurus sphyrus</i>	Border Thick-tailed Gecko	V	-	This species was recorded under granite exfoliation in the offset area.
Birds				
<i>Neophema pulchella</i>	Turquoise Parrot	V	-	This species appeared to be widespread across the offset area. They were mostly in pairs but a flock was also observed.
<i>Tyto novaehollandiae</i>	Masked Owl	V	-	Potential habitat.
<i>Climacteris picumnis</i>	Brown Treecreeper (eastern subspecies)	V	-	Brown Treecreepers were observed at a few locations. These sites were on the lower parts of the offset area near Maules Creek and along the southern boundary fence.
<i>Chthonicola sagittata</i>	Speckled Warbler	V	-	Potential habitat.
<i>Stagonopleura guttata</i>	Diamond Firetail	V	-	A substantial flock of Diamond Firetails lives adjacent to Maules Creek.
<i>Melithreptus gularis gularis</i>	Black-chinned Honeyeater (eastern species)	V	-	This species was observed on the top of a hill close to the southern boundary the offset area. It was observed feeding in Eucalypts.
<i>Melanodryas cucullata cucullata</i>	Hooded Robin (south-eastern form)	V	-	A pair of Hooded Robins was observed in the north-east portion of the offset area.
<i>Pomatostomus temporalis</i>	Grey-crowned Babbler	V	-	Six observed along Maules Creek behind the dwelling (not occupied).
<i>Daphoenositta chrysoptera</i>	Varied Sittella	V	-	Two Varied Sittellas were observed along Maules Creek east of the dwelling (not occupied).
<i>Glossopsitta pusilla</i>	Little Lorikeet	V	-	This species was observed at various locations in the offset area.
Swift Parrot	<i>Lathamus discolor</i>	E	CE	Potential habitat.
Regent Honeyeater	<i>Anthochaera phrygia</i>	CE	CE	Potential habitat.
Mammals				
<i>Phascolarctos cinereus</i>	Koala	V	V	Potential habitat.
<i>Petaurus norfolcensis</i>	Squirrel Glider	V	-	One record of this species was made within the offset area.
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat	V	-	Potential habitat.
<i>Nyctophilus corbeni</i>	South-eastern Long-eared Bat (previously Greater Long-eared Bat)	V	V	Potential habitat.
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V	V	Potential habitat.

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**Table 5-3 (Continued)
Threatened Species in the Offset Area**

Common Name	Scientific Name	Conservation Status ¹		Occurrence
		BC Act	EPBC Act	
<i>Mormopterus norfolkensis</i>	Eastern Freetail-bat	V	-	Possible calls of this species were recorded. This is a possible identification with a low confidence assigned to it.
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	V	-	Possible calls of this species were recorded. This is a possible identification with a low confidence assigned to it.

Source: Cenwest Environmental Services (2011).

¹ Threatened species conservation status V = Vulnerable.

In accordance with Condition 44 of Schedule 3 to PA 11_0047, the Biodiversity Offset Strategy is focused on protection, enhancement, revegetation and long-term maintenance of viable stands of suitable habitat for threatened species by implementing the management strategies outlined in:

- **Section 6.5.1** Revegetation Program;
- **Section 6.5.2** Habitat Augmentation; and
- **Section 7** describes the implementation of the *TCM Threatened Fauna Implementation Plan* (Whitehaven, 2015a) and *TCM Box-Gum Woodland Endangered Ecological Community Implementation Plan* (Whitehaven, 2015b) in accordance with Conditions 48 and 50 of Schedule 3 to PA 11_0047.

Table 5-4 quantifies the relevant habitat provided for the three specific threatened species for each vegetation community at Willeroi West Offset Area. In accordance with Condition 6 of the Approval Decision EPBC 2011/5923, the offset area provides no less than:

- 1,055 ha of equivalent or better quality of habitat for the Regent Honeyeater (*Xanthomyza phrygia*) (**Figure 12**);
- 397 ha of equivalent or better quality of habitat for the Swift Parrot (*Lathamus discolor*) (**Figure 13**); and
- 1,355 ha of equivalent or better quality of habitat for the South-eastern Long-eared Bat (*Nyctophilus corbeni*) (previously Greater Long-eared Bat) (**Figure 14**).

No threatened flora listed under the BC Act or EPBC Act have been recorded in the offset area.

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Table 5-4: Vegetation Type providing habitat for Key Threatened Species

Community Number ¹	Vegetation type and condition class	Swift Parrot ²	Regent Honey-eater ²	Greater Long-eared Bat ²
1	White Cypress Pine - Narrow-leaved Ironbark Shrubby Open Forest	0.0	127.8	127.8
1a	White Cypress Pine - Narrow-leaved Ironbark Shrubby Open Forest - White Cypress Pine Regeneration	0.0	0.0	67.4
1b	White Cypress Pine - Narrow-leaved Ironbark Shrubby Open Forest - Semi-cleared and regenerating	0.0	358.8	358.8
1c	White Cypress Pine - Narrow-leaved Ironbark Shrubby Open Forest - Derived Native Grassland	0.0	0.0	0.0
1d	White Cypress Pine - Narrow-leaved Ironbark Shrubby Open Forest - Grassland dominated by exotics	0.0	0.0	0.0
2	White Box - White Cypress Pine Shrubby Woodland	140.8	140.8	140.8
2a	White Box - White Cypress Pine Shrubby Woodland - White Cypress Pine Regeneration	233.1	0.0	233.1
2b	White Box - White Cypress Pine Shrubby Woodland - Semi-cleared and regenerating	0.0	2.5	2.5
2c	White Box - White Cypress Pine Shrubby Woodland - Derived Native Grassland	0.0	0.0	0.0
2d	White Box - White Cypress Pine Shrubby Woodland - Grassland dominated by exotics	0.0	0.0	0.0
3	White Box - White Cypress Pine Grassy Woodland	22.9	22.9	22.9
3c	White Box - White Cypress Pine Grassy Woodland - Derived Native Grassland	0.0	0.0	0.0
3d	White Box - White Cypress Pine Grassy Woodland - Grassland dominated by exotics	0.0	0.0	0.0
5	Bracteate Honey Myrtle Low Riparian Forest	0.0	27.2	27.2
7	Silver Leaved Ironbark-Narrow Leaved Ironbark - White Box Shrubby Open Forest	0.0	157.1	157.1
7b	Silver Leaved Ironbark-Narrow Leaved Ironbark - White Box Shrubby Open Forest (Regeneration) - Semi-cleared and regenerating	0.0	67.4	67.4
7c	Silver Leaved Ironbark-Narrow Leaved Ironbark - White Box Shrubby Open Forest - Derived Native Grassland	0.0	0.0	0.0
7d	Silver Leaved Ironbark-Narrow Leaved Ironbark - White Box Shrubby Open Forest - Grassland dominated by exotics	0.0	0.0	0.0
8	Yellow Box - Rough Barked Apple Grassy Woodland	0.0	14.5	14.5
8c	Yellow Box-Rough Barked Apple Grassy Woodland - Derived Native Grassland	0.0	0.0	0.0
9	River Oak - River Red Gum riparian forest	0.0	77.0	77.0
9c	River Oak - River Red Gum Riparian Forest - Derived Native Grassland	0.0	0.0	0.0
10	Rough-barked Apple Riparian Forb/Grass Open Forest	0.0	58.8	58.8
TOTAL		396.8	1,054.8	1,355.4

Source: FloraSearch (2011).

¹ Vegetation Community 6 is cleared Farmland and is not considered to be a native vegetation community

² Excludes cleared land with introduced grasses



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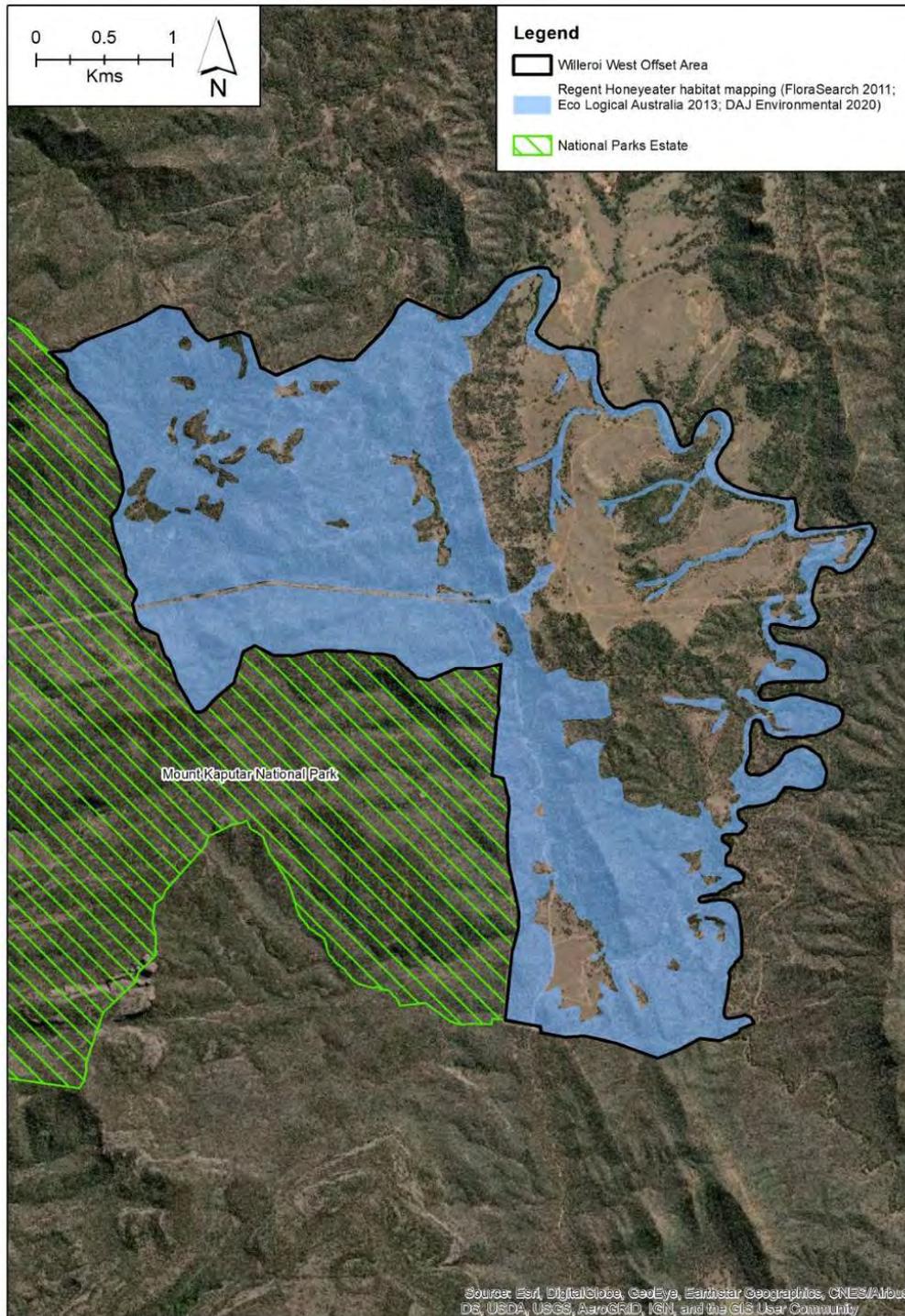


Figure 12: Regent Honeyeater habitat



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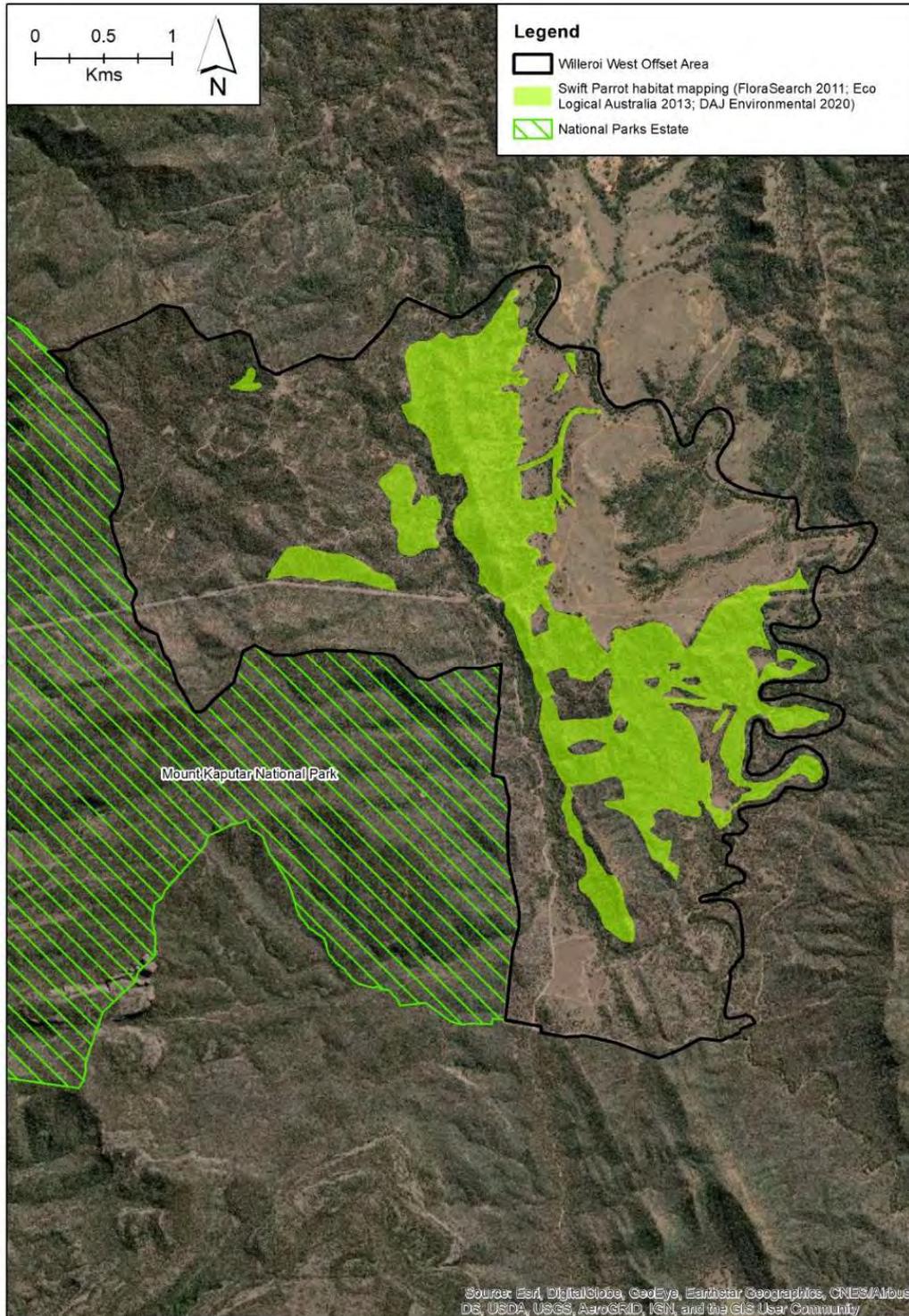


Figure 13: Swift Parrot habitat mapping



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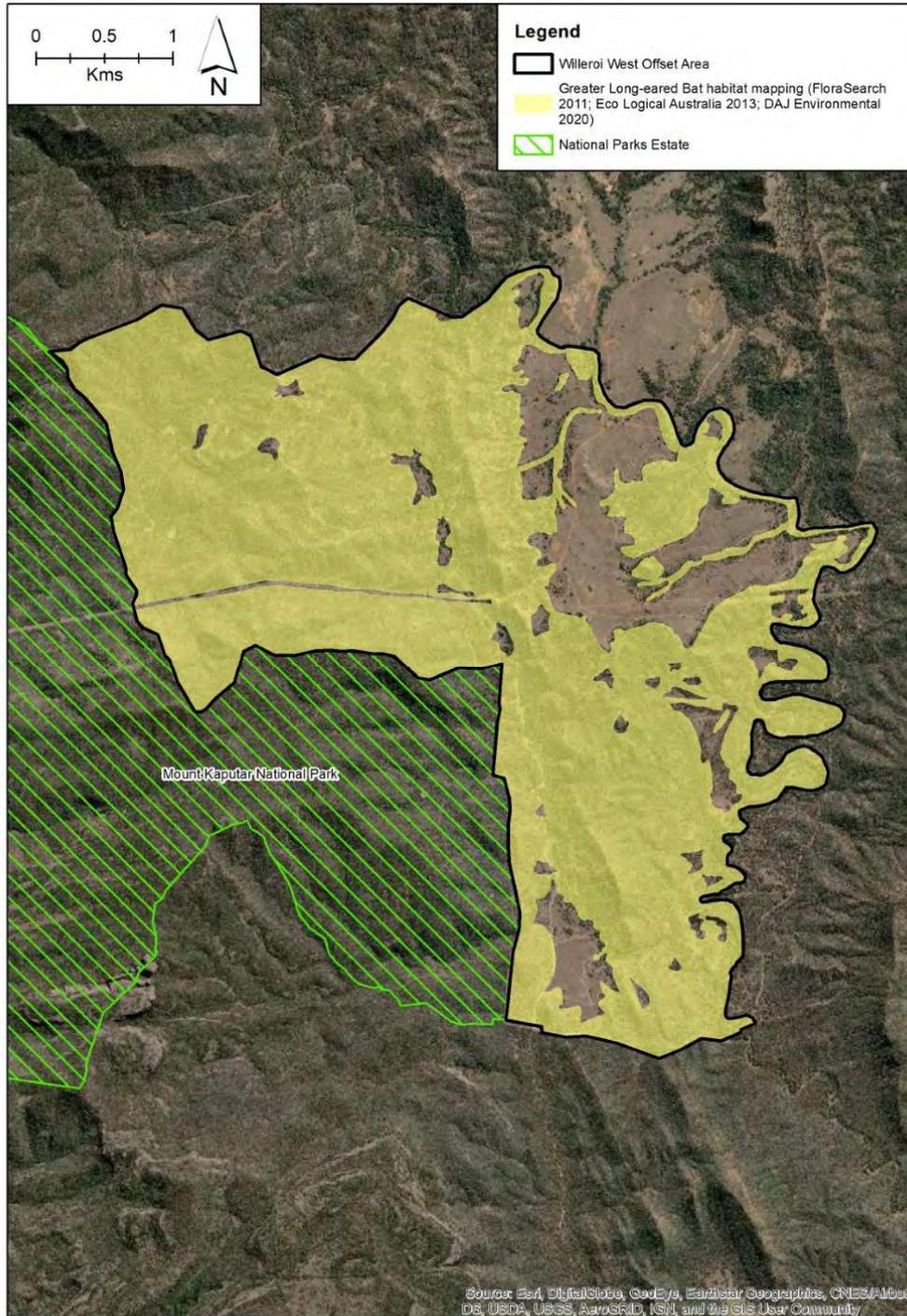


Figure 14: Greater Long-eared Bat habitat

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5.7 WEEDS

TCM will manage weeds in accordance with the NSW *Biosecurity Act 2015* and Condition 13 (e iv) of EPBC Act approval for EPBC 2011/5923. The *Biosecurity Act 2015* introduced the “General Biosecurity Duty” (GBD) which requires all land managers and users to ensure as far as is reasonably practicable, that biosecurity risks are prevented, eliminated or minimised. Condition 13 (e iv) of the EPBC Act approval for EPBC 2011/5923 further requires TCM to implement “measures to exclude weeds from all offset areas for the period covered by this approval”. In addition to TCM’s GBD responsibility; weed management will be implemented aligned with the *North West Regional Strategic Weed Management Plan (NWRSWMP) 2017 – 2022* (North West Local Land Services, 2017) and weed control measures will be guided by published control measures (e.g. DPI, 2014). The NWRSWMP introduces a risk management approach (based on the weed invasion curve stages of prevention, eradication, containment and asset protection) to prioritise weeds for management based on those weeds that are “State Level Determined Priority Weeds for the North West Local Land Services Region” and additional “Regional Priority Weeds”. Weeds recorded in the offset areas are listed in **Table 5-5**.

Table 5-5: Environmental and Priority Weeds in the Offset Area

Common Name	Scientific Name
Noogoora Burr	<i>Xanthium occidentale</i>
Common Prickly Pear	<i>Opuntia stricta</i>
Sweet Briar	<i>Rosa rubiginosa</i>

Source: FloraSearch (2011).

None of these weeds are particularly abundant, although Prickly Pear is widespread. In addition to these species, FloraSearch (2011) reported that two weed species are common in the offset area; Coolatai Grass (*Hyparrhenia hirta*) and Sweet Briar (*Rosa rubiginosa*). The highest proportions of weeds were found in the disturbed riparian zone of Maules Creek and in the cleared native pasture areas (FloraSearch 2011).

5.8 FERAL ANIMALS

TCM will implement feral animal management throughout the life of the operation as required based on seasonal conditions that determine the abundance of feral animal species and locations. As described above; feral animal management will be implemented in accordance with the NSW *Biosecurity Act 2015* and aligned with relevant industry guidelines and codes of practice (i.e. Local Land Service Pest Control Orders). Feral animals that have been recorded in the offset area are listed in **Table 5-6**.

Table 5-6: Feral Animals in the Offset Area

Common Name	Scientific Name
Feral Pigs	<i>Sus scrofa</i>
Feral Goats	<i>Capra hircus</i>
European Red Fox	<i>Vulpes</i>
European Rabbits	<i>Oryctolagus cuniculus</i>
Wild Dog	<i>Canis familiaris</i>
Black Rat	<i>Lepus capensis</i>
House Mouse	<i>Mus musculus</i>

Source: Cenwest Environmental Services (2011).

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5.9 ADDITIONAL THREATS

Although the offset land was previously a cattle station predominantly used for grazing livestock, the livestock have been removed and natural regeneration processes have commenced.

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6 MANAGEMENT OF THE WILLEROI WEST OFFSET AREA

This section describes short, medium and long-term measures that will be used to manage the vegetation and habitat in the offset area and to implement the biodiversity offset strategy. The management regime in the offset area will be adaptive over time to achieve and maintain the ecological management objectives.

6.1 ECOLOGICAL MANAGEMENT OBJECTIVES

The objectives of the offset area are to:

- Protect and enhance existing native woodland/forest (including areas of Box-Gum Woodland CEEC in woodland form and habitat for the Regent Honeyeater [*Xanthomyza phrygia*], Swift Parrot [*Lathamus discolor*] and the South-eastern Long-eared Bat [*Nyctophilus corbeni*]);
- Protect and enhance areas of semi-cleared woodland/forest; and
- Restore the woodland form of Box-Gum Woodland within existing areas of Box-Gum Woodland CEEC (derived native grassland).

These objectives are linked to the proposed management domains/units (**Section 6.3**), management performance criteria (**Section 6.12**), completion criteria (**Section 6.12**) and monitoring program (**Section 6.13**). Performance criteria are interim targets, and completion criteria are the final targets representing achievement of the objectives.

6.1.1 Implementation Schedule

The following **Table 6-1** summarises the management actions described and the frequency/timing of when those actions are to occur.

Table 6-1: BMP Implementation Schedule

Section	Management Action	Frequency and/or Timing
6.2.3	Removal of Mount Kaputar National Park boundary fence (subject to approval with NPWS)	Once only (indicative timing 2023-2025)
6.2.3	Fencing, gates, access tracks/fire trails and signage inspections	Annually
6.4	Seed assessment programs	Seasonal, based on life cycle stage and development of native plants
6.4	Seed collection and propagation	As required, and based on seed assessment results and/or from other opportunistic observations
6.5.3	Installation of nest boxes	Staged over three years commencing from July 2020
6.7	Primary weed control	Biannually, following monitoring
6.8	Feral animal control	As required
6.9	Erosion control	As required
6.11	Inspection of fire breaks and access trails	Annually, prior to the fire season
	Maintenance of fire breaks and access trails	As required
	Fuel load monitoring	Annually
	Controlled (Ecological) burns	As required (subject to consultation with RFS)

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**Table 6-1 (Continued)
BMP Implementation Schedule**

Section	Management Action	Frequency and/or Timing
6.13.1	Vegetation and habitat monitoring	All sites monitored annually in spring, revegetated sites monitored biannually (spring and autumn)
6.13.2	Fauna monitoring (reptiles, birds, bat arboreal and ground-dwelling mammals)	Annually in spring
	Monitoring for Swift Parrot	Annually between March and July
	Monitoring for Regent Honeyeater	Annually between September and March
	Monitoring for South-eastern Long-eared Bat	Annually between October and April
6.13.3	Weed monitoring	Biannually for the first four years, then annually
	Weed management review	After four years of monitoring
6.13.4	Feral animal monitoring	Quarterly
	Feral animal management review	After four years of monitoring

6.2 SETTING UP THE OFFSET AREA

6.2.1 Long-term Conservation Security

The offset area will be conserved long term by an appropriate mechanism as set out in Condition 46 of Schedule 3 to PA 11_0047 and Condition 10 of the Approval Decision EPBC 2011/5923. In accordance with Condition 46 of Schedule 3 to PA 11_0047, the long-term security shall be provided by way of:

- Entering into a conservation agreement or agreements pursuant to section 69B of the *National Parks and Wildlife Act 1974*, recording the obligations assumed by the Proponent under the conditions of this approval in relation to these offset area, and registering the agreement(s) pursuant to section 69F of the *National Parks and Wildlife Act 1974*; or
- A tenure of higher conservation status such as a National Park, or Nature Reserve, under the *National Parks and Wildlife Act 1974*.

Condition 10 of EPBC Approval 2011/5923 allows for the securing of the Willeroi West Offset Area until 31st March 2021 to provide the NSW Biodiversity Conservation Trust the time required to finalise the Willeroi Conservation Agreement. WHC will recommence negotiations with DPIE and NPWS regarding the transfer of the Willeroi West Offset Area to National Parks Estate as per the letter from NPWS dated 16 August 2017 once the conservation agreement has been registered on title.

Because WHC has materially progressed securement of the Willeroi West Offset; compliance with Condition 46 of Schedule 3 to PA 11_0047 has been met.

6.2.2 Offset Implementation Costs and Conservation Bond

In accordance with Condition 49 of Schedule 3 to PA 11_0047, the Willeroi West Offset Area has an approved Conservation and Biodiversity Bond lodged with DPIE that was most recently updated in January 2020 that ensures that the biodiversity offset strategy could be implemented in accordance with

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the performance and completion criteria if TCM were unable to continue management of the offset. Once the Conservation and Biodiversity Bond is lodged with DPIE; in accordance with EPBC Approval 2011/5923 Condition 27 then WHC/TCM have one month to submit details to DAWE.

The sum of the bond is determined by calculating the full cost of implementing the biodiversity offset strategy (other than land acquisition costs) in perpetuity. The sum of the bond will include all offset area management measures prescribed within this BMP and is based on third party rates for fencing, fire management, weed management, feral animal control, seed collection, replanting/revegetation, monitoring, auditing and reporting. A suitably qualified quantity surveyor will be employed to verify the calculated costs.

As required, TCM will review and accordingly update the Conservation and Biodiversity Bond (nominally annually) based on the progressive completion of biodiversity management works in accordance with this BMP.

6.2.3 Infrastructure

The offset area will be set-up on the ground by:

- Using existing fencing (where practicable and required) to demarcate the perimeter around the offset areas to exclude grazing livestock and avoid unauthorised disturbance/accidental clearance of the Willeroi Offset from external sources (**Section 6.10**);
- Installing gates into the offset area (**Section 6.10**); and
- Installing signage on gates into the offset area which recognises that the area is protected for conservation purposes (**Section 6.10**).

Indicative infrastructure in the offset areas (e.g. access tracks/fire trails and fences) is shown on **Figure 15**. The re-use of existing infrastructure in the offset areas will be maximised where practicable. If new infrastructure (e.g. access tracks/fire trails and fences) is required, it will be located in stable locations with vegetation clearing minimised where possible by using already cleared land and/or in accordance with the limits specified in Conservation Agreements with the Biodiversity Conservation Trust (i.e. maintaining existing access vehicular trails in the Conservation Area to a maximum width of 4m with 1m either side permissible for clearing plus clear a corridor not greater than 3 metres wide during construction or for maintenance for the installation of fences or other agreed rural structures). Wherever practical, new fencing will be fauna friendly, minimising the use of barbed wire consistent with RBS-2 Table 2.1 Point 2.3 (Umwelt, 2017). Fence construction style or techniques will be specific to the terrain, ground conditions and other biodiversity constraints identified. Existing infrastructure wholly or partly within the offset areas (e.g. electricity transmission lines, access tracks, water bores and pipes, homesteads and sheds) will be retained and managed as required by the relevant owners and/or managers/licenseses.

The boundaries of the offset area that adjoin with Mount Kaputar National Park or the existing offset areas to the north and east will not be fenced unless grazing livestock can access the offset area through these protected areas and as agreed to with NPWS consistent with RBS-2 Table 2.1 Point 2.3 (Umwelt, 2017). Fencing, gates, access tracks/fire trails and signage will be inspected annually for maintenance issues and at other times during management and monitoring activities. If inspections note that any fences are causing impacts to local wildlife; fauna friendly alternative fencing styles like the use of plain wire will be considered (consistent with RBS-2 Table 2.2 Point 2.3 (Umwelt, 2017)).

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6.3 MANAGEMENT DOMAINS

Management domains for the offset area have been developed in accordance with the *State and Transition Model for Box-Gum Woodland* (Rawlings *et al.*, 2010) which recognises different ecosystem states based on their condition (and the transition between states). For the purpose of this BMP, semi-cleared native woodland/forest has been identified separately to intact native woodland/forest in recognition that it would be in a stable degraded state, or a downwards trajectory towards a derived native grassland, without the offset.

The management domains and their land management objectives are defined in **Table 6-2** and shown on **Figure 15**. Management units are numbered management domains. There are three management domains and 12 management units (**Table 6-2; Figure 15**).

The offset area has been divided into a number of management units based on a combination of the following factors:

- Dominant management domains;
- Connectivity to adjacent areas of bushland; and
- Landscape position and topography.

The management units are likely to change over time as the habitats in the offset area improve (e.g. a management unit which is currently assigned an Enhancement Domain may change to a Habitat Management Domain once vegetation improves). Any domain changes would be identified via monitoring and reported by TCPL. However, any changes TCPL propose to the management units would be incorporated into a revised BMP in accordance with **Section 8.3**.



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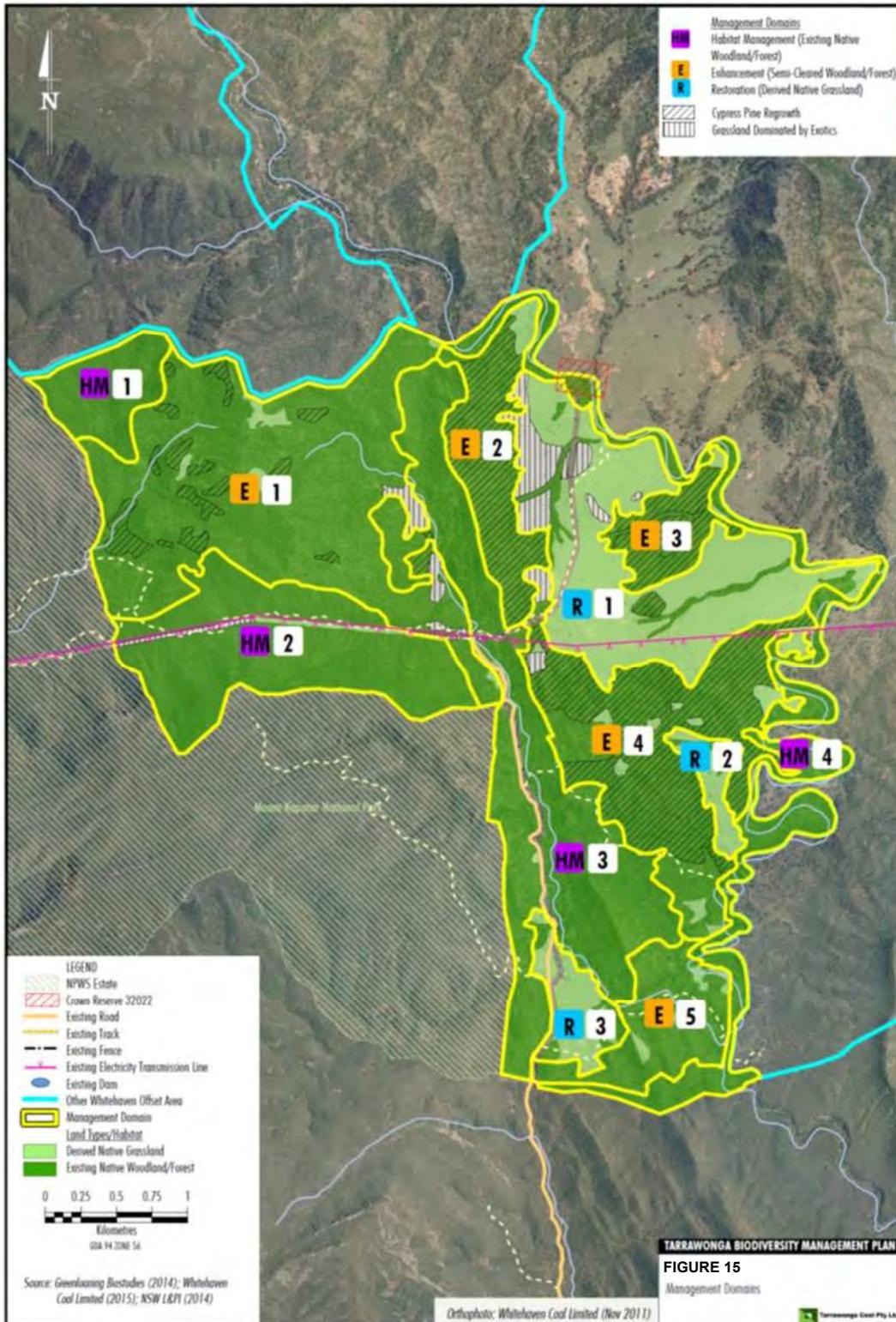


Figure 15: Management Domains

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Table 6-2: Management Domains

Management Domains	Habitat Management	Enhancement	Restoration
			
Ecosystem States	Native Woodland/Forest-Intact	Native Woodland/Forest-Semi-cleared	Derived Native Grassland
Objective	Existing native woodland/forest to be protected and enhanced	Semi-cleared woodland/forest to be protected and enhanced	Additional native vegetation to be established with the restoration of self-sustaining woodland vegetation communities within derived native grassland (moderate to good condition)
Main Management Actions	<ul style="list-style-type: none"> Natural regeneration. Weed and feral animal control (Sections 6.7 and 6.8). Access control (Section 6.10). Bushfire management (Section 6.11). 	<ul style="list-style-type: none"> Natural regeneration. Active revegetation (planting or direct seeding) depending on the success of natural regeneration. Weed and feral animal control (Sections 6.7 and 6.8). Access control (Section 6.10). Bushfire management (Section 6.11). 	<ul style="list-style-type: none"> Natural regeneration. Active revegetation (planting or direct seeding) depending on the success of natural regeneration. Weed and feral animal control (Sections 6.7 and 6.8). Access control (Section 6.10). Bushfire management (Section 6.11).

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Table 6-3: Management Domains and Units

Management Units (Figure 15)	Threatened Community Present (Figure 9)	Threatened Species Recorded (Figure 11 and Table 5-3)	Watercourses
Habitat Management			
HM1	Nil	-	Nil
HM2	Nil	Border Thick-tailed Gecko and Turquoise Parrot	Nil
HM3	Nil	Turquoise Parrot and Eastern Cave Bat	Teatree Gully
HM4	Small areas of Box-Gum Woodland CEEC	Turquoise Parrot, Brown Treecreeper (eastern subspecies), Little Lorikeet, Varied Sittella, Grey-crowned Babbler (eastern subspecies), Diamond Firetail, Squirrel Glider, Greater Broad-nosed Bat and Eastern Bentwing-bat	Maules Creek
Enhancement			
E1	Nil	-	Stony Creek, Teatree Gully
E2	Nil	Turquoise Parrot, Little Lorikeet, Eastern Bentwing-bat, Eastern False Pipistrelle and Eastern Cave Bat	Nil
E3	Nil	-	Nil
E4	Nil	-	Nil
E5	Small areas of Box-Gum Woodland CEEC	Black-chinned Honeyeater and Turquoise Parrot	Teatree Gully, Maules Creek
Restoration			
R1	Box-Gum Woodland CEEC Present	Brown Treecreeper (eastern subspecies), Hooded Robin (south-eastern form), Turquoise Parrot, Varied Sittella and Eastern Freetail Bat	Nil
R2	Box-Gum Woodland CEEC Present	-	Nil
R3	Nil	-	Nil

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6.4 COLLECTING AND PROPAGATING SEED

Aligned with **Section 4.4**; Whitehaven/TCM will undertake the following seed collection and propagation activities consistent with RBS-2 Table 2.1 Point 1.2 (Umwelt, 2017). WHC coordinates routine seed assessment programs designed to identify on a seasonal basis the life cycle stage and development of native plants across a range of BOAs to identify what, where, when and how to target appropriate resources to collect seed for future revegetation programs. The format of the seed assessments ensures that timely and prioritised seed collection is implemented and that reporting includes spatial information required by seed collection contractors to undertake the required works. Seed collection will be based on seed assessment results and/or from other opportunistic observations, but the collection and propagation will only be undertaken as required depending on the revegetation needs.

Seed Collection, Management and Storage

Seed collection, management and storage will be undertaken in consideration of Florabank guidelines (<http://www.florabank.org.au/>). Currently accepted best practice, as described in Rawlings *et al.* (2010) for local provenance seed collection includes:

- Seed collection will be based on seed assessment results and/or from other opportunistic observations, but the collection and propagation will only be undertaken as required depending on the revegetation needs (**Section 4.2**)
- Collection of seed from several source sites with similar rainfall, soil, altitude, aspect and slope position to the revegetation site to ensure they are most adapted to the landscape and environmental conditions.
- Collection of seed from between 20-50 plants of each species for genetic diversity.
- Collection of seed from plants spaced approximately three plant-heights apart to prevent collection of too many closely related seeds.

For seed collection undertaken onsite; records will include the species, quantities, dates and locations (in consideration of Florabank Guideline 4) and be reported in the Annual Summary Report consistent with RBS-2 Table 2.2 Point 1.2 (Umwelt, 2017).

Propagation

Revegetation by seedlings of the scale required will be undertaken by nurseries that can effectively collect commercial quantities of seed, propagate and grow the seed and harden the seedlings.

Orders will be placed in advance of revegetation works to meet the demand for tubestock. The likely time frames for plants to reach transplantable sizes will vary depending on the species and method of propagation (e.g. most species require one season to be of sufficient size, but other species such as *Xanthorrhoea*, *Callitris* and *Bursaria* can take two or more years).

6.5 REVEGETATION

6.5.1 Revegetation Program

Objectives

The objective of the revegetation program is to increase the area, quality and connectivity of native vegetation and habitats. This revegetation program was developed with regard to the *Florabank Native*

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Vegetation Management Tool (Carr *et al.*, 2010) and *A Guide to Managing Box Gum Grassy Woodlands* (Rawlings *et al.*, 2010) consistent with RBS-2 Table 2.1 Point 1.3 (Umwelt, 2017).

This revegetation program provides information on the revegetation target, revegetation works completed and maintenance.

Revegetation Target

Native vegetation and fauna habitat in the offset areas will be restored focusing on assisted natural regeneration and targeted vegetation establishment. Consistent with RBS-2 Table 2.1 Point 5.2 (Umwelt, 2017), this revegetation program will target:

- Restoration of Box-Gum Woodland CEEC;
- Expansion of patches of existing native vegetation for habitat of threatened species;
- Creation of buffer zones along watercourses and high value conservation areas (e.g. Mount Kaputar National Park); and
- Enhance connectivity and creation of corridors of native vegetation, where practicable linking the remnant native vegetation separate to the Mount Kaputar National Park.

The objectives of the offset areas include restoration of self-sustaining vegetation communities within previously cleared areas (i.e. derived native grassland [low to good condition], pasture improved and cultivated land) consistent with RBS-2 Table 2.1 Point 1.3 (Umwelt, 2017). Self-sustaining communities require little or no ongoing management intervention (Palmer and Ruhl, 2015) and are considered by TCPL to exist in areas where natural regeneration of a diverse range of native species occurs, and vegetation condition is maintained or improved over time against Performance and Completion Criteria in **Section 6.12**. This will be measured by ongoing monitoring as outlined in **Section 6.13.1**. Successful restoration of previously cleared areas with native vegetation will expand patches of existing native vegetation, increase connectivity and result in an improvement in biodiversity values.

Revegetation Works Completed

Primary revegetation of Willeroi West Offset Area is now complete with 125ha actively revegetated and of the remaining previously cleared land; 143ha is either natural regenerating and/or has natural constraints that restricts active revegetation in areas (**Figure 16**).

A summary of the revegetation programs completed between 2017 and 2019 are as follows:

- During 2017 revegetation ground preparation (tractor and excavator augured holes to a depth >0.3m every 10m to relieve compaction, improve permeability and infiltration to increase sub-surface soil moisture ahead of tree planting) was completed over 79ha.
- During the 2018 overstorey revegetation program, 86ha (of which 75ha was new tree planting) was planted with 6,469 seedlings (produced in hiko trays), with routine tree watering and maintenance activities post planting achieving over 80% survival;
- During 2019 additional revegetation ground preparation was completed ahead of the over-storey revegetation program planting over 60ha (with 50ha of new tree planting) with 3,398 hiko seedlings. Despite the prevailing drought conditions throughout 2019; routine tree watering and maintenance activities post planting were again successful to achieve 80% survival.



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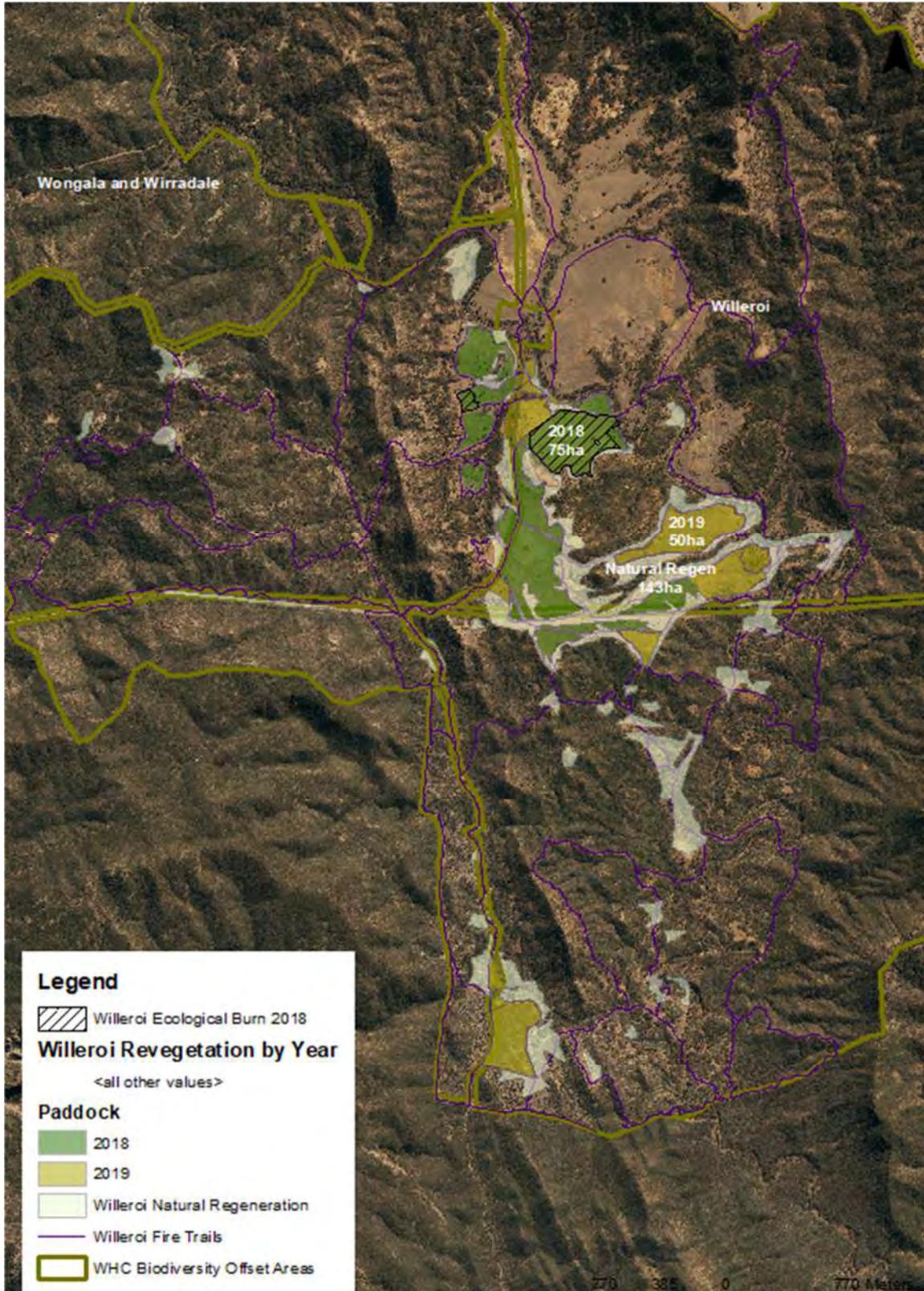


Figure 16: Primary Revegetation of Willeroi West Offset Area

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As noted above; revegetation planning for Willeroi West Offset Area considered existing or target vegetation communities and their condition/resilience to determine species selection/ratios; ground preparation requirements; physical and natural constraints to revegetation (i.e. natural regeneration, heritage, weeds, threatened species, former infrastructure or current infrastructure such as powerlines and soil condition/erosion).

Revegetation in the Willeroi West offset area utilised a combination of local endemic (adapted) and regional genetic provident species (Rawlings *et al.*, 2010). The target revegetation communities for Willeroi West Offset Area are White Box grassy woodland (BVT 226 and PCT 1383) and Narrow-leaved Ironbark - cypress pine - White Box shrubby open forest (BVT 316 and PCT 592). Given the level of resilience and high diversity of the native mid and ground layer species; Whitehaven only revegetated with overstorey species to be consistent with RBS-2 Table 2.1 Point 1.3 (Umwelt, 2017) to ensure that the revegetation program achieved a variety of grasses, low shrubs, mid-sized shrubs and tall trees towards creating a structurally diverse habitat. The indicative species list provided in **Table 6-4** also notes those overstorey species used for the hiko planting in 2018 and 2019 (including species specifically associated with the Box-Gum Woodland CEEC as per the NSW Final Determination and Commonwealth Listing Advice) as well as being recorded by FloraSearch (2011) previously in the offset area.

Table 6-4: Indicative Revegetation Species List

Common Name	Scientific Name	Common Name	Scientific Name
Overstorey		Understorey	
* White Box #	<i>Eucalyptus albens</i>	*Smooth Darling Pea	<i>Swainsona galegifolia</i>
* Yellow Box #	<i>Eucalyptus melliodora</i>	*Barb-wire Grass	<i>Cymbopogon refractus</i>
* Blakely's Red Gum #	<i>Eucalyptus blakelyi</i>	*Silky Blue-grass	<i>Dichanthium sericeum</i>
Narrow-leaved Ironbark #	<i>Eucalyptus crebra</i>	*Daises	<i>Brachyscome spp.</i>
Tumbledown Red Gum	<i>Eucalyptus dealbata</i>	*Wallaby Grass	<i>Austrodanthonia induta</i>
Silver-leaved Ironbark #	<i>Eucalyptus melanophloia</i>	*Kangaroo Grass	<i>Themeda triandra</i>
Midstorey		*Winter Apple	<i>Eremophila debilis</i>
*Sticky Hop-Bush	<i>Dodonaea viscosa ssp. angustifolia</i>	Blue Trumpet	<i>Brunoniella australis</i>
*Wilga	<i>Geijera parviflora</i>	Three-awn Speargrass	<i>Aristida vagans</i>
River Oak	<i>Casuarina cunninghamiana</i>	-	<i>Austrodanthonia spp.</i>
-	<i>Allocasuarina spp.</i>	Yellow Burr-daisy	<i>Calotis lappulacea</i>
Black Tea-tree	<i>Melaleuca bracteata</i>	-	<i>Chloris spp.</i>
Western Silver Wattle	<i>Acacia decora</i>	Two Coloured Panic	<i>Panicum simile</i>
Hickory Wattle	<i>Acacia implexa</i>	-	<i>Bothriochloa spp.</i>

* Species associated with the Box-Gum Woodland CEEC (consistent with RBS-2 Table 2.1 Point 1.3 (Umwelt, 2017) to create structurally diverse habitat (as per the NSW Final Determination and Commonwealth Listing Advice for these communities)). # notes the overstorey species used in actual hiko revegetation in 2018 & 2019.

The *TCM Threatened Fauna Implementation Plan* (Whitehaven, 2015a) was developed to maximise the prospect of providing suitable habitats for threatened fauna within the offset area (including those species listed in Condition 45 of Schedule 3 to PA 11_0047). **Table 6-4** includes flora species known to

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be used as habitat resources for threatened fauna that were identified in the *TCM Threatened Fauna Implementation Plan* (Whitehaven, 2015a).

The Regent Honeyeater (*Xanthomyza phrygia*) and Swift Parrot (*Lathamus discolor*) may use Box-Gum Woodland CEEC in the offset area as a foraging resource (although neither species was recorded in the offset area). In consideration of the potential foraging habitat requirements of the Regent Honeyeater (*Xanthomyza phrygia*), a variety of box, ironbark and gum eucalypt species will be established, including, but not limited to, White Box (*Eucalyptus albens*), Yellow Box (*E. melliodora*), Blakely's Red Gum (*E. blakelyi*) as well as Allocasuarina and Casuarina species (**Table 6-4**). In consideration of the potential habitat requirements of the Swift Parrot (*Lathamus discolor*), a variety of winter-flowering box, ironbark and gum eucalypt species will be established, including, but not limited to, White Box (*E. albens*) (**Table 6-4**).

The proposed revegetation of box, ironbark and gum eucalypt species (**Table 6-4**) can provide habitat for potential sources of prey for the South-eastern Long-eared Bat (*Nyctophilus corbeni*).

Box-Gum Woodland

Box-Gum Woodland is dominated or co-dominated by White Box, Yellow Box or Blakely's Red Gum trees; however, the species composition of Box-Gum Woodland varies across its range in NSW, Queensland and Victoria depending on local conditions (e.g. slope, aspect, and soil type). The revegetation program will focus on establishing Box-Gum Woodland with a similar composition of flora species to the existing vegetation communities which represent the Box-Gum Woodland CEEC. In other words, a patch will be expanded using species which occur (or likely to have formerly occurred) in that patch. This will also mimic the variation (patchiness) of the Box-Gum Woodland within the landscape. Box-Gum Woodland is represented by the following vegetation communities in the offset area (FloraSearch, 2011):

- White Box - White Cypress Pine Grassy Woodland; and
- Yellow Box – Rough Barked Apple Grassy Woodland.

Active revegetation of Box-Gum Woodland prioritised areas of Derived Native Grassland shown on **Figure 16**. Other areas of Derived Native Grassland were assessed as not requiring active revegetation due to natural regeneration or has natural constraints that restricts active revegetation in areas.

Local native perennial grasses, e.g. Kangaroo Grass (*Themeda triandra*), may be sown in revegetation areas targeting Box-Gum Woodland as these species are known to out-compete annual grass weeds and provide inter tussock spaces for a diversity of groundcover species (e.g. wildflowers). Additional information on species to include in revegetation of Box-Gum Woodland can be found in the Florabank (2014) *Box-Gum Grassy Woodland Species - Species Navigator Fact Sheets*.

Seed and Tube Stock Supply Strategy

Passive Revegetation - Natural Regeneration

As described above, natural regeneration will be favoured over planting or direct seeding in areas of native woodland/forest and derived native grassland (moderate to good condition) because natural regeneration conserves the natural genetic diversity of the local vegetation. For example, the condition of the Box-Gum Woodland in the offset area range from good to degraded condition mainly due to past clearing, grazing, weeds and pests.

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Natural regeneration in semi-cleared woodland or derived grasslands of Box-Gum Woodland will be promoted through management of threatening processes to Box-Gum Woodland.

Eucalypt regeneration in the derived grasslands could also be suppressed in the short-term due to the dense grassy layer in the derived grasslands. Management options that cause some disturbance to the grassland could be trialled. For example, slashing or low-intensity controlled burning around paddock trees before seed fall and seasonal rains. In areas with no paddock trees, disturbance could be caused before seasonal rains to encourage regrowth from soil seed stores.

Active Revegetation - Direct Seeding and Tubestock Planting

A combination of direct seeding and tubestock planting may be used to increase the diversity of species consistent with RBS-2 Table 2.1 Point 1.3 (Umwelt, 2017), as some species are better suited to direct seeding, and other species are better established by tubestock. Tubestock planting completed to date was undertaken in accordance with the Florabank *Native Vegetation Management Tool* (Carr *et al.*, 2010) and *A Guide to Managing Box-Gum Grassy Woodlands* (Rawlings *et al.*, 2010). As per the Performance and Completion Criteria, the target revegetation communities for Willeroi West Offset Area are White Box grassy woodland (BVT 226 and PCT 1383) and Narrow-leaved Ironbark - cypress pine - White Box shrubby open forest (BVT 316 and PCT 592).

As described above, revegetation was undertaken at planting densities of tube stock to mimic natural communities (species relative abundance and community structure) as well as allowing for mortality over time. This will ensure that Box-Gum Woodlands will achieve a minimum widely spaced trees (30–40 trees/ha) with a groundcover of grasses and a sparse or patchy shrub layer (Rawlings *et al.*, 2010; DEH, 2006). In an ideal patch of Box-Gum Woodland, the groundcover is a mixture of tussock grasses (i.e. grasses in clumps or bunches, rather than a lawn), bare ground, leaf litter, fallen timber, rocks and forbs (Rawlings *et al.*, 2010).

Slow-release native plant fertiliser may be used to promote plant growth.

Livestock will be excluded from areas undergoing active revegetation (i.e. planting or seeding).

Planting season depends largely on germination conditions including stored moisture, soil temperature, humidity and rainfall. Local conditions will be considered before planting; however, general planting seasons for Central Western NSW are at autumn break through to the beginning of spring (Rawlings *et al.*, 2010).

Weed control is described in **Section 6.7** and weed monitoring is discussed in **Section 6.13.3**. There will be a higher need for weed control in cleared land and along waterways compared to existing intact native woodland/forest. Controlling weeds prior to active revegetation will reduce competition and improve the success of revegetation. Cultivation or targeted scalping may be required to remove weeds and nutrients prior to seeding/planting.

Soil compaction inhibits germination of seeds or growth of seedlings (Eddy, 2002; Department of Sustainability and the Environment, 2005; Rawlings *et al.*, 2010; DECCW, 2011). Ground preparation will be undertaken as required to reduce soil compaction and improve infiltration which can affect the success of the revegetation.

Cultural heritage considerations are discussed in **Section 6.6**.

Maintenance

The revegetation areas will be maintained through a variety of activities, including weed control (**Section 6.7**) and feral animal control (particularly grazing herbivores) (**Section 6.8**).

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Contingency measures to address potential issues with the revegetation areas (e.g. poor understorey diversity, poor plant growth or grazing kangaroos) are provided in **Section 6.14**.

Revegetation Monitoring and Reporting

Monitoring of the revegetation areas is discussed in **Section 6.13**, record keeping is discussed in **Section 8.1**, and reporting requirements are discussed in **Section 8.2**. Whitehaven is undertaking a review of revegetation management in 2020 to standardise practices across all Whitehaven managed Biodiversity Offsets; with this Section to be updated in future revisions of the BMP.

6.5.2 Ecological Thinning – Cypress Pine Regrowth

White Cypress Pine has already regrown in some areas of the offset area forming a dense locked growth monoculture (e.g. Management Units E2, E3 and E4) (**Figure 15**). Dense overstorey and midstorey revegetation may remove forest-woodland edges and open grasslands leading to the loss of some existing threatened species from the offset area such as the Grey-crowned Babbler (eastern subspecies) and Diamond Firetail (Resource Strategies and Cenwest Environmental Services, 2011).

Ecological thinning can increase floristic diversity and structural complexity within a revegetated area and prevent poor or stunted growth of established plants (Bauhus *et al.*, 2001). It also promotes greater access of understorey species, typically herbaceous groundcovers, to resources such as space, light, and nutrients that may otherwise have been restricted by high tree densities. Thinning also increases the amount of woody debris in an area which can provide suitable habitat for ground dwelling fauna and create microhabitats for flora.

Ecological thinning will be undertaken in an adaptive fashion in select areas where necessary (particularly in Management Units E2, E3 and E4 - **Figure 15**) to promote the floristic diversity and structural complexity consistent with RBS-2 Table 2.1 Point 3.2 and 1.1 (Umwelt, 2017). Thinning density will be consistent with the species relative abundance and community structure of the target vegetation community (see specific information on Box-Gum Woodland below).

Trees will be felled using a chainsaw or brush cutter to minimise the potential for disturbance to non-target vegetation. Targeted weed monitoring and control will be undertaken (if necessary) in disturbed areas subject to ecological thinning. Ecological thinning may be supplemented with appropriate plantings or seeding (**Section 6.5.1**).

Native vegetation clearing in the offset area will not be undertaken unless for ecological thinning, infrastructure related to the offset area, maintenance or access for monitoring and bushfire management.

Whitehaven is undertaking a review of ecological thinning management in 2020 to standardise practices across all Whitehaven managed Biodiversity Offsets; with this Section to be updated in future revisions of the BMP.

Box-Gum Woodland

Box-Gum Woodland tree density of 30-40 mature trees per hectare is considered ecologically optimal (Rawlings *et al.*, 2010; McIntyre *et al.*, 2002), with spacing (between mature trees) of half to two crown widths. When undertaken, thinning methods will be consistent with *A Guide to Managing Box-Gum Grassy Woodlands* (Rawlings *et al.*, 2010). Smaller regrowth trees (less than 10 cm diameter at breast height) will be thinned to 400 stems/ha (approximately 5 x 5 m spacing). Larger regrowth trees of

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Cypress Pine (greater than 10 cm diameter at breast height) will be thinned to 250 stems/ha (approximately 6 x 7 m spacing). However, smaller trees will be preferentially removed.

Targeted revegetation may also be undertaken in these areas to increase the condition of the vegetation above the criteria for the Box-Gum Woodland CEEC.

6.5.3 Habitat Augmentation

Section 4.3 describes the salvage of naturally scarce fauna habitat features (bush rocks, fallen timber, hollow-bearing trees and logs) during vegetation clearance at the TCM for beneficial reuse consistent with RBS-2 Table 2.1 Point 2.1 (Umwelt, 2017). Due to the geographical separation from TCM to Willeroi West Offset, the reuse of salvaged habitat resources will not be undertaken in the Offset.

Habitat augmentation (using salvaged resources or nest boxes) should be undertaken in habitats identified as having low habitat resources consistent with RBS-2 Table 2.1 Point 2.2 (Umwelt, 2017). Whitehaven will complete the Habitat Needs Assessment to identify across the offset area where low habitat resources are and will outline how, the quantum and the schedule of habitat augmentation including the installation of nest boxes after July 2020. Where nest boxes are to be installed they will be made from high quality and durable materials that, ideally, provide for a long lifespan and of designs will be targeted to the hollow-dependent threatened species known to occur in the locality of the offset site such as woodland birds, arboreal mammals and micro-bats. It is expected that the installation of nest boxes will be staged over time to mirror the regeneration of the woodland and the species that are utilising each site initially for a 3 year period starting from July 2020. Whitehaven is undertaking a review of habitat augmentation management in 2020 to standardise practices across all Whitehaven managed Biodiversity Offsets; with this Section to be updated in future revisions of the BMP.

6.6 MANAGEMENT OF CULTURAL HERITAGE VALUES

There is not expected to be any conflict between the proposed restoration works in the offset area and any Aboriginal heritage values (both cultural and archaeological) (this was a recommendation from the TCM Independent Biodiversity Audit 2017 (ERM, 2017) to describe how potential heritage conflict will be managed). However, it is noted that:

- All offset area will need to meet all statutory requirements under the National Parks and Wildlife Act 1974.
- Any disturbance works in the offsets will consider potential impacts to heritage values.
- The outcomes of the Aboriginal Heritage Conservation Strategy required by Condition 51, Schedule 3 to PA 11_0047 will be considered, once approved.
- If any artefacts are found or known to occur, then consultation will be undertaken with qualified heritage consultants and an appropriate course of action identified.

6.7 CONTROL OF WEEDS

Objectives

Promote natural regeneration by reducing weeds so that cover does not comprise of more than 20% of any strata in native vegetation communities consistent with RBS-2 Table 2.1 Point 1.1 and Table 2.3 Point 3.2 (Umwelt, 2017) by implementing measures to exclude Weeds of National Significance [WONS]) and NSW biosecurity priority weeds (formerly noxious weeds) from the offset area (EPBC 2011/5923 Condition 13e iv).

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Weed Prevention

The spread and introduction of weeds can be prevented by the practice of weed hygiene measures and minimising disturbances that result in bare soil. WHC will instruct contractor vehicles and equipment entering the offset area to be clean and free from weeds and/or seeds. Access tracks/fire trails will be maintained and preferentially used to provide access within the offset area (**Section 6.2.3**). Access to the offset area will also be controlled as described in **Section 6.10**.

The implementation of measures that favour the restoration of healthy native vegetation that out competes weed species can also be an effective method of weed management. Revegetation is discussed in **Section 6.5**.

Weed Control Program/Timing

The weed control program will involve:

- Identifying weeds through monitoring (**Section 6.13.3**);
- Application of weed control techniques in areas requiring weed control;
- Follow-up monitoring of weed control areas; and
- Follow-up weed control if required.

Routine weed monitoring (seasonally based) will determine the need and frequency of weed control which will reflect the extent and condition of the weed infestation and the prevailing seasonal conditions, following monitoring.

Follow-up or secondary weed control will be undertaken, where required, in areas that have received past primary weed control treatments. Follow-up weed control involves the selective removal or treatment of weeds, whilst allowing regenerating or planted native plants to increase in size, abundance and percentage cover.

Weed Control Techniques

A number of environmental and priority weeds are known to occur in the offset area as listed in **Table 6-5**. Initially primary weed control will take place targeting the priority weeds as well as any other environmental weeds present in the offset area. However, if new weed species are found during monitoring those new weed species will also be controlled in accordance with this BMP.

Recommended techniques for the control of priority weeds that have been published by DPI Agriculture will be consulted prior to weed control, e.g. *New South Wales Weed Control Handbook* (DPI, 2018) and resources on the NSW WeedWise website consistent with RBS-2 Table 2.1 Point 3.2 (Umwelt, 2017). Local weed management plans published by the Local Councils (Narrabri Shire Council, 2014) also provide information on the control of priority weeds. Relevant methods for controlling priority weeds known to occur in the offset area are summarised in **Table 6-5**.

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Table 6-5: Control of Example Target Priority Weeds

Common Name	Scientific Name	Control Methods (DPI, 2018)
Sweet Briar	<i>Rosa rubiginosa</i>	<ul style="list-style-type: none"> Physical removal Herbicide application
Common Prickly Pear	<i>Opuntia stricta</i>	<ul style="list-style-type: none"> Herbicide application
Noogoora Burr	<i>Xanthium occidentale</i>	<ul style="list-style-type: none"> Physical removal Herbicide application
Galvanised Burr	<i>Sclerolaena birchii</i>	<ul style="list-style-type: none"> Herbicide application

In addition to species listed in **Table 6-5**, Coolatai Grass (*Hyparrhenia hirta*) is particularly invasive and is a recognised threat to Box-Gum Woodland CEEC (DECCW, 2011). Coolatai Grass will be treated with herbicide as described in the *NSW Weed Control Handbook* (DPI, 2018) consistent with RBS-2 Table 2.1 Point 3.2 (Umwelt, 2017).

All personnel involved in weed control will be required to hold valid licences/ permits for weeding works, including a chemical licence to use herbicides and a chainsaw certificate to operate chainsaws (where applicable).

Weed Communication

Consistent with the RBS-2 (Umwelt, 2017) Table 2.1 Point 3.1; weed management conditions (monitoring and control results) and trends to be communicated across the Leard Forest Mining Precinct and should include:

- Review monitoring reports for up-to-date information on weeds and pests;
- Discussing and prioritising weed and pest animal prevention, control methods and target species across the Leard Forest Mining Precinct for the following year;
- Liaise with local land managers and stakeholders on control measures and schedules.

In addition, a feedback loop will be developed to alert the Leard Forest Mining Precinct of any new or emerging weeds detected on any offset site.

Weed Monitoring and Reporting

Weed monitoring is discussed in **Section 6.13.3**, including a coordinated approach for consistent record keeping (**Section 8.1**), and reporting requirements are discussed in **Section 8.2**. Whitehaven is undertaking a review of weed management in 2020 to standardise practices across all Whitehaven managed Biodiversity Offsets; with this Section to be updated in future revisions of the BMP.

6.8 CONTROL OF FERAL ANIMALS

Objectives

The goal of feral animal management in the offset area will be to reduce feral animal species and populations impacts to native species, existing vegetation and rehabilitation efforts consistent with RBS-2 Table 2.1 Point 1.1 and Table 2.3 and 3.3 (Umwelt, 2017). Feral animals will be controlled within all

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offset areas so that the biodiversity value of native vegetation and rehabilitation efforts and restorations areas are not at high risk from feral animals.

Feral Animal Control Techniques

Feral animal control will focus on the main feral animals recorded from the offset area (**Table 6-6**). However, if new feral animals are found during monitoring those new feral animals will also be controlled in accordance with this BMP. The control of feral animals is intended to be adaptive and will be informed/reviewed based on the findings from the Feral Animal Monitoring Program (**Section 6.13.4**).

Control measures will be implemented by mine staff or by an appropriate Pest Control Contractor(s). All personnel involved in feral animal control will be required to hold valid licences/permits, including any relevant chemical licences for pesticide use or a firearms licence. The *Humane Pest Animal Control: Code of Practice and Standard Operating Procedures* (DPI, 2013, or its revision) will be followed.

Feral animal control techniques in **Table 6-6** are described in **Section 4.7** and below. A selection of these techniques or additional techniques will be implemented depending on the feral animal species requiring control (as determined through monitoring) and the success of these control techniques. Feral animal control will be undertaken with regard for the control recommendations outlined in the *Department of Primary Industries Vertebrate Pest Control Manual* (DPI 2014) and that control strategies follow the NSW Codes of Practices (COPs) and Standard Operating Procedures (SOPs) consistent with RBS-2 Table 2.1 Point 3.3 (Umwelt, 2017).

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Table 6-6: Control Methods for Target Feral Animals

Common Name	Scientific Name	Control Method	Relevant Documents ²
Feral Pig	<i>Sus scrofa</i>	<ul style="list-style-type: none"> Trapping, ground or aerial shooting; and/or Ground baiting (using 1080 poison). 	<ul style="list-style-type: none"> <i>Threat Abatement Plan for Predation, Habitat Degradation, Competition and Disease Transmission by Feral Pigs</i> (Department of the Environment and Heritage, 2005); <i>PestSmart Toolkit</i> (Invasive Animals Cooperative Research Centre, 2015); and <i>Vertebrate Pest Control Manual</i> (DPI, 2014b).
Feral Goat	<i>Capra hircus</i>	<ul style="list-style-type: none"> Ground or aerial shooting; and/or Mustering or trapping. 	<ul style="list-style-type: none"> <i>Threat Abatement Plan for Competition and Land Degradation by Unmanaged Goats</i> (Department of Environment, Water, Heritage and the Arts [DEWHA], 2008d); and <i>PestSmart Toolkit</i> (Invasive Animals Cooperative Research Centre, 2015).
European Red Fox	<i>Vulpes vulpes</i>	<ul style="list-style-type: none"> Trapping, ground or aerial shooting; and/or Ground baiting (using 1080 poison). 	<ul style="list-style-type: none"> <i>Threat Abatement Plan for Predation by European Red Fox</i> (DEWHA, 2008a); <i>NSW Threat Abatement Plan For Predation by The Red Fox (Vulpes vulpes)</i> (OEH, 2011); <i>PestSmart Toolkit</i> (Invasive Animals Cooperative Research Centre, 2015); and <i>Vertebrate Pest Control Manual</i> (DPI, 2014b).
European Rabbit	<i>Oryctolagus cuniculus</i>	<ul style="list-style-type: none"> Warren ripping/fumigation; Ground or aerial shooting; and/or Ground baiting (using poison). 	<ul style="list-style-type: none"> <i>Threat Abatement Plan for Competition and Land Degradation by Rabbits</i> (DEWHA, 2008b); <i>PestSmart Toolkit</i> (Invasive Animals Cooperative Research Centre, 2015); and <i>Vertebrate Pest Control Manual</i> (DPI, 2014b).
Wild Dog	<i>Canis familiaris</i>	<ul style="list-style-type: none"> Ground baiting (using 1080 poison); and/or Trapping, ground or aerial shooting. 	<ul style="list-style-type: none"> <i>New South Wales Wild Dog Management Strategy 2012-2015</i> (DPI, 2012); <i>Wild Dog Policy</i> (Department of Environment and Climate Change [DECC], 2005); <i>PestSmart Toolkit</i> (Invasive Animals Cooperative Research Centre, 2015); and <i>Vertebrate Pest Control Manual</i> (DPI, 2014b).
Black Rat	<i>Rattus rattus</i>	<ul style="list-style-type: none"> Ground baiting. 	<ul style="list-style-type: none"> <i>Vertebrate Pest Control Manual</i> (DPI, 2014b).
House Mouse	<i>Mus musculus</i>	<ul style="list-style-type: none"> Ground baiting. 	<ul style="list-style-type: none"> <i>Vertebrate Pest Control Manual</i> (DPI, 2014b).

² An alternative published method may be used as required.

Pest Animal Communication

Consistent with RBS-2 (Umwelt, 2017) Table 2.1 Point 3.1 recommends pest animal management conditions (monitoring and control) and trends to be communicated across the Leard Forest Mining Precinct and should include:

- Review monitoring reports for up-to-date information on feral animals;

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- Discussing and prioritising feral animal prevention, control methods and target species across the Leard Forest Mining Precinct for the following year;
- Liaise with local land managers and stakeholders on control measures and schedules.

In addition, a feedback loop will be developed to alert the Leard Forest Mining Precinct of any new or emerging pest animals detected on any offset site. WHCs feral animal contractor maintains an online pest animal sighting form that is communicated daily as the primary reporting tool and the spatial data could be used for public communication of pest animal records; with a secondary use may be reported through Feralscan.

Pest Animal Monitoring and Reporting

Pest animal monitoring is discussed in **Section 6.13.4**, including implementing a coordinated approach for consistent record keeping (**Section 8.1**), and reporting requirements are discussed in **Section 8.2**. A review of the previous feral animal monitoring program was undertaken in 2020 and the scope incorporated all WHC biodiversity offset properties, including Willeroi, (AMBS 2020).

6.9 CONTROLLING EROSION

Erosion control will be implemented in areas observed to be displaying relevant characteristics (e.g. gullyng), through visual monitoring. Visual observations will focus on drainage areas and disturbed areas (e.g. access tracks including creek crossings).

The following measures may be used to control erosion within the offset area:

- Selective plantings/direct seeding of local endemic species to stabilise the soil; and/or
- Surface water management structures (e.g. contour banks and temporary sediment traps (such as hay bales)).

An existing area of erosion occurs in R1 (**Figure 15**) which will be subject to the above measures.

6.10 CONTROLLING ACCESS AND EXCLUDING GRAZING

As described in **Section 6.2.3**, the offset area will be set-up on the ground by:

- Using existing fencing (where practicable and required) to demarcate the perimeter around the offset area to exclude grazing livestock to promote natural regeneration consistent with RBS-2 Table 2.1 Point 1.1 (Umwelt, 2017) and avoid unauthorised disturbance/accidental clearance;
- Installing gates into the offset area; and
- Installing signage on entries into the offset area which recognise that the area is protected for conservation purposes to deter third party access into the area.

Vehicle access will be predominantly restricted to designated tracks to minimise ground disturbance (e.g. compaction) with the exception for biodiversity management actions and inspections which unavoidably result in vehicles and machinery travelling off-tracks within the offset area. Maintenance of all access tracks, fire trails, fences and gates to be undertaken as required.

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6.11 MANAGING BUSHFIRE RISK

Objectives

The objective of fire management for the offset area is to:

- Appropriately manage the risk of unplanned bushfire occurring;
- Respond to an unplanned bushfire were it to occur; and
- Use fire to reduce weeds and/or enhance the biodiversity of the offset area.

Maintaining Fire Breaks and Access Trails

Fire access trails identified in **Figure 16** are indicative only. Final locations of fire breaks will be determined based on routine fuel load and fire hazard assessments. Fire breaks will be periodically maintained as zero fuel barriers acknowledging that in between maintenance that some fuel accumulation will occur. Where not limited by terrain/topography, fire breaks will be located along the perimeter of property/offset boundaries to mitigate fire spreading onto or off the site; as well as fire breaks established strategically within the properties/offsets utilising internal infrastructure boundaries, access trails and fence lines for controlled or back burn ignition sites in case of bush fires.

All fire breaks and access trails will be inspected at least once a year for maintenance requirements prior to the fire season consistent with RBS-2 Table 2.1 and 2.2 Point 4.1 (Umwelt, 2017). However, maintenance issues may also be noted during other routine management and monitoring activities undertaken in the offset area.

Emergency Bushfire Response

If a bushfire were to occur within or move towards the offset area, the local NSW Rural Fire Service will be notified. TCM will assist the Rural Fire Service, emergency services and National Parks and Wildlife Services if there is a fire in the surrounding area. The assistance provided will be based on the nature of the request from emergency services and is subject to the legal and statutory obligation held by TCM for its people and or plant.

After a bushfire, a record will be made of the timing, intensity and extent of each fire.

Assessing Fuel Loads

Monitoring fuel levels will take place as part of the annual inspection consistent with RBS-2 Table 2.1 and 2.2 Point 4.1 (Umwelt, 2017). Where fuel loads pose a threat and fuel loads are required to be reduced, the method to reduce fuel loads will involve one or more of the following and consultation with the NSW Rural Fire Services prior to implementation.

No Controlled Grazing to Reduce Fuel Loads

Strategic grazing of fuel loads will not be trialled for the Willeroi Offset not in accordance with RBS-2 Table 2.1 Point 4.1 (Umwelt, 2017) because:

- Grazing exclusion promotes natural regeneration (**Section 6.10**);
- Fuel load monitoring and assessment by fire professionals does not indicate a need for alternative fuel load reduction methods to be introduced;

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- The geographical position of the Willeroi Offset and restricted access limits the ability for trucks to access the property and therefore increases difficulty in supervision and management of livestock;
- The terrain and removal of derelict fences, stockyards and water infrastructure limits potential strategic grazing sites;
- Restrictions to grazing (**Section 6.2.3**) as well as existing and potential revegetation areas limits potential strategic grazing sites; and
- NPWS have indicated that pending Whitehaven agreement and payment of management funds; Willeroi Offset (areas not subject to revegetation) is of a standard to be transferred (as soon as practicable) to National Parks Estate and therefore strategic grazing could risk this land transfer proposal.

Controlled (Ecological) Burns to Reduce Fuel Loads

Fuel reduction can also be undertaken through controlled burns (or ecological burns) consistent with RBS-2 Table 2.1 and 2.2 Point 4.1 (Umwelt, 2017). The NSW Rural Fire Service will be consulted when planning control burns. The use of fire in each management domain is discussed below and is consistent with Section 9 of *A Guide to Management Box Gum Grassy Woodlands* (Rawlings *et al.* 2010).

Restoration Domains

Controlled burns may be undertaken in the Restoration Domains to reduce weeds and/or promote the biodiversity through natural regeneration consistent with RBS-2 Table 2.1 Point 1.1 (Umwelt, 2017). Spring burns can be useful for reducing the mass of exotic annual grasses (Rawlings *et al.*, 2010) which occur in the Restoration Domains.

No controlled burns will be undertaken if native vegetation is establishing (e.g. if planting or seeding has occurred) until the revegetation is sufficiently mature to withstand controlled burns.

Habitat Management and Enhancement Domains

Controlled burns may occur in existing woodland/forest within the Habitat Management and Enhancement Domains in consultation with the NSW Rural Fire Service. The relevant Bush Fire Risk Management Plans to the offset area provide fire frequency intervals for vegetation forms (**Table 6-7**).

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Table 6-7: Fire Frequency Intervals for Vegetation Forms

Vegetation Type	Fire Frequency Intervals (Years)	
	Minimum	Maximum
Grassland	3	10
Grassy Woodland	8	40
Dry Sclerophyll Forest (Shrub/Grass Subformation)	8	50
Dry Sclerophyll Forest (Shrub Subformation)	10	30
Semi-Arid Woodlands (Grassy Subformation)	9	No Maximum
Semi-Arid Woodlands (Shrubby Subformation)	15	No Maximum

Modified Source: Narrabri/Moree Bush Fire Management Committee (2010)

Further to the intervals in **Table 6-7**, the fire frequency interval of controlled burns in patches of Box Gum Woodland CEEC (existing grassy woodland) will be no less than five years. DECCW (2011) suggests fire frequency in Box-Gum Woodland CEEC will be a minimum interval of five years and a maximum interval of 40 years. Rawlings *et al.* (2010) recommends fire frequency in Box Gum Woodland CEEC to be every four to eight years.

Prior to controlled burns, consideration will be given to known occurrences of threatened flora species and their sensitivities to fire; as well as mosaic burning and to avoid burning trees with hollows to minimise impact to fauna consistent with RBS-2 Table 2.2 Point 4.2 (Umwelt, 2017). Further RBS-2 (Umwelt, 2017) Table 2.2 Point 4.2 recommends additional flora monitoring points will be required to assess the impacts of control measures on native vegetation communities (particularly within White Box – Yellow Box – Blakely’s Red Gum Woodland CEEC) as well as in habitat restoration areas and regeneration/revegetation zones, monitoring will be required to record the response to a fire event and guide the need for potential active and adaptive management.

Autumn burns can be useful for reducing biomass and increasing native species diversity (Rawlings *et al.*, 2010). If controlled burns are to be implemented, low intensity prescribed burning will be employed for all vegetation types in the offset area (after NSW Rural Fire Services, 2006). As defined by the NSW Rural Fire Services (2006) low intensity prescribed burning means:

the use of fire intended to result in the removal of the leaf litter, grass and shrub layer with minimal canopy scorching. Fires will be patchy and the actual area burnt may vary between 40% and 80%. The average flame height will be less than one metre. This can be achieved by lighting under conditions where a combination of some or all of following factors influence fire behaviour – low fuel loads, moist fuels, low temperatures, high humidity, low wind speeds and fire lighting patterns.

The timing, intensity and extent of each fire will be recorded so that the fire frequency intervals are within the above thresholds. After an uncontrolled wildfire, the fire frequency interval may need to increase depending on the intensity of the wildfire.

Communication with Adjacent Landholders

Landholders adjacent to the offset area will be contacted before controlled burns are conducted to notify them of the controlled burn as well as to discuss burning programs on the adjacent properties and possibilities of co-ordinating controlled burns.

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6.12 PERFORMANCE AND COMPLETION CRITERIA

Performance criteria are interim targets for the implementation of management activities in this BMP while completion criteria are the desired targets to be attained and then maintained for the period of approval. Once achieved; completion criteria indicate that management has been successful at obtaining the desired result towards woodland ecological restoration. The following performance and completion criteria have been updated in accordance with the *Leard Forest Regional Biodiversity Strategy Stage 2 – Strategy Report* (Umwelt, 2017) Table 2.3. Whitehaven further refined its performance and completion criteria in consultation with DPIE during 2018 during preparation of the Maules Creek Coal Mine (MCCM) and Tarrawonga Coal Mine Mining Operations Plans, specifically addressing:

- Inclusion of sufficient parameters/indicators such that successful completion of each (rehabilitation) phase can be demonstrated,
- Inclusion of defined trigger points to inform trajectory analysis, and
- Defined reference sites and site specific benchmarks.

Table 6-8 outlines the SMART principles (specific, measurable, achievable, repeatable, time-bound) that have been applied to the flora and vegetation performance and completion criteria that give quantified annual metrics to assess year on year performance of woodland restoration for the Willeroi offset area and is consistent with the MCCM MOP (and future revision of the TCM MOP) and *TCM Mine Site Rehabilitation Plan* (WHC, 2020).

Condition 12 of the EPBC Act approval for the TCM notes:

for consistency, the proponent may develop a Biodiversity Management plan that includes the requirements set for managing offsets and set out in these conditions, to align with the requirements of the NSW state government Project Approval dated 22 January 2013 (application number 11_0047) and this approval.

The requirements of the NSW state government project approval include that these performance and completion criteria must be consistent with those provided in the *Leard Forest Regional Biodiversity Strategy Stage 2 – Strategy Report*. Performance and completion criteria to address the desired outcomes for this BMP are comprehensively addressed in the Strategy Report and are replicated in Table 6-9.

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Table 6-8: Vegetation Performance and Completion Criteria

Domain Objective	Performance Indicator	Performance Criteria							Justification/ Source
PERFORMANCE CRITERIA		Time since Initial Revegetation	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	
Woodland revegetation for White Box grassy woodland (BVT 226 and PCT 1383) and Narrow-leaved Ironbark - cypress pine - White Box shrubby open forest (BVT 316 and PCT 592) as consulted with DPIE September 2018	BVT 226 and PCT 1383 Native Species Richness	Mean Target	1	2	3	4	5	5	Powerpoint Presentation used to consult with DPIE in September 2018 titled "WHC-OEH Woodland Revegetation Completion Criteria Meeting 25Sept18. pptx"
		Minimum Target	1	1	2	3	3	4	
	BVT 226 and PCT 1383 Native Overstorey Cover	Mean Target	1%	3%	4%	5%	6%	8%	
		Minimum Target	0%	0%	0%	0%	0%	0%	
	BVT 226 and PCT 1383 Native Mid-storey Cover	Mean Target	0%	1%	1%	1%	1%	2%	
		Minimum Target	0%	0%	0%	0%	0%	0%	
	BVT 226 and PCT 1383 Native Groundcover (Grasses)	Mean Target	2%	4%	6%	8%	10%	12%	
		Minimum Target	2%	3%	5%	6%	8%	9%	
	BVT 316 and PCT 592 Native Species Richness	Mean Target	1	2	4	5	6	7	
		Minimum Target	1	2	3	4	5	6	
	BVT 316 and PCT 592 Native Overstorey Cover	Mean Target	2%	4%	6%	8%	10%	12%	
		Minimum Target	0%	0%	0%	0%	0%	0%	
	BVT 316 and PCT 592 Native Mid-storey Cover	Mean Target	1%	3%	4%	5%	6%	8%	
		Minimum Target	0%	1%	1%	1%	2%	2%	
BVT 316 and PCT 592 Native Groundcover (Grasses)	Mean Target	2%	3%	5%	6%	8%	9%		
	Minimum Target	1%	2%	3%	4%	5%	6%		

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**Table 6-8 (Continued)
Vegetation Performance and Completion Criteria**

Domain Objective	Performance Indicator	Completion Criteria					Justification/ Source	
COMPLETION CRITERIA		Benchmarks	RBS* (80%) BVT NA 226	BVT NA 226	PCT BBS 1383**	Local Reference		
Woodland revegetation for White Box grassy woodland (BVT 226 and PCT 1383) and Narrow-leaved Ironbark - cypress pine - White Box shrubby open forest (BVT 316 and PCT 592) as consulted with DPIE September 2018	BVT 226 and PCT 1383 Native Species Richness	Mean Target	18	23	33	60	Powerpoint Presentation used to consult with DPIE in September 2018 titled "WHC-OEH Woodland Revegetation Completion Criteria Meeting 25Sept18. pptx"	
		Minimum Target	13	18	28	55		
	BVT 226 and PCT 1383 Native Overstorey Cover	Mean Target	Not Applicable	25%	17%	13%		
		Minimum Target	Not Applicable	6%	Not Applicable	Not Applicable		
	BVT 226 and PCT 1383 Native Mid-storey Cover	Mean Target	Not Applicable	5%	2%	4%		
		Minimum Target	Not Applicable	0%	Not Applicable	Not Applicable		
	BVT 226 and PCT 1383 Native Groundcover (Grasses)	Mean Target	Not Applicable	40%	45%	38%		
		Minimum Target	Not Applicable	30%	Not Applicable	Not Applicable		
		Benchmarks	RBS* (80%) BVT NA 316	BVT NA 316	PCT BBS 592**	Local Reference		
	BVT 316 and PCT 592 Native Species Richness	Mean Target	24	30	35	Not Applicable		Powerpoint Presentation used to consult with DPIE in September 2018 titled "WHC-OEH Woodland Revegetation Completion Criteria Meeting 25Sept18. pptx"
		Minimum Target	19	25	30	Not Applicable		
	BVT 316 and PCT 592 Native Overstorey Cover	Mean Target	Not Applicable	40	59	Not Applicable		
Minimum Target		Not Applicable	25	Not Applicable	Not Applicable			
BVT 316 and PCT 592 Native Mid-storey Cover	Mean Target	Not Applicable	25	30	Not Applicable			
	Minimum Target	Not Applicable	6	Not Applicable	Not Applicable			
BVT 316 and PCT 592 Native Groundcover (Grasses)	Mean Target	Not Applicable	30	22	Not Applicable			
	Minimum Target	Not Applicable	20	Not Applicable	Not Applicable			

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The performance of management actions undertaken within the offset area will be monitored against the performance criteria provided in **Table 6-8** and **Table 6-9**. If performance criteria are not being met, contingency measures will be considered (**Section 6.14**).

Table 6-9: Additional Performance and Completion Criteria (from RBS-2 Table 2.3)

Strategic Focus Areas/ Management Component	Performance Measures and Preliminary Completion Criteria	Timeframe (following Offset establishment)*	
		Ongoing Performance Measured	Completion Timeframe
Strategic Focus Area 1 - Enhance the quality of habitats and landscapes at the offset sites for White Box – Yellow Box – Blakely's Red Gum Woodland EEC and CEEC			
1.1 Natural regeneration (in semi-cleared and remnant native woodland vegetation in good condition)	100% of the White Box – Yellow Box – Blakely's Red Gum Woodland EEC and CEEC monitoring sites across the relevant vegetation zones in each offset site show all locally-occurring canopy species recruiting ³ (i.e. canopy tree species occurring in the moderate to good condition PCT at the offset site or surrounds are recruiting in the semi-cleared and remnant native woodland vegetation). Where monitoring is undertaken according to the BBAM sampling should occur across each entire vegetation zones. Where monitoring is undertaken according to the BAM sampling should be undertaken in the monitoring sites of each vegetation zone. ³ To meet the definition of "canopy species recruiting" there should be evidence of recruitment of at least 5 saplings per hectare.	Annually	By year 10
	Naturally regenerated areas of White Box – Yellow Box – Blakely's Red Gum Woodland EEC and CEEC monitoring sites conform to the condition assessment outlined on page 5 of the EPBC Policy Statement 3.5 White Box – Yellow Box – Blakely's Red Gum Grassy Woodlands and Derived Native Grasslands across the relevant vegetation zones in each offset site.	Annually	By year 10
	100% of the White Box – Yellow Box – Blakely's Red Gum Woodland EEC and CEEC across the relevant vegetation zones in each offset site show evidence of occupation or presence of at least 80% of the native fauna species comparative to approved benchmark or monitoring reference sites.	Annually	By year 10
	100% of the White Box – Yellow Box – Blakely's Red Gum Woodland EEC and CEEC monitoring sites across the relevant vegetation zones in each offset site is within the benchmark ranges for the cover scores (i.e. overstorey, midstorey and groundcover) and at 80% or above for species richness benchmarks.	Annually	By year 10
1.2 Collect and propagate seed	Seed collection records, including location of plantings and success rates (where available), are reported on in the Annual Summary Report.	Annually	All years
	Seed is collected over a range of sites across the locality to adequately capture local variations within the offset sites and disturbance areas.	Annually	All years

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Table 6-9 (Continued)
Additional Performance and Completion Criteria (from RBS-2 Table 2.3)

Strategic Focus Areas/ Management Component	Performance Measures and Preliminary Completion Criteria	Timeframe (following Offset establishment)*	
		Ongoing Performance Measured	Completion Timeframe
1.3 Active revegetation (in semi-cleared woodland, derived native grasslands and cleared land)	100% of the White Box – Yellow Box – Blakely's Red Gum Woodland EEC and CEEC monitoring sites across the relevant vegetation zones in each offset site show all locally-occurring canopy species recruiting ³ (i.e. canopy tree species occurring in the moderate to good condition PCT at the offset site or surrounds are recruiting in the semi-cleared, derived native grasslands and cleared land). Where monitoring is undertaken according to the BBAM sampling should occur across each entire vegetation zones. ³ To meet the definition of "canopy species recruiting" there should be evidence of recruitment of at least 5 saplings per hectare.	Annually following active revegetation	By year 15 following active revegetation
	Active regeneration areas of White Box – Yellow Box – Blakely's Red Gum Woodland EEC and CEEC monitoring sites conform to the condition assessment outlined on page 5 of the EPBC Policy Statement 3.5 White Box – Yellow Box – Blakely's Red Gum Grassy Woodlands and Derived Native Grasslands across the relevant vegetation zones in each offset site.	Annually following active revegetation	By year 15 following active revegetation
	100% of the White Box – Yellow Box – Blakely's Red Gum Woodland EEC and CEEC across the relevant vegetation zones in each offset site show evidence of occupation or presence of at least 80% of the native fauna species comparative to approved benchmark or monitoring reference sites.	Annually following active revegetation	By year 20 following active revegetation
	100% of the White Box – Yellow Box – Blakely's Red Gum Woodland EEC and CEEC monitoring sites across the relevant vegetation zones in each offset site is within the benchmark ranges for the cover scores (i.e. overstorey, midstorey and groundcover) and at 80% or above for species richness benchmarks.	Annually following active revegetation	By year 20 following active revegetation
Strategic Focus Area 2 – Provide ongoing management and enhancement of existing habitats at the offset sites for threatened species and communities			
2.1 Salvage of habitat resources	Salvaged resources that are reused or relocated in offset sites are in structurally good condition.	Annually following placement	By year 5 following placement.
2.2 Habitat augmentation and nest box installation	80% of the nest boxes installed are being utilised or show signs of use by native species across the offset sites. Utilisation of nest boxes by pest species such as European honey bee (<i>Apis mellifera</i>), common myna (<i>Acridotheres tristis</i>), common starling (<i>Sturnus vulgaris</i>) and feral rodent species (<i>Rattus</i> and <i>Mus</i> spp.) should be recorded.	Each nest box should be monitored at least once every 5 years	Ongoing
	Each nest box installed within the offset sites should be in good structural condition and functioning in the landscape.	Annually following installation	Ongoing

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Table 6-9 (Continued)
Additional Performance and Completion Criteria (from RBS-2 Table 2.3)

Strategic Focus Areas/ Management Component	Performance Measures and Preliminary Completion Criteria	Timeframe (following Offset establishment)*	
		Ongoing Performance Measured	Completion Timeframe
2.3 Access control	Livestock are excluded from restoration areas following planting and high quality woodland vegetation at the offset sites (it is acknowledged that strategic grazing may be required in some areas).	Annually	Ongoing
	Wildlife-friendly fencing is utilised, where appropriate, within the offset sites.	1 year	By year 10
	Inspection of Erosion Areas and Boundary Fences	Annually	Ongoing
<i>Strategic Focus Area 3 - Promote a consistent and coordinated approach to weed management and pest animal control</i>			
3.1 Weed and pest prevention and communication	Weed trends and control schedules are communicated across the Leard Forest Mining Precinct in the relevant forums.	Annually	Ongoing
	The most recent offset monitoring summary reports containing information on weed and pest records, trends and issues are provided across the Leard Forest Mining Precinct and reported on in the Annual Summary Report.	Annually	Ongoing
	Key messages on weeds are effectively communicated, where appropriate, with relevant local land holders, managers and stakeholders.	Annually	Ongoing
3.2 Weed control	Offset site flora monitoring shows an overall reduction in exotic plant cover following control measures implemented across the offset sites.	Annually	Ongoing
	Weed species do not comprise more than 20% of any strata in the native vegetation communities within the offset sites.	Annually	Ongoing
	Weed control is undertaken across the offset sites using methods outlined in the NSW Weeds Control Handbook (6th Edition) (DPI 2018), Narrabri Shire Council Weed Management Plans, and/or the NSW WeedWise website.	Annually	Ongoing
	Significant weed infestations or newly identified weed species within the offset sites are reviewed and control measures implemented within 1 year of identification of the issue.	Annually	Ongoing
3.3 Pest animal control	Offset site fauna monitoring shows an overall reduction in pest animal species and population sizes targeted by control measures implemented across the offset sites (in consideration of potential drought conditions and seasonal trends).	Annually	By year 5
	Pest animal control is undertaken across the offset sites using methods approved under the NSW Codes of Practices (COPs) and Standard Operating Procedures (SOPs).	Annually	Ongoing
	Significant pest animal occurrences or newly identified pest species within the offset sites are reviewed and control measures implemented (if required) within 1 year of identification of the issue.	Annually	Ongoing

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Table 6-9 (Continued)
Additional Performance and Completion Criteria (from RBS-2 Table 2.3)

Strategic Focus Areas/ Management Component	Performance Measures and Preliminary Completion Criteria	Timeframe (following Offset establishment)*	
		Ongoing Performance Measured	Completion Timeframe
Strategic Focus Area 4 - Promote a consistent and coordinated approach to fire management for biodiversity			
4.1 Managing fuel loads	If determined to be suitable following recommendations from monitoring or the RFS, strategic grazing will not be used in management zones to manage fuel loads.	No grazing to occur in TCM Offsets	No grazing to occur in TCM Offsets
4.3 Ecological control burns	Fuel reduction is undertaken in the form of controlled burning (as per recommendations in Rawlings <i>et al.</i> 2010) as deemed required and in consultation with the RFS.	Every 5 years	Ongoing
	The impacts of control and mosaic burning on native and weed species diversity is reported on and information made available to all Leard Forest Mining Precinct sites.	Within 1 year of completed monitoring reports.	Ongoing
Strategic Focus Area 5 – Enhance the connectivity of habitats through corridor and buffer area establishment and management			
5.1 Connected landscapes and broader regional corridors	Corridors within the offset sites are in accordance with the performance indicators outlined in Strategic Focus Area 3 in relation to weeds and pests.	As per Strategic Focus Area 3.	As per Strategic Focus Area 3.
	Targeted fauna monitoring indicates that the offset site corridors provide habitat for native fauna species in the locality through monitoring as outlined in Table 6-15 .	Annually	By year 10
5.2 Mine rehabilitation and the vegetated buffer corridor for habitat connectivity	The rehabilitated habitat in mine rehabilitation and the vegetated buffer corridor provides a wildlife corridor linking habitats from conservation areas in the east, linking Leard State Forest and to west towards the Namoi River.	Annually following rehabilitation	By year 30 (subject to relinquishment of mining lease by DRG)
Strategic Focus Area 6 – Consult and workshop biodiversity issues with local stakeholders and land managers			
6.1 Biodiversity management consultation	Targeted consultation with key stakeholders, land managers and agencies regarding biodiversity issues is demonstrated through the development of resources and workshops involving stakeholders	Annually	Ongoing
	An annual summary report is to be prepared detailing the overall biodiversity performance and outcomes of the offset sites across the region.	Annually	Ongoing

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6.13 MONITORING PROGRAM

There are four components to the monitoring program:

- Vegetation and habitat monitoring (**Section 6.13.1**);
- Fauna monitoring (**Section 6.13.2**);
- Weed monitoring (**Section 6.13.3**); and
- Feral animal monitoring (**Section 6.13.4**).

Suitably qualified and licenced personnel will be engaged to undertake the monitoring program.

6.13.1 Vegetation and Habitat Monitoring

Purpose

Monitoring will be undertaken by qualified ecologists to track changes in vegetation and habitat in the offset area in response to management measures. The data collected will be used to evaluate the progress of habitat re-establishment, restoration and enhancement towards meeting the completion criteria (**Section 6.12**).

Vegetation and habitat monitoring will include documenting native and introduced (including priority weed) flora species. Weed monitoring is also outlined in **Section 6.13.3**.

Monitoring Design

The monitoring program includes detailed systematic surveys:

- In degraded native vegetation which will be subject to restoration and enhancement through predominantly natural regeneration (i.e. the Restoration and Enhancement Domains); and
- In cleared areas subject to active revegetation (i.e. the Revegetation Domain).

The vegetation and habitat monitoring program also includes observational and photo monitoring throughout the offset areas (including the Habitat Management Domain and along watercourses).

A number of plots will be established at each monitoring site and two types of monitoring plot will be used to monitor vegetation and habitat (**Table 6-10**).

Table 6-10: Types of Monitoring Sites

Types of Monitoring Plots	Definition
Action Plots	Action plots will be located in areas that are subject to management activities
Control Plots	Control plots will be located in areas that are not subject to management activities

The number of initial Vegetation and Habitat Monitoring Sites and plots per restoration and enhancement domains are listed in **Table 6-11**. Additional monitoring sites may be progressively established for testing

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specific management techniques in an adaptive management framework (e.g. testing a management technique and revising the technique based on a monitoring outcome).

Table 6-11: Number of Vegetation and Habitat Monitoring Sites per Domain

Domain	General Description	Objective	Number of Sites (Replicates)	Area of Domain (ha)
Restoration	Derived Native Grassland	Additional native vegetation to be established with the restoration of self-sustaining vegetation communities within derived native grassland	4*(3)	278.17
Enhancement	Semi-cleared Woodland/Forest	Semi-cleared woodland/forest to be protected and enhanced	4*(3)	755.77
Total Sites (replicates)			8(3)	1,034
Total Plots			24	1,034

* Based on BBAM (as required under the RBS) five monitoring sites would be required for the Restoration Domain and seven sites for the Enhancement Domain.

The monitoring program has been designed to be as statistically robust as possible. The key aspect of the survey design is that each monitoring site has three replicated monitoring plots and transects to allow for statistical analysis, specifically to analyse the variation around mean values. If the variation among sites of the same condition is too large to detect meaningful change, then the number of sites will be increased to increase the statistical power of the monitoring program. Furthermore, as the monitoring program collects greater than 30 parameters for flora monitoring, it is likely that some parameters will be more useful for testing change in response to management than others. Analysis of the appropriate response measures will also be undertaken following initial data collection.

As indicated in **Table 6-11**, the number of monitoring sites based on the BBAM (as required under RBS-2) is higher than currently outlined by this BMP, however, development of an Integrated Monitoring Strategy (IMS) is currently underway as a requirement of the BCT for securing the Willeroi Conservation Agreement. Once the IMS is complete, Whitehaven will resubmit the BMP to DPIE and DAWE for approval on required changes to the monitoring program that will incorporate the BCT requirements with existing Approvals and RBS-2.

Location of Monitoring Sites

The aim is not to sample every vegetation community, but to adequately sample each domain, to detect trends and changes in the vegetation condition within each domain. Monitoring sites will be mostly located in Box-Gum Woodland CEEC (**Figure 17**).

Timing and Frequency

Vegetation and habitat will be monitored on an annual basis in spring, when the highest diversity of plants is expected to be present (after Rawlings *et al.*, 2010) and also just monitor the restoration (those subject to revegetation) sites in autumn to maximise the detection of native perennials consistent with RBS-2 Table 2.2 Point 1.1 & 1.3 (Umwelt, 2017).



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Figure 17: Flora Monitoring Site locations within the Willeroi West Offset Area

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Methodology

The vegetation and habitat monitoring methodology will include:

- detailed records of all management activities (e.g. date, location, on-ground works);
- fixed monitoring plots;
- photographic monitoring; and
- general observations.

The methodology is detailed below. Generally the *BioBanking Assessment Methodology* (BBAM) (2014) will be used to analyse trends against benchmark data by undertaking plot and transect surveys consistent with RBS-2 Table 2.2 Point 1.1 & 1.3 (Umwelt, 2017); undertaking at least the minimum number of plots and transects per vegetation zone; and photographic monitoring at permanent monitoring points conducted using a consistent methodology across the offset sites.

Fixed Monitoring Plots

Fixed monitoring plots measuring 20 x 50 m will be established at each Vegetation and Habitat Monitoring Site to gather habitat data. Within each plot, a 20 x 20 m quadrat will be established to sample flora. **Figure 18** shows the layout of a plot and quadrat.

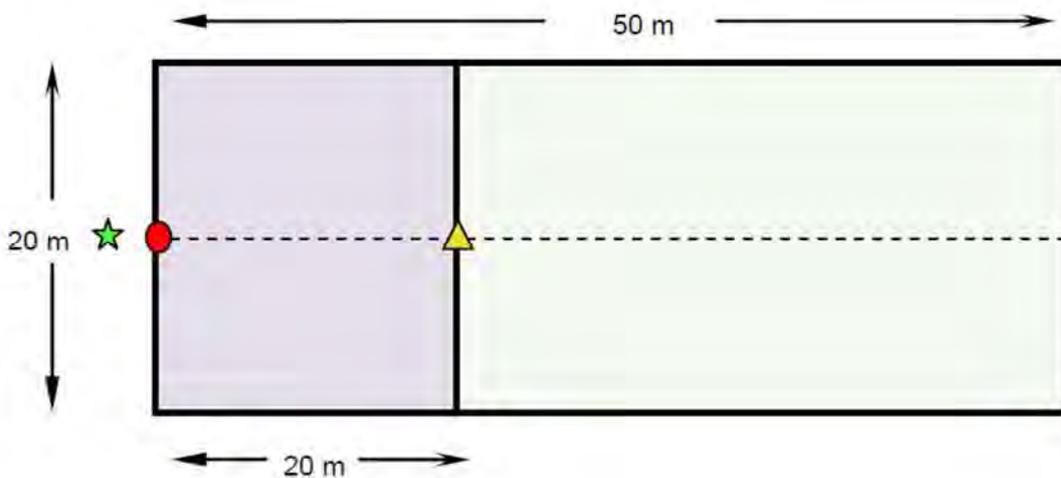


Figure 18: Layout of the Vegetation and Habitat Monitoring Plot

Plots will be permanently marked by placement of star pickets as recommended by Rawlings *et al.* (2010) at the northern and southern end of the midline of each plot. The location of the pickets will be recorded using a GPS. The methodology includes monitoring vegetation structural parameters and flora species (**Table 6-12**) and a range of parameters such as habitat, management issues/response and vegetation cover (**Table 6-13**). Parameters 1 to 4 in **Table 6-13** will be recorded every 10 years. The parameters specified below to be measured by monitoring will produce data for comparison with the ecological indicators outlined previously in **Table 6-8** and **Table 6-9** as Performance and Completion Criteria.

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Table 6-12: Field Survey Parameters to be Recorded Annually in Each 20 x 20 m Quadrat

	Parameter	Assessment Technique	Activity	Box-Gum Woodland condition indicators	Threatened Fauna Habitat value indicators
1	Overall site cover: Cryptogam cover	Average within 20 x 20 m plot	Record cryptogam as a percentage of the site. Record in 5% increments. Cryptogams occurring on soil and rocks are included in the assessment.	✓	-
2	Overall site cover: Rock Cover	Average within 20 x 20 m quadrat	Record rock cover as a percentage of the site. Record in 5% increments.	✓	-
3	Overall site cover: Bare ground	Average within 20 x 20 m quadrat	Record bare ground as a percentage of the site. Record in 5% increments. Bare ground excludes rocks.	✓	-
4	Structural Assessment: Canopy	Average within 20 x 20 m quadrat	Record percentage cover of canopy species. Canopy species are classified as vegetation >8 m. Record the height range of canopy species in metres.	✓	✓
5	Structural Assessment: Midstorey 1	Average within 20 x 20 m quadrat	Record percentage cover of Mid 1 species. Mid 1 is classified as vegetation <8 m and >5 m. Record the height range of Mid 1 species in metres.	✓	-
6	Structural Assessment: Midstorey 2	Average within 20 x 20 m quadrat	Record percentage cover of Mid 2 species. Mid 2 is classified as vegetation <5 m and >1 m. Record the height range of Mid 2 species in metres.	✓	-
7	Structural Assessment: Ground layer	Average within 20 x 20 m quadrat	Record percentage cover of living ground layer species. The ground layer is classified as vegetation <1 m. Record the height range of ground layer species in centimetres.	✓	-
8	Tree Species Size Classing	Count within 20 x 20 m quadrat	Record height classes of all tree species present. The classes include <1m, 1-2m, 2-5m, 5-10m, 10-15m, 15-20m, 20-25m, 25-30m, >30m. Count the number of each species which occurs within each class. Record the total number of each species as the sum of all records.	✓	✓
9	Flora Species Richness	Count within 20 x 20 m quadrat	Record presence of all flora species. Record with sample identification and field name where applicable. Identify specimens using floristic keys. Canopy species richness should be recorded across the whole plot.	✓	-

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Table 6-13: Field Survey Parameters Recorded Annually in Each 20 x 50 m Plot

	Factor assessed	Assessment Technique	Activity	Box-Gum Woodland condition indicators	Threatened Fauna Habitat value indicators
Habitat					
1	Habitat Feature Tree Hollows*	Count 20 x 50 m plot	Count all hollows >10 cm occurring in plot. Consistent with BioBanking methodology. Record comments where applicable. If absent record as zero.	-	✓
2	Habitat Feature: Fallen logs	Count 20 x 50 m plot	Count all fallen logs >10 cm diameter and >50 cm in length occurring in plot. Record comments where applicable. If absent record as zero.	-	-
3	Proximity to water	Observation General area	Record in meters type and distance of standing and ephemeral water occurring <500 m from the site. This includes dams, streams and drainage lines. Record comments where applicable. If absent record as zero.	-	-
4	Proximity to rocks, caves and overhangs	Observation General area	Record in meters distance to large habitat rocks, caves or overhangs occurring <300 m from the site. Record comments where applicable. If absent record as zero.	-	-
5	Presence of flowering Eucalypts	Observation 20 x 50 m plot	Record presence or absence of flowering Eucalypts. Where flowering occurs record species and proportion of site containing the flowering species (e.g. <i>Eucalyptus crebra</i> <5%). Record comments where applicable. If absent record as zero.	-	✓
Management Issues/Response					
6	Evidence of extensive erosion or waterlogging disturbing native vegetation	Observation General area	Record in meters distance to erosion or waterlogging occurring <300 m from the site. Record comments where applicable. If absent record as zero.	✓	✓
7	Dense stands of regeneration (<i>Callitris glaucophylla</i>) that may require thinning	Observation General area	Record presence or absence of dense stands of <i>Callitris glaucophylla</i> occurring within or directly adjacent to the plot. Record comments where applicable. If absent record as zero.	✓	✓
8	Evidence of past disturbance	Observation 20 x 50 m plot	Record presence or absence of disturbance and document disturbance type. This include, but is not limited to, fire, logging, tree thinning, roads/tracks, grazing. If absent record as zero.	✓	✓
9	Dieback of Eucalypts that could be due to water stress	Observation 20 x 50 m plot	Record presence or absence of Eucalypt dieback and description of site topography. Record comments where applicable. If absent record as zero.	✓	✓

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Table 6-13 (Continued)
Field Survey Parameters Recorded Annually in Each 20 x 50 m Plot

	Factor assessed	Assessment Technique	Activity	Box-Gum Woodland condition indicators	Threatened Fauna Habitat value indicators
10	Presence/absence of Noisy Mynas	Observations/Call Identification General area	Record presence or absence of Noisy Mynas and/or Yellow-eared Mynas if not distinguishable. Record comments where applicable. If absent record as zero.	-	✓
11	Presence/absence of other Honeyeaters	Observation/Call Identification General area	Record presence or absence of other Honeyeaters. Record habitat and comments where applicable. If absent record as zero.	-	✓
Management Issues/Response (Cont.)					
12	Evidence of disturbance by pest animals.	Observation 20 x 50 m plot	Record presence or absence of pest animals. Evidence includes sighting, scats, tracks or obvious grazing. This includes but is not limited to livestock, fox, rabbit, deer, pigs, goats. Record comments where applicable. If absent record as zero.	✓	✓
13	Regeneration of canopy species	Observation 20 x 50 m plot	Record presence or absence of canopy species regeneration. Where possible record species and proportion of site containing the regenerating species (i.e. <i>Eucalyptus crebra</i> 5 to 15%). Record comments where applicable. If absent record as zero.	✓	✓
14	Overall vegetation condition (Resilience)	Observation 20 x 50 m plot	Record vegetation condition on a scale of 1-4, where 1 is Very Poor and 4 is Good. Classify based on modified BioBanking descriptions (e.g. Good: <10% weed and/or healthy strata and high assemblage diversity. Moderate: 10 to 30% weed and/or minor stratum dieback and moderate assemblage diversity. Poor: 30 to 80% weed and/or moderate stratum dieback and low assemblage diversity. Very Poor: >80% weed and/or extensive stratum dieback/extremely reduced diversity)	✓	✓
Vegetation Cover					
15	Native overstorey cover (NOS)	At 10 points along a 50 m transect	Record height of highest layer in metres. Record health of overstorey (on a 1-3 scale in which 1 is poor and 3 is good). Record projected foliage cover directly over the selected point and within the boundaries of a confined shape (e.g. 5 cm tube).	✓	✓

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Table 6-13 (Continued)
Field Survey Parameters Recorded Annually in Each 20 x 50 m Plot

	Factor assessed	Assessment Technique	Activity	Box-Gum Woodland condition indicators	Threatened Fauna Habitat value indicators
16	Native midstorey cover (NMS)	At 10 points along a 50 m transect	Record height of highest layer in metres. Record health of midstorey (on a 1-3 scale in which 1 is poor and 3 is good). Record projected foliage cover directly over the selected point and within the boundaries of a confined shape (e.g. 5 cm tube).	✓	-
17	Exotic overstorey and midstorey cover	At 10 points along a 50 m transect	Record height of highest layer in metres. Record health of midstorey (on a 1-3 scale in which 1 is poor and 3 is good). Record projected foliage cover directly over the selected point and within the boundaries of a confined shape (e.g. 5 cm tube).	✓	-
18	Native groundcover (grasses)	At 50 points along a 50 m transect	Record occurrences or hit at each point. Record only occurrence, even if multiple "hits" of native grasses occur at the point. Consistent with BioBanking methodology.	✓	-
19	Native groundcover (forb)	At 50 points along a 50 m transect	Record occurrences or hit at each point. Record only occurrence, even if multiple "hits" of native forbs occur at the point. Consistent with Biobanking methodology.	✓	-
20	Native groundcover (other)	At 50 points along a 50 m transect	Record occurrences or hit at each point. Record only occurrence, even if multiple "hits" of native groundcovers occur at the point. Include cryptogams. Consistent with Biobanking methodology.	✓	-
21	Exotic groundcover	At 50 points along a 50 m transect	Record occurrences or hit at each point. Record only occurrence, even if multiple "hits" of exotic species occur at the point. Consistent with Biobanking methodology.	✓	-
22	Overall site cover: Litter cover	Average within 20 x 20 m quadrat	Record litter cover as a percentage of the site. Record in 5% increments. Litter cover includes all dead material but excludes cryptogams and rocks. Litter depth is captured in the fire fuel hazard assessment.	✓	-

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Photographic Monitoring

Photo monitoring will be undertaken at fixed sites in the offset area:

- each Vegetation and Habitat Monitoring Site; and
- any additional Vegetation and Habitat Monitoring Sites established over time (including at least one Photo Monitoring Site per Management Domain, particularly in areas undergoing active management).

Photos will be taken in a consistent direction, location (at global positioning system [GPS] points), height above the ground and time of day. These aspects and the date will be recorded for each photo taken (north, south, east and west). Aerial photographs will also be used to show enhancement of vegetation connectivity.

General Observations

General observations outside monitoring sites will also be made during monitoring activities. During monitoring activities, surveys will make observations and record dense or emerging stands of plant species, such as Coolatai grass (*Hyparrhenia hirta*), white cypress pine (*Callitris glaucophylla*) or black cypress pine (*Callitris endlicheri*), that may result in the suppression of native understorey species establishment consistent with RBS-2 Table 2.2 Point 1.1 & 1.3 (Umwelt, 2017). Weed occurrences in the offset area will be identified in regards to effectiveness of control measures but for major (or new) weed infestations specific information about the species, location, size and density will be documented to all for reporting and control to be undertaken consistent with RBS-2 Table 2.2 Point 3.2 (Umwelt, 2017).

Data Analysis and Storage

The monitoring program includes measurement of a number of indicators (parameters) that will enable changes to the Box-Gum Woodland CEEC to be detected (e.g. floristics, recruitment), including changes that may be ascribed to water stress (e.g. dieback of Eucalypts – Monitoring parameter 9 in **Table 6-13**)

The monitoring program also includes measurement of a number of indicators (parameters) that will indicate changes to the habitat values for the Regent Honeyeater, Swift Parrot and South-eastern Long-eared Bat.

All quadrat data will be entered in databases and stored for later use and analysis. Data will be added as recorded so that it will form a data matrix that is amenable to analysis using classification and ordination techniques, and parametric statistics.

Data collected will be analysed and compared with the performance criteria (**Section 6.12**).

After the photographic monitoring event the photos will be compared to the photos from the previous monitoring periods. Natural regeneration of native understorey and overstorey species, the occurrence of habitat features (e.g. logs, litter), plant establishment and the status of weeds will all be noted. As noted above, Whitehaven is undertaking a review of the flora monitoring program in 2020 to standardise practices across all Whitehaven managed Biodiversity Offsets; with this Section to be updated in future revisions of the BMP.

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6.13.2 Fauna Monitoring

Purpose

Monitoring will be undertaken to document the fauna species response to improvement in vegetation and habitat in the offset area and to demonstrate progress towards Completion Criteria (**Table 6-8** and **Table 6-9**). Generally, an increase in the species richness and/or abundance is anticipated as the quantity and/or quality of habitat resources increases over time. The observed changes in species richness and abundance should also result in detectable changes in occupancy as well as changes in species composition of each general fauna assemblage (birds, reptiles, mammals).

Fauna monitoring will include documentation of native and introduced (including pest) animals. Pest animal monitoring is also outlined in **Section 6.13.4**.

Monitoring Design

WHC undertook a 5-year review of the data collected from the Maules Creek and Tarrawonga (Willeroi) Offset Annual Fauna Monitoring Program (AMBS 2020b). The results indicated that while general trends in species richness and abundance over time were detected by the current survey methodologies and survey effort, the variance in the data set was extremely high and no meaningful statistical analysis linking changes in species richness and abundance to specific variables was possible.

Based on the conclusions of the 5-year review, WHC undertook a review of all fauna monitoring methodologies and designs used across all offset properties, including Willeroi (AMBS 2020c). The review identified that while all methods were somewhat effective at detecting fauna species richness and abundance, there were aspects of each monitoring design and monitoring methodology that were contributing to high levels of variance in the data set. It concluded the monitoring design was struggling to deal with the spatial challenges associated with the large area of biodiversity offsets monitored by WHC (including Willeroi) and the associated variables that were generated as a result of the large area. It identified that while the methods would continue to generate somewhat indicative species richness and abundance data sets, the data sets would not be sufficiently robust to link changes with specific variables including the management actions currently being undertaken by WHC.

Given the challenges faced by the monitoring projects managed by WHC, it was proposed that a series of structural modifications to the monitoring programs (including Willeroi) were required to improve the rigour of the data set that was generated. The proposed modifications aimed to increase the likelihood that informative data on the influence of land management actions would be collected, while continuing to address the Strategic Focus Areas identified in the RBS-2 (Umwelt, 2017). The recommended modifications focused on adjustments to the timing of surveys, the number of survey sites, the focus of the surveys, and the methodology of the surveys. The recommended modifications included:

- Changing the frequency of sampling for some monitoring components from annual to biennial, with the purpose of pooling financial resources for other structural survey modifications;
- Using pooled financial resources to increase the number of sites, site survey replication and seasonal survey effort;
- Targeting surveys on spatially explicit focus areas. The focus areas would encompass the habitat variability of the BOA, and are also likely to show detectable responses to land management actions that are influencing fauna response while maximising the chance of revealing total BOA species richness;
- Modification of some methods used to detect fauna; and
- Modification of survey windows used to detect some fauna.

The number of Fauna Monitoring Sites per domain will vary depending on the group of fauna targeted and the methodology being used. Fauna monitoring has evolved from a series of generalised fauna

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survey sites which target all fauna associated with the site to a series of spatially explicit focus areas where survey effort can be increased to test specific hypotheses associated with fauna responses to management actions.

The species richness and abundance data collected by the new program would still be comparable to historic survey data sets for the purposes of continuing to assess long-term trends (AMBS, 2020c). This would be achieved by comparing relative abundance and relative species richness; measures that calculate species richness on a scale of zero to one by dividing the recorded values by the survey effort. Relative species richness and abundance has already been utilised for the Maules Creek and Willeroi monitoring results (AMBS, 2020b), due to the fact that the number of fauna monitoring survey sites has progressively increased overtime to account for the introduction of survey sites in revegetation/grassland areas.

The number of sites per habitat management domain and survey type are listed in **Table 6-14**.

Table 6-14: Number of Fauna Monitoring Sites per Domain

Domain	General Description	Objective	Number of Bird Survey Sites	Number of Owl Survey Sites	Number of Harp Trap Sites	Number of Echolocation Sites	Number of Reptile Survey Sites	Number of Targeted Glider Survey Sites
Restoration	Derived Native Grassland	Additional native vegetation to be established with the restoration of self-sustaining vegetation communities within derived native grassland.	6	0	1	5	6	0
Enhancement	Semi-cleared Woodland/Forest	Semi-cleared woodland/forest to be protected and enhanced.	6	0	1	2	0	4
Habitat Management	Existing Native Woodland/Forest	Existing woodland/forest to be protected and enhanced.	12	2	2	5	6	6
Total Sites			24	2	4	12	12	10

Frequency

Fauna surveys timing will vary depending on the target fauna species. AMBS (2020c) identified that most land management actions focused on improving species richness, abundance, occupancy and species composition would act over varying temporal scales. As such, for some techniques, survey frequency could be modified from annual surveys to biennial survey without a loss of qualitative power in the data set, especially if decreased frequency was matched by an increase in survey sites and site sample replication. As such, the following survey frequency is planned:

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- Bird Surveys – 24 survey sites surveyed ever 2 years with 12 of those 24 sites sampled annually
- Owl Surveys – 2 sites surveyed annually (as part of a broader program also focused on offsets associated with Maules Creek)
- Reptile Surveys – 12 survey sites surveyed biennially
- Harp Trap Surveys – 4 sites surveyed annually
- Echolocation Surveys – 12 sites surveyed annually
- Targeted Glider Surveys – 10 sites biennially

Habitat monitoring will occur annually as described in **Section 6.13.1**.

Target Fauna

All native and introduced vertebrate fauna groups will be targeted (except frogs), including:

- reptiles;
- birds (including nectivorous woodland birds, arboreal insectivorous woodland birds, ground dwelling insectivorous woodland birds and bark-gleaning woodland birds);
- bats;
- other arboreal mammals; and
- ground-dwelling mammals.

Target Habitat

Salvaged arboreal hollows and fallen timber when installed within the offset area will be monitored for their use and condition by remote cameras during annual spring monitoring consistent with RBS-2 Table 2.2 Point 2.1 (Umwelt, 2017). Further, the Habitat Needs Assessment (**Section 6.5.3**) will determine the required monitoring and maintenance regime of any habitat augmentation. Specifically, nest boxes installed within the offset sites will be monitored for signs of use and condition during annual spring monitoring consistent with RBS-2 Table 2.2 Point 2.2 (Umwelt, 2017).

Target Faunal Movement Corridors

Camera monitoring of native fauna will be integrated with the pest animal camera monitoring programs of offset sites to survey for use of potential corridors by fauna through connected landscapes within the locality or region, consistent with RBS-2 Table 2.2 Point 5.1 (Umwelt, 2017).

Methodology

Fauna monitoring methods implemented annually are outlined in **Table 6-15** with other survey methods employed targeted to MNES species (Swift Parrot, Regent Honeyeater and South-eastern Long-eared Bat) are described below. **Figure 19** presents the locations of the revised monitoring locations and survey periods described in **Table 6-15**.

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Table 6-15: Fauna Monitoring Methods

Group	Location	Method	Description	Relevant Survey Period	Method Source
Reptiles	Indicative Active Forage Sites	Habitat Search	Active search of potential reptile habitats performed for 60 person minutes at each site.	Spring	Department of Environment and Conservation (DEC) (2004)
Diurnal Birds	Indicative Diurnal Bird Survey Sites	Area Search	10 minute fixed area timed search and each site will be surveyed five times . All birds observed or heard will be recorded.	Spring	Webb et al. (2014)
Nocturnal Birds	Indicative (Diurnal) Bird Survey Sites	Passive Acoustic Recording units	Targeting Masked Owl and Barking Owl. Units deployed for 28 days between June and August	Winter	
Terrestrial Mammals	Integrated Fauna Camera Monitoring with Pest Animal Camera Sites	Camera Traps	Each camera left in-situ for a minimum of 28 days prior to pest animal control and 28 days after pest animal control days with a bait chamber positioned between 1 to 3 m from the camera.	Spring	Eyre <i>et al.</i> (2012)
	All monitoring sites.	Secondary Evidence	Opportunistic observations of fauna signs throughout the study area.	Spring	DEC (2004)
	Indicative Glider Transect Sites	Spotlighting	Fixed length transects following distance sample methods targeting all arboreal mammals but primarily focused on gliding species. Active searches for nocturnal species, including nocturnal mammals will be performed for 120 person minutes at each site.	Spring /Summer	DEC (2004)
Bats (including the Southern Long-eared Bat)	Indicative Microbat Echolocation Transects	Anabat Detectors	One Anabat unit left for 5 nights at each site	Spring /Summer	DEC (2004); DEWHA (2010a)
	Indicative Microbat Harp Trap Sites	Harp-trapping	Four Harp traps per site left for 4 nights, moved after each night	Spring /Summer	DEC (2004); DEWHA (2010a)

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The methodology outlined in **Table 6-15** will enable detection of threatened fauna species. The target threatened fauna are listed below in **Table 6-16**. These are species that have been recorded in the offset area and surrounding areas. Although not all of these species have been recorded on the offset area, potential habitat for these species occurs, and therefore they will be surveyed for using the methods in **Table 6-15**. Observations of pest animals will also be recorded as part of the annual fauna monitoring consistent with RBS-2 Table 2.2 Point 3.3 (Umwelt, 2017).

Table 6-16: Threatened Species

Common Name	Scientific Name	Conservation Status ¹		Known to Occur in the Offset Area (Table 5-3)
		BC Act	EPBC Act	
Reptiles				
<i>Underwoodisaurus sphyrus</i>	Border Thick-tailed Gecko	V	-	✓
Birds				
<i>Neophema pulchella</i>	Turquoise Parrot	V	-	✓
<i>Tyto novaehollandiae</i>	Masked Owl	V	-	Potential
<i>Climacteris picumnis</i>	Brown Treecreeper (eastern subspecies)	V	-	✓
<i>Chthonicola sagittata</i>	Speckled Warbler	V	-	Potential
<i>Stagonopleura guttata</i>	Diamond Firetail	V	-	✓
<i>Melithreptus gularis</i>	Black-chinned Honeyeater (eastern species)	V	-	✓
<i>Melanodryas cucullata</i>	Hooded Robin (south-eastern form)	V	-	✓
<i>Pomatostomus temporalis</i>	Grey-crowned Babbler	V	-	✓
<i>Daphoenositta chrysoptera</i>	Varied Sittella	V	-	✓
<i>Glossopsitta pusilla</i>	Little Lorikeet	V	-	✓
Swift Parrot	<i>Lathamus discolor</i>	E	E	Potential
Regent Honeyeater	<i>Anthochaera phrygia</i>	CE	E	Potential
Mammals				
<i>Phascolarctos cinereus</i>	Koala	V	V	Potential
<i>Petaurus norfolcensis</i>	Squirrel Glider	V	-	✓
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat	V	-	Potential
<i>Nyctophilus corbeni</i>	South-eastern Long-eared Bat (previously Greater Long-eared Bat)	V	V	Potential
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V	V	Potential
<i>Mormopterus norfolkensis</i>	Eastern Freetail-bat	V	-	✓

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**Table 6 16 (Continued)
Threatened Species**

Common Name	Scientific Name	Conservation Status ¹		Known to Occur in the Offset Area (Table 5-3)
		BC Act	EPBC Act	
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	V	-	✓
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V	-	✓
<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing-bat	V	-	✓
<i>Vespadelus troughtoni</i>	Eastern Cave Bat	V	-	✓

Threatened Fauna Listed Under the EPBC Act

Monitoring for the Regent Honeyeater (*Xanthomyza phrygia*), Swift Parrot (*Lathamus discolor*) and the South-eastern Long eared Bat (*Nyctophilus corbeni*) will be carried out annually, generally at the same time of year as the baseline surveys, as agreed in writing by DAWE in accordance with Condition 14 of the EPBC Approval 2011/5923.

Baseline surveys were undertaken in July 2017 for the Regent Honeyeater and Swift Parrot. The revised Winter Bird Survey Monitoring Program for the Willeroi Offset, as part of an extended program across all WHC Biodiversity Offset Areas, will continue annually, generally at the same time of year between May and August. WHC commissioned a review of its Winter Bird Survey Monitoring requirements (Ecoplanning 2020) across all WHC Biodiversity (Offset) Management Plans (BOMP/BMP) and propose that the standardised Winter Bird Survey Monitoring Program going forward for all WHC BOAs; will apply this methodology:

1. Trigger point for survey - Starting May each year, relevant WHC staff and community groups to report on presence of Winter flowering eucalypts. This will provide a trigger to initiate the scoping survey. If no trigger is provided, scoping survey to be initiated by the last week in July.
2. Scoping survey - Ecologists traverse the study area noting indicators for survey, such as, flowering eucalypts and/or congregations of nectar feeding birds. Linear, well-connected patches should also be noted. Flower intensity score and patch quality to be used to inform subsequent surveys.
3. Field survey - Ecologists to traverse the study area and conduct bird surveys at previously identified sites (as in the Scoping survey above). Survey effort will be guided by the intensity score at a site. At each site, flowering intensity scores are to be recorded and all bird species (sighted or heard) are to be recorded. A total survey effort cannot be prescribed because this is ultimately dependant on flowering intensity in any one year. However, to meet Commonwealth survey guidelines for targeted surveys (DEWHA 2010b), there should be a minimum of 20 hours of bird surveys across 8 days targeted to sampling winter flowering species across all WHC BOAs by the end of August.

The baseline surveys for the South-eastern Long eared Bat were undertaken in November and December 2017 in accordance with the *Survey Guidelines for Australian Threatened Bats* (DEWHA, 2010a). Ongoing annual monitoring will target the South-eastern Long eared Bat as outlined in **Table 6-15** to be more spatially explicit focus areas where survey effort can be increased to test specific hypotheses associated with fauna responses to management actions. As evident in **Figure 19** and **Table 6-15**; the revised monitoring locations and survey periods align with the baseline monitoring.



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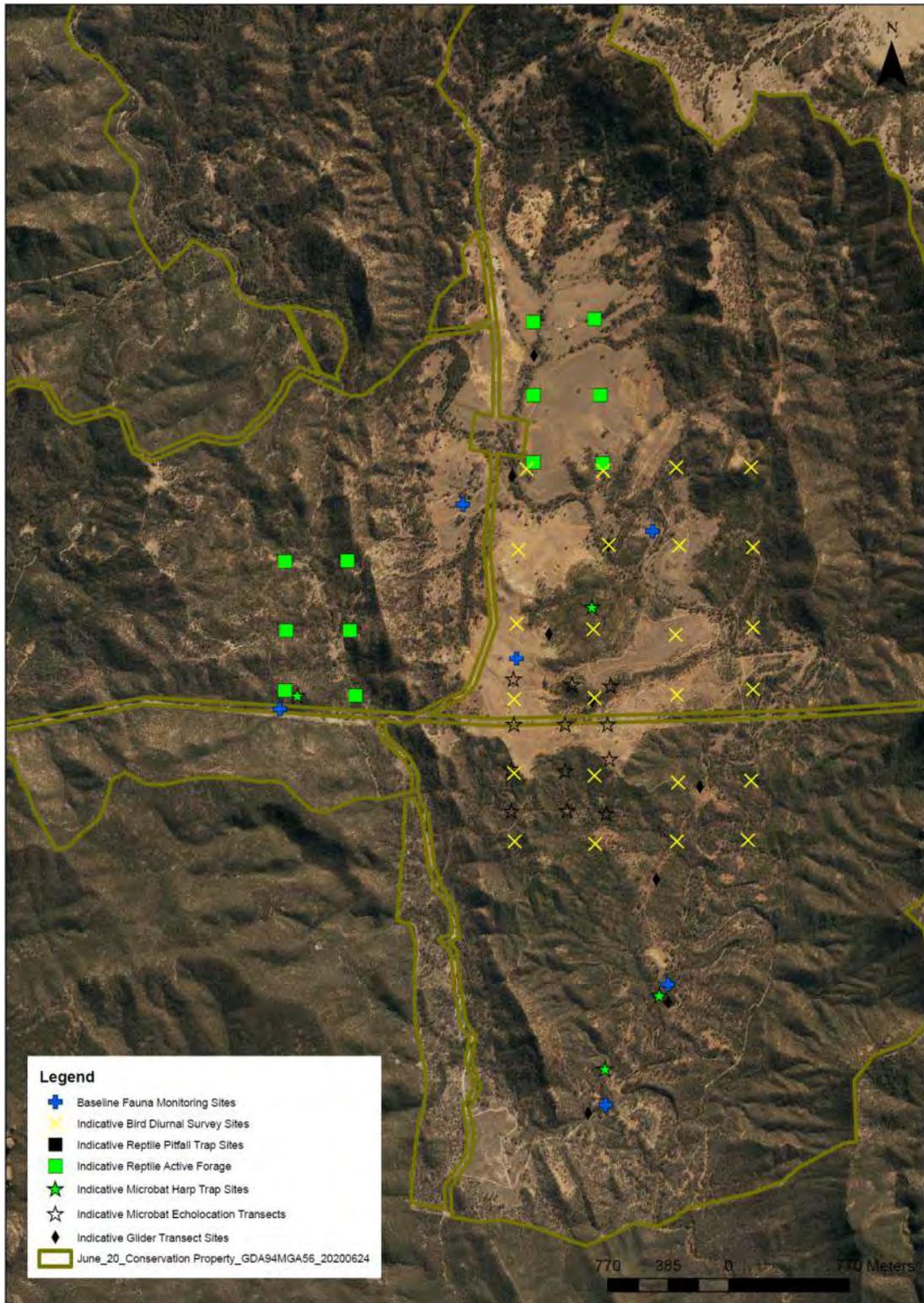


Figure 19: Willeroi Offset Revised Fauna Monitoring Locations and Baseline Fauna Monitoring Locations

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Data Analysis and Storage

All fauna data will be entered in a database and stored for later use and analysis. Data will be added to as recorded so that it will form a data matrix that is amenable to analysis using classification and ordination techniques, and parametric statistics.

6.13.3 Weed Monitoring

Purpose

Monitoring will be undertaken to document the change in the type, extent and density of major environmental (e.g. WONS) and priority weed occurrences in the offset area over time. Regular inspections will also facilitate detection of new infestations of weeds and enable assessment of the effectiveness of the weed management measures as outlined in **Section 6.7**. EPBC Act Approval Condition 13 (e iv) requires monitoring to measure if management excludes weeds from the Willeroi offset area for the period covered by this approval.

Methodology

As described in **Section 6.13.1**, the vegetation and habitat monitoring methodology will include documentation of native and introduced (including priority weeds) flora species. However, additional methodology to specifically inspect weeds is outlined below.

Environmental (e.g. WONS) and priority weeds will be monitored via inspections of the offset area by a suitably qualified person(s) with experience in identification of weeds. If major weed infestations are discovered in the offset area, the coordinates will be recorded, including the boundaries of large infestations and details recorded regarding the estimated density of the infestation and the number of plants consistent with RBS-2 Table 2.2 Point 3.2 (Umwelt, 2017). Mapping will be prepared showing the extent of weeds requiring control.

The weeds will be controlled as outlined in **Section 6.7**. Follow-up inspections will be undertaken to assess the effectiveness of the weed management measures implemented and the requirement for any additional management measures.

Frequency

Environmental (e.g. WONS) and priority weeds will be monitored seasonally consistent with RBS-2 Table 2.3 Point 3.2. Each monitoring event will inspect the effectiveness of weed control. Review of the weed management measures will be completed based on the results of the weed inspections and developed in accordance with a regulator-approved revised plan.

Data Analysis and Storage

All weed monitoring data will be entered in a database and stored for later use and analysis. Data should include control measures (e.g. date, activity, location). New species detected during surveys will be added to the database and reported on within the BMP Annual Report (**Section 8.2.2**). As noted above in **Section 6.7**, Whitehaven is undertaking a review of weed management in 2020 to standardise practices across all Whitehaven managed Biodiversity Offsets; with this Section to be updated in future revisions of the BMP.

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6.13.4 Pest Animal Monitoring

Purpose

The abundance and distribution of pest animals within the offset area will be monitored to:

- provide the necessary information to trigger management actions; and
- determine the efficacy of control measures aimed at reducing pest animal abundance.

Methodology

As described in **Section 6.13.2**, the fauna monitoring methodology will include documentation of native and introduced (including formally feral but the term pest now adopted aligned with NSW and Commonwealth guidelines) animal species. A review of the previous feral animal monitoring program was undertaken in 2020 and the scope incorporated all WHC biodiversity offset properties, including Willeroi (AMBS 2020). It identified that the diurnal transect method being utilised was generating a data set that was not fulfilling the purpose for the feral animal monitoring program and that the survey effort required to improve the data from diurnal transects was prohibitive; therefore the previous feral animal monitoring methodologies adopted in accordance with the NSW DPI *Monitoring Techniques for Vertebrate Pests* (Mitchell and Balogh, 2007a to e) and consistent with RBS-2 Table 2.2 Point 3.3 (Umwelt, 2017) were outdated and needed to be contemporised.

The review also identified that the motion detection camera program was delivering more informative results on most target pest animal species, though the ability to assess the efficacy of control was constrained by some aspects of the monitoring survey design and sampling effort.

Building upon published peer reviewed literature such as the NSW DPI *An Introduction to Camera Trapping for Wildlife Surveys in Australia* (Meek *et al.* 2012) and "Guide for camera trapping wild dogs, foxes and feral cats" (DPI, 2018); as well as conducting a statistical power analysis on motion detection camera data from the Annual Fauna Monitoring program for the Maules Creek and Tarrawonga Biodiversity Offsets, the review recommended:

1. Increasing the number of cameras deployed across biodiversity offset properties from the current 1 camera per 650 hectares to 1 camera per 150-200 hectares;
2. Eliminating diurnal transects from the pest animal monitoring method;
3. Standardising the motion detection camera sample effort across all offset properties;
4. Undertaking motion detection camera survey effort in discreet 28 day periods before control actions are initiated and 28 days after control actions are finished; and
5. Evaluating the results using occupancy related statistical frameworks.

Frequency

In order to monitor population changes over time and determine the efficacy of control measures, pest animals will continue to be monitored quarterly in accordance with AMBS (2020).

Data Analysis and Storage

After each quarterly pest animal monitoring, the camera photos will be analysed and the data generated will be used in an occupancy model for the targeted pest animal species. Unless animals are distinctively

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marked, the ability of motion detecting cameras to estimate a distinct animal population (or abundance) is constrained (Carter *et al.* 2019). However, abundance can be inferred by rates of detection. Occupancy models have become a regularly used statistical method to investigate presence/absence data derived from motion detection cameras (Stobo-Wilson *et al.*, 2020, Einoder *et al.* 2018, Gormley *et al.* 2011). Occupancy calculations are expressed as the probability of a target species being detected per sample unit (i.e. night). Thus, an occupancy of 0.8 means that the model predicts a target species will be detected on 80% of the nights that the motion detection camera is deployed. For the purposes of investigating the impact of the targeted pest species control, it assumes that rates of occupancy will decrease significantly if pest animal control is influencing the size of the target animal population.

Changes in quarterly occupancy will inform future levels and the focus of control activities. It is anticipated that an effective control program will result in steady long-term declines in occupancy of targeted pest animal species on Willeroi.

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7 POTENTIAL RISKS AND CONTINGENCY MEASURES

Section 6.13.1 describes the flora monitoring program that allows for adaptive management of monitoring White Box—Yellow Box—Blakely's Red Gum Grassy Woodland and Derived Native Grassland ecological community and other vegetation communities including the production of an annual report that will compare the data to the Performance and Completion Criteria in **Section 6.12** and outline the annual status against the TARPs/Contingency Actions specified in the following section including description of how the relevant “Action/Response” items will be implemented if the flora monitoring program identifies below trigger or trajectory performance or progress in each year.

Contingency Measures

The following Biodiversity Trigger, Action and Response Plan has been updated to be consistent with RBS-2 Table 2.4 (Umwelt, 2017) and aligned to the performance and completion criteria in **Section 6.12**. **Table 7-1** provides trigger points for contingency measures (corrective actions) to be implemented if the monitoring programs (described in **Section 6.13**) identify that the performance criteria (**Table 6-8** and **Table 6-9**) are not being met. Contingency measures may not be limited to those listed in **Table 7-1**.

Table 7-1: Contingency Measures

Aspect	Trigger	Action/ Response
Strategic Focus Area 1 – Enhance the quality of habitats and landscapes at the offset sites for White Box – Yellow Box – Blakely's Red Gum Woodland EEC and CEEC		
1.1 Natural regeneration (in semi-cleared and remnant native woodland vegetation in good condition)	<ul style="list-style-type: none"> Canopy species are not recruiting across 100% of the relevant vegetation zones in the offset sites after 5 years following offset establishment. Naturally regenerated areas do not conform to the definition of the community in the EPBC Policy Statement 3.5 White Box – Yellow Box – Blakely's Red Gum Grassy Woodlands and Derived Native Grasslands after 10 years following offset establishment. 	<ul style="list-style-type: none"> Review the likely reasons for success in other naturally regenerating areas within the offset sites and the potential cause of plant species failure. Targeted removal of non-characteristic species and weeds, following supplementary planting with tubestock and seed, if deemed required. Consider additional monitoring to examine the establishment of tubestock and seed.
	<ul style="list-style-type: none"> Naturally regenerated grassland areas are regenerating into vegetation community types other than White Box – Yellow Box – Blakely's Red Gum Woodland EEC and CEEC (such as grey box (<i>Eucalyptus microcarpa</i>) or poplar box (<i>Eucalyptus populnea</i>) dominated vegetation). 	<ul style="list-style-type: none"> Undertake consultation with DPIE on whether actions are required. Targeted removal of non-characteristic species, following supplementary planting with tubestock and seed, if deemed required.
	<ul style="list-style-type: none"> White Box – Yellow Box – Blakely's Red Gum Woodland EEC and CEEC across 100% of the relevant vegetation zones in each offset site do not show evidence of occupation or presence of at least 80% of the native fauna species comparative to approved benchmark or monitoring reference sites after 10 years following offset establishment. 	<ul style="list-style-type: none"> Investigate and prioritise augmentation of habitat resources for the targeted threatened species.

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**Table 7-1 (Continued)
Contingency Measures**

Aspect	Trigger	Action/ Response
	<ul style="list-style-type: none"> White Box – Yellow Box – Blakely’s Red Gum Woodland EEC and CEEC across the relevant vegetation zones in each offset site is not within the benchmark ranges for the cover scores (i.e. overstorey, midstorey and groundcover) and at 80% or above for species richness benchmarks; OR the benchmark ranges for the cover scores and 80% or more of the species richness benchmarks are met but not across 100% of the offset sites after 10 years following offset establishment. 	<ul style="list-style-type: none"> Review the likely reasons for success in other naturally regenerating areas within the offset sites and the potential cause of below benchmark performance. Undertake consultation with DPIE on whether actions are required. Evaluate whether supplementary planting with appropriate tubestock and seed is required.
1.2 Collect and propagate seed	<ul style="list-style-type: none"> Seed collection records are not reported on in the Annual Review 	<ul style="list-style-type: none"> Make appropriate notations in the Annual Summary Report on environmental documentation performance
	<ul style="list-style-type: none"> Seed is not collected over a range of sites across the locality and local variations in species mixes are not captured. 	<ul style="list-style-type: none"> Review seed inventory and propagated plants and investigate the need to collect seed in other areas. Review the success or otherwise of rehabilitation/revegetation that has used seed and tubestock and determine if more diversity is required.
1.3 Active revegetation (in semi-cleared woodland, derived native grasslands and cleared land)	<ul style="list-style-type: none"> Canopy species are not recruiting across 100% of the relevant vegetation zones in each offset site after 15 years following offset establishment. Actively revegetated areas do not conform to the definition of the community in the EPBC Policy Statement 3.5 White Box – Yellow Box– Blakely’s Red Gum Grassy Woodlands and Derived Native Grasslands broadly across the offset sites after 15 years following offset establishment. 	<ul style="list-style-type: none"> Review the likely reasons for success in other actively revegetated areas within the offset sites and the potential cause of plant species failure. Targeted removal of non-characteristic species and weeds following further supplementary planting with tubestock and seed, if deemed required. Consider additional monitoring to examine the success or otherwise of management measures.
	<ul style="list-style-type: none"> White Box – Yellow Box – Blakely’s Red Gum Woodland EEC and CEEC across 100% of the relevant vegetation zones in each offset site do not show evidence of occupation or presence of at least 80% of the native fauna species comparative to approved benchmark or monitoring reference sites after 15 years following offset establishment. 	<ul style="list-style-type: none"> Investigate and prioritise augmentation of habitat resources for locally-occurring fauna species.
	<ul style="list-style-type: none"> White Box – Yellow Box – Blakely’s Red Gum Woodland EEC and CEEC across the relevant vegetation zones in each offset site is not within the benchmark ranges for the cover scores (i.e. overstorey, midstorey and groundcover) and at 80% or above for species richness benchmarks; OR the benchmark ranges for the cover scores and 80% or more of the species richness benchmarks are met but not across 100% of the offset sites after 15 years following offset establishment. 	<ul style="list-style-type: none"> Review the likely reasons for success in other naturally regenerating areas within the offset sites and the potential cause of below benchmark performance. Undertake consultation with DPIE on whether actions are required. Evaluate whether supplementary planting with appropriate tubestock and seed is required.

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**Table 7-1 (Continued)
Contingency Measures**

Aspect	Trigger	Action/ Response
Strategic Focus Area 2 – Provide ongoing management and enhancement of existing habitats at the offset sites for threatened species and communities		
2.1 Salvage of habitat resources	<ul style="list-style-type: none"> Salvaged resources are damaged, have deteriorated or are no longer present. 	<ul style="list-style-type: none"> Re-establish salvaged resources, if appropriate. Review and identify the need to replace hollow loss with nest boxes. Review and identify appropriate measures to reduce loss, damage or deterioration of salvaged resources in the future.
2.2 Habitat augmentation and nest box installation	<ul style="list-style-type: none"> Loss or damage of nest boxes or evidence of deterioration of nest box condition. 	<ul style="list-style-type: none"> Identify and replace all lost and damaged nest boxes. Review and identify appropriate measures to reduce loss, damage or deterioration nest boxes in the future.
	<ul style="list-style-type: none"> Monitoring shows less than 80% sign of use of nest boxes across the offset sites after 5 years following installation. 	<ul style="list-style-type: none"> Review the performance of nest boxes and naturally occurring hollows at reference sites to investigate the need for new nest box designs, replacements, or change in location of nest boxes.
	<ul style="list-style-type: none"> Nest boxes are not in good structural condition or found to be utilised by pest species such as European honey bee (<i>Apis mellifera</i>), common myna (<i>Acridotheres tristis</i>), common starling (<i>Sturnus vulgaris</i>) and feral rodent species (<i>Rattus</i> and <i>Mus</i> spp.). 	<ul style="list-style-type: none"> Remove pest animals. Consider the need for nest box replacement or repair.
2.3 Access control	<ul style="list-style-type: none"> Livestock are accessing and causing damage in areas where they should be excluded. 	<ul style="list-style-type: none"> Identify location of entry and repair fencing as required. Specifically monitor livestock occupancy in conservation areas.
	<ul style="list-style-type: none"> Reports of fauna being injured or killed as a result of barbed wire fencing within the offset sites. 	<ul style="list-style-type: none"> Review the incident/s and advise on whether alternative fencing materials are required or should be investigated.
Strategic Focus Area 3 - Promote a consistent and coordinated approach to weed management and pest animal control		
3.1 Weed and pest prevention and communication	<ul style="list-style-type: none"> Weed trends and control schedules are not communicated across the Leard Forest Mining Precinct or with relevant local land holders, managers and stakeholders. 	<ul style="list-style-type: none"> Mine Site Environmental Representative to be responsible for making information available for meetings and forums as appropriate.
3.2 Weed control	<ul style="list-style-type: none"> Offset site flora monitoring show an increased level of exotic plant cover following control measures implemented across the offset sites. Weed species collectively comprise more than 20% of any strata in the native vegetation communities within the offset sites during any year following offset establishment. 	<ul style="list-style-type: none"> Identify location of weed issues and review the need for further control measures such as physical removal, herbicides, strategic grazing and control burns.* Consider additional monitoring to examine the success or otherwise of additional control measures.

* WHC will implement additional control measures to prevent seed set and dispersal/further infestation.

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**Table 7-1 (Continued)
Contingency Measures**

Aspect	Trigger	Action/ Response
	<ul style="list-style-type: none"> Weed control is not undertaken across the offset sites using methods outlined in the NSW Weeds Control Handbook (8th Edition) (DPI 2018), Narrabri Shire Council Weed Management Plans, and/or the NSW WeedWise website. 	<ul style="list-style-type: none"> Review the methods being used and consult with agencies on the other suitable methods of weed control. Discuss alternative control methods with contractors hired to undertake weed control.
	<ul style="list-style-type: none"> Significant weed invasions or newly identified weeds species within the offset sites are identified through site inspections and monitoring. 	<ul style="list-style-type: none"> Review the issues and facilitate additional control measures within 1 year of identification of the issue.*
3.3 Pest animal control	<ul style="list-style-type: none"> Offset site fauna monitoring shows show an increase of pest animal species following control measures implemented across the offset sites. 	<ul style="list-style-type: none"> Identify location of pest animal issues and review the need for further control measures in accordance with NSW Codes of Practices (COPs) and Standard Operating Procedures (SOPs). Consider additional monitoring to examine the success or otherwise of additional control measures. Consider the potential impact of drought conditions and seasonal trends.
	<ul style="list-style-type: none"> Pest animal control is not being undertaken using methods approved under the NSW Codes of Practices (COPs) and Standard Operating Procedures (SOPs). 	<ul style="list-style-type: none"> Review the methods being used and consult with DPI on the other suitable methods of pest animal control. Discuss alternative control methods with contractors hired to undertake pest animal control.
	<ul style="list-style-type: none"> Significant pest animal occurrences or newly identified pest species within the offset sites are identified through site inspections and monitoring. 	<ul style="list-style-type: none"> Review the issues and facilitate additional control measures as required within 1 year of identification of the issue.
	<p>Strategic Focus Area 4 - Promote a consistent and coordinated approach to fire management for biodiversity</p>	
4.1 Managing fuel loads	<ul style="list-style-type: none"> Fuel loads are assessed as being moderate or high risk for intense and damaging bushfires. 	<ul style="list-style-type: none"> Undertake controlled burning as required but in consideration of the recommendations in Rawlings <i>et al.</i> (2010) and in consultation with the RFS. Consider the implementation of strategic grazing in appropriate management zones where control burning is not considered suitable.¹
4.2 Ecological control burns	<ul style="list-style-type: none"> The impacts of control and mosaic burning on weed species and native species diversity is found to be detrimental to the Strategic Focus Areas of biodiversity conservation.² 	<ul style="list-style-type: none"> Investigate suitable actions and reinstate restoration activities. Review the most up to date advice and information on control burning in relation to the restoration of Box-Gum Woodland and fauna habitats.

* WHC will implement additional control measures to prevent seed set and dispersal/further infestation.

¹ WHC will not implement strategic grazing where control burning is not considered suitable.

²As determined by post control-burning and mosaic-burn monitoring.

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**Table 7-1 (Continued)
Contingency Measures**

Aspect	Trigger	Action/ Response
	<ul style="list-style-type: none"> Fuel reduction in the form of controlled burning is not undertaken as recommended in Rawlings <i>et al.</i> (2010). 	<ul style="list-style-type: none"> Review monitoring reports and inspection reports to determine the level of fuel loads in the offset sites and discuss the appropriateness of control burning with the local Rural Fire Services and adjacent land managers. Review the most up to date authoritative advice and information on the frequency of control burning in relation to the restoration of Box-Gum Woodland and fauna habitats. Consider the implementation of strategic grazing in appropriate management zones where control burning is not considered suitable.¹
Strategic Focus Area 5 – Enhance the connectivity of habitats through corridor and buffer area establishment and management		
5.1 Connected landscapes and broader regional corridors	<ul style="list-style-type: none"> Corridors within the offset sites are not in accordance with the TARPs outlined in Strategic Focus Area 3 in relation to weeds and pests. 	<ul style="list-style-type: none"> As per Strategic Focus Area 3.
	<ul style="list-style-type: none"> Targeted fauna monitoring does not indicate that the offset site corridors provide habitat for native fauna species in the locality 10 years following offset establishment. 	<ul style="list-style-type: none"> Investigate the need for further habitat augmentation (such as nest boxes, fallen timber) to provide suitable 'stepping stone' habitat across the offset sites. Investigate the need for and implement additional or different monitoring methods to monitor fauna movement.
5.2 Mine rehabilitation and the vegetated buffer corridor for habitat connectivity	<ul style="list-style-type: none"> Rehabilitation and the vegetated buffer corridor does not provide linking habitats from conservation areas in the east, linking Leard State Forest and west towards the Namoi River 30 years following the approval of the Strategy.* 	<ul style="list-style-type: none"> Investigate the need for further habitat augmentation (such as nest boxes, fallen timber) to provide suitable 'stepping stone' habitat across the offset sites. Review the mine rehabilitation status and confirm whether further targeted canopy tree planting is required. Investigate the opportunity to secure other land holdings that would, with appropriate management, increase the habitat connectivity of the mine rehabilitation.

¹ WHC will not implement strategic grazing where control burning is not considered suitable.

* Point 5.2 is aligned to the RBS-2 but the Leard State Forest to Namoi River corridor is relevant to Maules Creek Coal Mine rather than Tarrawonga Coal Mine; however monitoring of the Rehabilitation at Tarrawonga Mine is undertaken annually in accordance with Section 4.11

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**Table 7-1 (Continued)
Contingency Measures**

Aspect	Trigger	Action/ Response
Strategic Focus Area 6 – Consult and workshop biodiversity issues with local stakeholders and land managers		
6.1 Biodiversity management consultation	<ul style="list-style-type: none"> Targeted consultation with key stakeholders, land managers is not undertaken through the development of resources and workshops involving stakeholders. Meetings have not included relevant authorities and agencies (DPIE, LLS, NPWS) and the CCC. 	<ul style="list-style-type: none"> Mine Site Environmental Representative to be responsible for invitations sent out with an appropriate lead time to allow for key stakeholders, land managers, relevant authorities and agencies are given the opportunity to engage in the biodiversity management issues.

Threatened Species and Box-Gum Woodland Implementation Plans

As described in **Section 2.3**, the *TCM Threatened Fauna Implementation Plan* (Whitehaven, 2015a) and *TCM Box-Gum Woodland Endangered Ecological Community Implementation Plan* (Whitehaven, 2015b) were prepared by Whitehaven in accordance with Conditions 48 and 50 of Schedule 3 to PA 11_0047. These implementation plans were approved by DPIE on the 14 January 2015.

The *TCM Threatened Fauna Implementation Plan* (Whitehaven, 2015a) was developed to maximise the provision of suitable habitats for threatened fauna on the offset area and on the post mining landform. This investigation involved identifying all factors likely to enhance or impede the long term provision of suitable habitat(s) for threatened species. The investigation resulted in the identification of 15 individual actions relating to the Biodiversity Offset Strategy.

The *TCM Box-Gum Woodland Endangered Ecological Community Implementation Plan* (Whitehaven, 2015b) was developed to maximise rehabilitation and regeneration of the Box-Gum Woodland CEEC on the offset area and the mine site. This investigation involved identifying factors likely to enhance or impede the effective long term restoration of degraded remnants of Box-Gum Woodland in offset area or regeneration of Box-Gum Woodland on disturbed areas. The investigation resulted in the identification of 39 individual actions relating to the Biodiversity Offset Strategy.

The approved implementation plans are incorporated into this BMP. **Appendix B** provides the individual actions of the implementation plans together with a reference to where the individual actions are addressed in this BMP.

Risk Assessment

Following preparation of the *TCM Threatened Fauna Implementation Plan* (Whitehaven, 2015a) and *TCM Box-Gum Woodland Endangered Ecological Community Implementation Plan* (Whitehaven, 2015b), a risk assessment was undertaken to confirm that appropriate measures are included in the BMP to manage risks (impediments) to achieving the objectives of the offset area. The risk assessment is provided in **Appendix D**.

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8 REPORTING AND REVIEW

This BMP will be effective as the Willeroi Offset Management Plan (EPBC Approval 2011/5923 Condition 13e) for the period of effect of EPBC Act approval. The BMP may be revised from time to time in accordance with that approval.

8.1 DOCUMENTATION

8.1.1 Recording Survey Data and Other Information

A summary of documentation requirements is provided in **Table 8-1**.

Table 8-1: Documentation

Aspect	Section	Recording Requirements	Frequency/Timing
Mine Site			
Marking Limits of Clearing	Section 4.5	Documented in LDP form and signed off.	Following vegetation clearing.
Pre-clearance Flora and Fauna Surveys	Section 4.5	Documented in LDP form and signed off.	Following vegetation clearing
Maximising Salvage of Habitat Resources	Section 4.3	Documented in LDP form and signed off.	Following vegetation clearing
Seed Collection	Section 4.4	To be documented as part of the MOP.	Ongoing
Control of Weeds	Section 4.7	This will include documentation of locations and dates subject to weeding, weeding techniques used, target species controlled, new species identified (if any) and chemicals used. Where necessary, management actions will be summarised on maps of the relevant management areas.	Ongoing
Control of Feral Animals	Section 4.7	This will include documentation of the techniques used for each feral species, the quantity of bait material purchased and locations deployed, the areas subject to control, estimates of the numbers of animals culled, new species identified (if any) and any other chemicals used. Where necessary, management actions will be summarised on maps of the relevant management areas.	Ongoing
Monitoring Program	Section 4.11	Methods and results.	After monitoring events
Offset Area			
Seed Collection and Propagation	Section 6.4	Record all seed collected, species, quantities, dates and locations as per the seed collection protocols.	Ongoing
Revegetation	Section 6.5	Results of site planning, site preparation, species and quantities planted/seeded, location of revegetation, dates of revegetation, and maintenance undertaken.	Ongoing
Management of Cultural Heritage	Section 6.6	Any known or potential heritage finds are to be recorded, placed on the heritage database and added to the GIS mapping file.	Ongoing

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**Table 7-1 (Continued)
Documentation**

Aspect	Section	Recording Requirements	Frequency/Timing
Control of Weeds	Section 6.7	Record information on areas worked, timing of works, techniques used, any issues encountered, recommendations and the control program for the subsequent year. Every second reporting year, a map of weed extents and densities is to be included in the records.	Ongoing
Control of Feral Animals	Section 6.8	Report documenting timing of works, techniques used, data on kills or bait update, any issues encountered, maps and data on the areas of impact and population estimates per species, recommendations and the control program for the subsequent year/s. Records to include monitoring results and population size estimates compared to previous years of monitoring to identify any trends in vertebrate pest control performance.	Ongoing
Control of Erosion	Section 6.9	Remediation techniques, dates and locations.	Ongoing – following remediation
Control of Access	Section 6.10	Inspect and record fencing and gates.	Annually
Bushfire Management	Section 6.11	Inspect and record access tracks.	Annually
Monitoring Program	Section 6.13	Monitoring results.	Following monitoring

8.1.2 Reporting Survey Data

In accordance with Condition 30 of the EPBC Approval 2011/5923, survey data will be recorded so as to conform to data standards notified from time to time by DAWE. When requested by the DAWE, TCPL will provide all species and ecological survey data and related survey information from ecological surveys undertaken for the relevant Matters of National Environmental Significance. This survey data will be provided within 30 business days of request, or in a timeframe agreed to in writing by DAWE.

In accordance with Condition 37 of the EPBC Approval 2011/5923, TCPL will maintain accurate records substantiating all activities and outcomes associated with or relevant to EPBC Approval 2011/5923, including measures taken to implement BMP, and make them available upon request to the DAWE.

8.2 REPORTING REQUIREMENTS

The following reporting and auditing protocols will take place to assess the quality and compliance of the management of the offset area.

8.2.1 TCM Annual Review

An Annual Review will be submitted in March, or an agreed alternate time, each year under Condition 4, Schedule 5 of PA 11_0047, which outlines the environmental performance of the TCM over the previous calendar year.

TCPL will liaise with Forestry Corporation of NSW on feral animal and weed control efforts and population observations in Leard State Forest to assist Forestry Corporation of NSW in scheduling feral animal control in the adjacent forest.

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8.2.2 Commonwealth Approval Reporting

A report pertaining to the annual compliance with EPBC Approval 2011/5923 will be published on the TCPL website by 12 June each year after the commencement of the TCM in accordance with Condition 32 of the Approval Decision EPBC 2011/5923. Non-compliance with any of the conditions will be reported to DAWE at the same time as the compliance report is published.

The TCM Annual Review (**Section 8.2.1**) will be the process by which to report to DAWE the progress of management activities undertaken in the offset areas and the outcome of those activities, including identifying any need for improved management and activities to undertake such improvement in accordance with Condition 13 e vi of the Approval Decision EPBC 2011/5923.

8.2.3 BTM Complex Joint Annual Biodiversity Summary Report

The RBS was prepared to provide a strategic framework for the management and implementation of the BTM Complex biodiversity offset programs and to provide guidance for co-ordinated management with other land managers within the region (Umwelt, 2017). To achieve coordinated and successful biodiversity management within the region, the RBS specifies that the BTM Complex must prepare an 'Annual Summary Report' detailing the overall biodiversity performance and outcomes of biodiversity offsets (Table 2.2 Point 6.1 of the RBS). The purpose of Joint Annual Biodiversity Summary Report is to detail the performance and outcomes of the BTM Complex biodiversity offsets as stipulated in the RBS. Specifically, this report aims to address all requirements relating to the preparation of the 'Annual Summary Report' as per the RBS summarised in **Table 8-2**.

Table 8-2: Reporting Requirements for the Joint Annual Biodiversity Summary Report

RBS Reference	Monitoring Component	RBS Annual Summary Report Requirement
Point 6.1	Biodiversity management consultation	This communication (across the BTM Complex, for example) should facilitate the preparation of an Annual Summary Report detailing the overall biodiversity performance and outcomes of the offset sites using the information provided from annual biodiversity monitoring reports.
Point 1.1	Natural regeneration (undertaken in semi-cleared and remnant native woodland vegetation in good condition)	For the BTM Complex, monitoring results should be outlined in a consistent summary report template to allow for the comparison of results and a consistent understanding of the condition of naturally regenerating White Box – Yellow Box – Blakely's Red Gum Woodland EEC and CEEC broadly across the offset sites.
Point 1.2	Collect and propagate seed	The completion of an Annual Summary Report should be undertaken following each collection event. This should include records of species, qualities, dates and locations as per the Florabank Guideline 4 (www.florabank.org.au/).
Point 1.3	Active revegetation (undertaken in semi-cleared woodland, derived native grasslands and cleared land)	For the BTM Complex, monitoring results should be outlined in a consistent summary report template to allow for the comparison of results and a consistent understanding of the condition of actively revegetated White Box – Yellow Box – Blakely's Red Gum Woodland EEC and CEEC broadly across the offset sites.
Point 2.2	Habitat augmentation and nest box installation	Monitoring results of nest box usage should be reported in the relevant Annual Summary Report.

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Table 7-2 (Continued)
Reporting Requirements for the Joint Annual Biodiversity Summary Report

RBS Reference	Monitoring Component	RBS Annual Summary Report Requirement
Point 3.2	Weed control	For the BTM Complex, monitoring results should be outlined in a consistent summary report template to allow for the comparison of results and consistent understanding of the key weeds issues in a broad regional context.
Point 3.3	Pest animal control	For the BTM Complex, monitoring results should be outlined in a consistent summary report template to allow for the comparison of results and a consistent understanding of the key pest animal issues in a broad regional context.
Point 5.2	Mine rehabilitation	For the BTM Complex, monitoring results should be outlined in a consistent summary report template to allow for the comparison of results and an understanding of the overall success of mine rehabilitation in the area.
Point 6.1	Biodiversity management consultation	Any research or monitoring data in relation to biodiversity should be made available across the BTM Complex to facilitate the sharing of knowledge for the broader conservation of offset sites. This may include reports, guidelines, and/or expert input into management of cypress pine regrowth, species translocation success, pest animal and weed outcomes and controls and techniques. The Annual Summary Report will detail the overall biodiversity performance and outcomes of the offset sites using the information provided from the monitoring reports.
Point 1.2	Collect and propagate	Seed collection records, including location of plantings and success rates (where available), are reported on in the Annual Summary Report.
Point 3.1	Weed and pest prevention and communication	The most recent offset monitoring summary reports containing information on weed and pest records, trends and issues are provided across the BTM Complex and reported upon in the Annual Summary Report.
Point 6.1	Biodiversity management consultation	An Annual Summary Report is to be prepared detailing the overall biodiversity performance and outcomes of the offset sites across the region.

8.2.4 BMP Publishing

The approved BMP will be published on the TCPL website. Any revisions to this BMP will be published on the TCPL website within one month of being approved.

8.3 REVIEW AND REVISION OF THE BIODIVERSITY MANAGEMENT PLAN

This BMP will be effective as the Willeroi Offset Management Plan (EPBC Approval 2011/5923 Condition 13e) for the period of effect of approval and will be reviewed and revised from time to time in accordance with that approval. An overview of the Commonwealth and NSW triggers are provided below.

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Commonwealth Requirements

In accordance with Condition 34 of the EPBC Approval 2011/5923, if TCPL wishes to carry out any activity otherwise than in accordance with this BMP (as it pertains to EPBC Approval 2011/5923), TCPL will submit a revised BMP to DAWE for the Minister's written approval. The varied activity shall not commence until the Minister has approved the revised plan in writing. The Minister will not approve a revised plan unless the revised plan would result in an equivalent or improved environmental outcome, therefore, should TCPL submit a revised BMP for EPBC Act approval TCPL will specify in its submission to the Commonwealth how the revised approved BMP meets this requirement

NSW Requirements

In accordance with Condition 5 of Schedule 5 to PA 11_0047, the BMP will be reviewed, and revised if necessary to the satisfaction of the NSW Secretary of DPIE, within three months of:

- the submission of an annual review (**Section 8.2.1**);
- the submission of an incident report (Condition 8 of Schedule 5 to PA 11_0047);
- the submission of an audit report (**Section 8.4.2**); or
- any modification to the conditions of the consent (unless the conditions require otherwise).

Further, under Condition 4 in Schedule 2 to PA 11_0047, TCPL must comply with reasonable requirements of the Secretary of DPIE in respect of DPIE's assessment of this BMP or the implementation of actions or measures under this BMP, including any reasonable request to amend this BMP.

Under Condition 19 in Schedule 2 to PA 11_0047, TCPL may progressively submit a BMP with the approval of the Secretary of DPIE.

In accordance with Condition 48 of Schedule 3 to PA 11_0047, the BMP will be reviewed, and revised if necessary to the satisfaction of the NSW Secretary of DPIE, within six months of the completion of Stage 2 of the Leard Forest Mining Precinct Regional Biodiversity Management Strategy.

8.4 BIODIVERSITY AUDIT

8.4.1 Commonwealth Audit

In accordance with Condition 33 of the EPBC Approval 2011/5923, upon the direction of the Commonwealth Minister, TCPL will ensure that an independent audit of compliance with the conditions of approval is conducted and a report submitted to the Commonwealth Minister. The independent auditor will be approved by the Commonwealth Minister prior to the commencement of the audit. Audit criteria will be agreed to by the Commonwealth Minister and the audit report will address the criteria to the satisfaction of the Commonwealth Minister.

8.4.2 NSW Audits

Independent Environmental Audit

In accordance with Condition 10 of Schedule 5 to PA 11_0047, an independent audit will be undertaken every 3 years, unless the Secretary directs otherwise. This Environmental Audit will be conducted by a suitably qualified, experienced and independent team of experts whose appointment was endorsed by

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the NSW Secretary of DPIE. The Independent Environmental Audit will assess the environmental performance of the TCM and the TCM's compliance to the conditions of PA 11_0047.

Biodiversity Audit

In accordance with Condition 50 of Schedule 3 to PA 11_0047, every three years TCM will commission suitably qualified, experienced and independent person/s, whose appointment was approved by the NSW Secretary of DPIE, to undertake an audit of the revegetation of the rehabilitation area, management and restoration within the Biodiversity Offset Strategy areas.

8.5 INCIDENT REPORTING

Incident reporting will be undertaken in accordance with Schedule Condition 8 of PA11_0047.

8.6 COMPLAINT RECEIPT AND RESPONSE PROCEDURE

Whilst all endeavours will be made by TCPL to avoid adverse noise impacts on local landowners / residents, it is acknowledged that from time to time such impacts may occur. In order to ensure an appropriate and consistent level of reporting, response and follow-up to any complaints is adopted by TCPL, the following complaints management protocol will be followed:

- A publicly advertised telephone complaints line will be in place to receive complaints during operating hours and record complaints at other times.
- Each complaint received will be recorded on a Complaints Register, which will include the following details:
 - The date and time of complaint.
 - Any personal details the complainant wishes to provide or if no such details are provided a note to that effect.
 - The nature of the incident that led to the complaint.
 - The action taken by TCPL in relation to the complaint, including any follow-up contact with the complainant.
 - If no action was taken by TCPL, the reason why no action was taken.
- The Environmental Officer will be responsible for ensuring that an initial response is provided within 24 hours of receipt of a complaint (except in the event of complaints recorded when the mine is not operational).
- Data from the site weather station and the real time noise monitoring unit will be obtained for the time applicable to the complaint for use in determination of cause and identification of future remedial actions.
- Additional measures will be undertaken as required to address the complaint. This may include visiting the complainant, or inviting the complainant to the mine site.
- Once the identified measures are undertaken, the Environmental Officer will sign off on the relevant complaint within the Complaints Register.
- If necessary, follow-up monitoring will take place to confirm the source of the complaint is adequately mitigated.

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- A copy of the Complaints Register will be kept by TCPL and made available to the CCC and the complainant (on request). A summary of complaints received every 12 months will be included in the Annual Review.

Based on the nature of individual complaints, specific contingency measures may be implemented to the (reasonable) satisfaction of the complainant. The Environmental Officer retains responsibility for ensuring that complaints received are properly recorded and addressed appropriately.

8.7 RESPONSE TO NON-COMPLIANCES

Compliance with all approvals, plans and procedures is the responsibility of all personnel and contractors employed on, or in association with, the mine and is achieved through promotion of project ownership under the direction of the General Manager – Open Cut Operations and Environmental Officer.

Any non-compliance of conditions of NSW PA 11_0047 is reported in the TCM Annual Review which is submitted to the Secretary. This information is also made publicly available on the Whitehaven website.

Additionally, an independent audit is undertaken a minimum of once every three years and the report submitted to the Secretary, and any other relevant authorities, and made available to the public on the Whitehaven website.

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LAND DISTURBANCE PROTOCOL



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WHC_PRO_TCM_LAND DISTURBANCE PROTOCOL

TARRAWONGA COAL MINE

LAND DISTURBANCE PROTOCOL FORM

LDP Number: (Env. Department only)	
--	--

FOR COMPLETION & STAGED SIGN-OFF PRIOR TO UNDERTAKING ANY DISTURBANCE, THEN FINAL SIGNOFF AT COMPLETION OF WORKS

Note: The below form is to be completed by the Environmental Department or contractor and signed by the TCM Environmental Officer and Site Manager prior to the commencement of all proposed land disturbance works.

Name of Operator /Contractor

Position/s

Name/s of Person Responsible

Company

Description of Work to be Undertaken

Describe any access constraints that require consideration

Date Scheduled to Commence

Scheduled Date of Completion

Duration of Works



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WHC_PRO_TCM_LAND DISTURBANCE PROTOCOL

ATTACHMENTS

To be reviewed by: Construction Supervisor/Site Manager(s) responsible for all disturbance and clearing activity

Please check the following has been attached as required:

- Design Plans
- Sediment and Erosion Control Plans
- Excavation Permit
- Dial Before you Dig

- Map(s) clearly indicating:
- LDP boundary;
 - Disturbance footprint;
 - Proposed access tracks
 - Sensitive flora and fauna habitat boundaries;
 - Adjacent water ways;
 - Above and underground utility services;
 - Identified Aboriginal sites (including scar trees identified by pre-clearance surveys); and
 - Location of habitat trees, boulders and other habitat resources which will be salvaged for use in rehabilitation/restoration activities.

Please list any other supporting documentation or attachments in the order provided

Name	
Position	
Signature	
Date	



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WHC_PRO_TCM_LAND DISTURBANCE PROTOCOL

1.0 PROPOSED DISTURBANCE ACTIVITY LOCATION

To be reviewed by: Construction Supervisor/Site Manager(s) responsible for all disturbance and clearing activity

GPS Coordinates	<input type="text"/>	Disturbance Area (Ha)	<input type="text"/>
Landholder Name	<input type="text"/>	Lot / Plan/Tenement	<input type="text"/>
Property Name	<input type="text"/>	Local Council	<input type="text"/>
Tenure	<input type="text"/>		

Is the area to be disturbed clearly demarcated for site inspections to be undertaken?

Is the proposed disturbance within 5m of a project boundary, ML or EL boundary, EPBC DLA boundary or outside the EPL boundary?

If Yes can the disturbance be reduced to maintain a 5m distance from the boundary?

If No has the boundary been marked with continuous flagging/bunting, walked by the clearing contractor and WHC Supervisor and, where possible, pre-cleared using survey controlled equipment (e.g. Dozer with GPS)

Name	<input type="text"/>
Position	<input type="text"/>
Signature	<input type="text"/>
Date	<input type="text"/>



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WHC_PRO_TCM_LAND DISTURBANCE PROTOCOL

2.0 EXCAVATIONS AND SERVICES

To be reviewed by: Construction Supervisor/Site Manager(s) responsible for all disturbance and clearing activity

Is an excavation or penetration to a depth of 150 mm or greater below ground level required for any of the associated works (ERSED control work, pits, footings, cuttings etc.)?

If YES an excavation permit and associated Dial Before You Dig/Utility Clearance Survey is required

Has an excavation permit and dial before you dig been completed?

Are you satisfied that the proposed works will not interfere with any existing power, water or telecommunication lines?

Has a subsurface utility clearance survey of the area been undertaken to locate and mark identified utilities?

If no, please provide details on items that may be impacted by the proposed disturbance activities and attach a map showing services:

Two horizontal light blue bars for providing details on impacted items and attaching a map.

List any mitigation measures to be implemented to avoid risks involved with nearby power, water, gas or telecommunication lines:

Two horizontal light blue bars for listing mitigation measures.

Name	
Position	
Signature	
Date	



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3.0 PLANNING APPROVALS / ENVIRONMENTAL

To be reviewed by: Environmental Officer

3.1 INTRODUCTION

Are access arrangements in place with the Landholder?
If no, then works cannot commence until arrangements are in place. Advise person responsible for activity. What action(s) need to be taken?

Blank lines for response

Do the proposed works adhere to the conditions of the Occupation Agreement (Forests NSW)?
If no, then works cannot commence until works meet conditions of Occupation Agreement. Advise person responsible for activity. What action(s) need to be taken to meet Occupation Agreement conditions?

Blank lines for response

Are the proposed works in accordance with the Project Approval?
If no, then works cannot commence until works meet conditions of Project Approval. Advise person responsible for activity. What action(s) need to be taken to meet Project Approval conditions?

Blank lines for response

Are the proposed works in accordance with the approved Environmental Management Plans?
If no, then works cannot commence until works meet requirements of approved Environmental Management Plans. Advise person responsible for activity. What action(s) need to be taken to meet requirements of Environmental Management Plans?

Blank lines for response

Are the proposed works in compliance with the MOP?
If no, then works cannot commence until works meet requirements of MOP. Advise person responsible for activity. What action(s) need to be taken to meet requirements of MOP?

Blank lines for response

Are there any outstanding complaints in regards to this disturbance activity?
If yes, then works cannot commence until complaints have been responded to. Advise person responsible for activity. What action(s) need to be taken?

Blank lines for response

Name	
Position	
Signature	
Date	



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3.2 FAUNA AND FLORA

To be reviewed by: Environmental Officer

- Ensure key vegetation clearance criteria are met:-
- Vegetation removal only to be undertaken between 15th February and 30th April,
 - Clearing to cease when temperatures exceed 35°C.

Ensure the proposed disturbance area has had a Fauna and Flora survey undertaken no greater than 4 weeks prior to commencement of disturbance.

Has a pre-clearance survey (including consideration of seasonality) been completed?

Date and type of survey

Fauna identified

Flora to be removed

Trees:

Key Native Species

Area to be cleared (approx.)

How many habitat trees were identified?

Have habitat trees been clearly marked throughout the area to be cleared?

Shrubs:

Key Native Species

Description

Cover

Groundcover:

Key Native Species

Description

Cover

Boulders/Other Features:

Number in area to be cleared (approx.)

How many boulders/other features with habitat potential were identified?

Have items of potential habitat value been clearly marked throughout the area to be cleared?

Describe how identified fauna should be managed

Describe how the felled timber should be managed:

Describe how habitat features marked for rehabilitation are to be managed/stored:



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Identify any Management strategies or plans which detail mitigation techniques and methods to minimise harm.

Stage 1 Signoff: Environmental Officer to complete an inspection of the site to be disturbed and storage area to confirm that the above identified fauna habitat features have been labelled? *If yes, Stage 1 clearing activities can proceed (i.e. clearing of vegetation around labelled fauna habitat features), otherwise advise person responsible of remaining actions prior to signoff.*

Name	
Position	
Signature	
Date	

Stage 2 Signoff: On the day following Stage 1 clearing activities, identified habitat features are to be cleared using the procedure(s) described within the Biodiversity Management Plan.

Environmental Officer to record the details of the recovered habitat features and where they are stored to track reuse within rehabilitation/restoration activities. Has this been undertaken?

Name	
Position	
Signature	
Date	



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3.3 WATER, SEDIMENT AND EROSION CONTROL

To be reviewed by: Environmental Officer

Confirm plan has been developed according to the requirements of the Water Management Plan?

Are there any potential issues associated with sediment and erosion prior to clearance?

Describe these issues:

a) Analysis of the drainage of the site to be cleared:

b) Potential for soil dispersivity/ erosivity:

c) Identify potential impacts to nearby creeks or drainage lines that may be impacted:

d) Other

Has the site Erosion and Sediment Control Plan been attached

Have clean water diversion drains been included in the Erosion and Sediment Control Plans for catchments upslope of proposed disturbance?

Are these diversion banks/structures considered adequate for the works being undertaken?

Have preliminary ERSED works (vegetation barriers, silt fencing etc.) been proposed and designed for installation prior to the construction of ERSED works requiring excavation?

Have all mitigation measures been completed and in working order prior to disturbance activity e.g. sediment dams, silt fencing, culverts

Preliminary Signoff: Environmental Officer to complete an inspection of the site and confirm erosion and sediment control mitigation and management measures have been completed to a satisfactory standard prior to any clearing commencing? *If yes, clearing activities can proceed, otherwise advise person responsible of remaining actions that need to be completed prior to signing off.*

Name	<input type="text"/>
Position	<input type="text"/>
Signature	<input type="text"/>
Date	<input type="text"/>



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3.4 SOIL MANAGEMENT

To be reviewed by: Environmental Officer

Soil Type(s)

Please describe any existing land degradation issues:

Has the top soil clarification assessment been undertaken?

Identify the soil resources to be separately stripped and stockpiled for reuse in rehabilitation.

Topsoil Depth (m)
Subsoil Depth (m)

For larger areas with varying soil profiles please attach a map identifying soil type and stripping procedures/depth.

Can topsoil be utilised directly on rehabilitation areas?

If no, provide details for topsoil stockpiling and any resources to be transported in accordance with the soil stripping and stockpiling strategy detailed in the Rehabilitation Management Plan.

Please detail any proposed mitigation measures to manage the possible impacts:

Name	
Position	
Signature	
Date	



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3.5 AIR QUALITY MANAGEMENT

To be reviewed by: Environmental Officer

Is a water cart readily available during disturbance activities?

Where will the water be sourced from?

Identify any potential impacts on air quality that may result because of land clearance and disturbance:

List mitigation measures to manage possible impacts:

Name	<input type="text"/>
Position	<input type="text"/>
Signature	<input type="text"/>
Date	<input type="text"/>



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3.6 ACOUSTICS MANAGEMENT

To be reviewed by: Environmental Officer

Are all works scheduled within approved work hours?

Has all the plant machinery and tools to be used onsite been serviced (or tagged) and fitted with the necessary attenuation equipment (e.g. exhaust silencers)?

Identify any potential environmental impacts on acoustics that may result because of land disturbance:

List mitigation measures to manage the possible impacts:

Name	
Position	
Signature	
Date	



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3.7 TRAFFIC MANAGEMENT

To be reviewed by: Environmental Officer

Will the proposed works impact upon the capacity of the public traffic network? (if **NO** please skip to next section)

If **YES**, has a Traffic Control Plan been prepared to the satisfaction of the relevant roads authority (Narrabri Shire Council and / or Roads and Maritime Services)?

Please detail any mitigation measures that have been put in place to minimise impacts to other workers:

Identify any other potential impacts as a result of increased traffic to sites of disturbance:

List mitigation measures to manage the possible impacts:

Name	<input type="text"/>
Position	<input type="text"/>
Signature	<input type="text"/>
Date	<input type="text"/>



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3.8 ABORIGINAL AND CULTURAL HERITAGE

To be reviewed by: Environmental Officer

Are the works to be undertaken within the vicinity of Significant Heritage Areas or culturally sensitive heritage areas (refer to Aboriginal Cultural Heritage Management Plan)?

If yes please notify the Environmental Officer and arrange a site inspection

If there are listed artefacts in the disturbance area, has the required salvage program been undertaken?

If yes, Environmental Officer to attach the completed Archaeological Clearance Works Sign Off Form. Clearing activities can then proceed.

Have all listed artefacts or culturally significant areas either been collected (as above) or adequately fenced off and is signage provided to limit disturbance?

If a relic was found has this been reported to the Heritage Council compliant with Section 146 of the Heritage Act?

Identify any potential environmental impacts on Aboriginal and Cultural Heritage that may result because of land clearance and excavation:

List mitigation measures to manage the possible impacts

Preliminary Signoff: Attending Archaeologist (only where items identified)

Name	
Position	
Signature	
Date	

Preliminary Signoff: Environmental Officer

Name	
Position	
Signature	
Date	



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3.9 REHABILITATION

To be reviewed by: Environmental Officer

Describe rehabilitation tasks that are required to be carried out in order to restore the land to previous conditions:

Preliminary Signoff: Environmental Officer to complete an inspection of the site to confirm that rehabilitation tasks have been completed to a satisfactory standard? *If yes, the LDP can be closed out in Section 5.0, otherwise advise person responsible of remaining actions that need to be completed prior to signing off.*

Name	
Position	
Signature	
Date	

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**RECONCILIATION OF THE BIODIVERSITY MANAGEMENT PLAN AGAINST THE TCM
THREATENED FAUNA IMPLEMENTATION PLAN AND TCM BOX-GUM WOODLAND
ENDANGERED ECOLOGICAL COMMUNITY IMPLEMENTATION PLAN**

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Table B-1: Implementation Plan for the Provision of Habitat for Threatened Fauna in the Offset Area

Actions for Implementing the Biodiversity Offset Strategy in the BMP	Section
Revegetation, Seeds and Tubestock	
<ul style="list-style-type: none"> The BMP will describe that seed and tubestock used in revegetation will include a variety of grasses, low shrubs, mid-sized shrubs and tall trees to create structurally diverse habitat. 	Section 6.5.1
<ul style="list-style-type: none"> The BMP will include the planting of <i>Acacia</i> species, including both tree and shrub varieties. 	Section 6.5.1
<ul style="list-style-type: none"> The BMP will include the planting (in appropriate soil landscapes) of a variety of box, ironbark and gum eucalypt species, these may include: <ul style="list-style-type: none"> White Box (<i>Eucalyptus albens</i>); Yellow Box (<i>E. melliodora</i>); and Blakely's Red Gum (<i>E. blakelyi</i>). 	Section 6.5.1
<ul style="list-style-type: none"> The BMP will include the planting of a variety of native shrubs. 	Section 6.5.1
<ul style="list-style-type: none"> The BMP will include the planting of a variety of native grasses, including tussock grass species. 	Section 6.5.1
<ul style="list-style-type: none"> The BMP will include the planting of a variety of native herbs. 	Section 6.5.1
<ul style="list-style-type: none"> The BMP will include the planting of a variety of native forbs. 	Section 6.5.1
<ul style="list-style-type: none"> The BMP will focus on increasing woodland patch size within the offset area and aim to enhance ecological connectivity. 	Section 6.5.1
Habitat Features	
<ul style="list-style-type: none"> The BMP will not permit firewood collection. 	Section 4.5
Grazing Management	
<ul style="list-style-type: none"> The BMP will describe how livestock will be excluded from areas undergoing active revegetation (i.e. planting or seeding). 	Section 6.5.1
Weed Management	
<ul style="list-style-type: none"> The BMP will provide methods for the use of herbicides (minimised through spot-spraying, basal spraying, stem injection or cut and paint application methods). 	Section 6.7
Feral Animal Management	
<ul style="list-style-type: none"> The BMP will provide methods for the safe use of pesticides. 	Section 6.8
<ul style="list-style-type: none"> The BMP will describe procedures to prevent, monitor and control feral animals (including feral pigs, goats, rabbits and foxes). 	Sections 6.8 and 6.13.4
Fire Management	
<ul style="list-style-type: none"> The BMP will describe measures to prevent fires, such as maintaining fire breaks and access (i.e. no controlled burns would be undertaken whilst vegetation is establishing). 	Section 6.11
<ul style="list-style-type: none"> The BMP will prescribe any controlled burns in patches of Box-Gum Woodland CEEC (existing woodland or derived grasslands) to be no less than 5 years and then to occur in spring or autumn burns depending on a range of factors (except in revegetation areas). 	Section 6.11

¹ This species will be planted as a dominant species within woodland habitat.

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Table B-2: Implementation Plan for the Box-Gum Woodland in the Offset Area

Actions for Implementing the Biodiversity Offset Strategy in the BMP	Section
Planning	
<ul style="list-style-type: none"> The BMP will define the objectives for the Box-Gum Woodland CEEC. 	Section 6.1
<ul style="list-style-type: none"> The BMP will discuss an adaptive management framework and monitoring programme for the management of the Box-Gum Woodland CEEC. 	Section 6.13
<ul style="list-style-type: none"> The BMP will include a visual inspection of each mapped vegetation management unit in each offset area to identify constraints and requirements for specific management measures. 	Sections 6.3 and 6.5.1
<ul style="list-style-type: none"> The BMP will describe targeted revegetation along drainage lines and scalded areas to minimise risk of erosion. 	Section 6.5
<ul style="list-style-type: none"> The BMP will aim to maximise the re-use of existing infrastructure (e.g. access roads) instead of creating new infrastructure. 	Section 6.2.3
<ul style="list-style-type: none"> The BMP will aim to locate new offset area management infrastructure (e.g. access roads) preferentially in cleared land. 	Section 6.2.3
<ul style="list-style-type: none"> The BMP will aim to locate new offset area management infrastructure (e.g. access roads) in stable locations. 	Section 6.2.3
<ul style="list-style-type: none"> The BMP will describe provision of fencing and signage around the perimeter of the offset area to exclude livestock and avoid accidental clearance. 	Section 6.2.3
<ul style="list-style-type: none"> The BMP will describe roles for suitability qualified personnel (e.g. restoration ecologist) to provide direction about the rehabilitation and restoration of the Box-Gum Woodland CEEC). 	Section 6.5.1
Surface Preparation	
<ul style="list-style-type: none"> The BMP will describe site preparation in cleared land (e.g. ripping or use of spiked rollers) and (where relevant) in derived grassland (e.g. use of spiked rollers) to reduce soil compaction impacting the success of the revegetation. 	Section 6.5.1
<ul style="list-style-type: none"> The BMP will restrict the use of revegetation techniques that involve high level of physical disturbance in existing Box-Gum Woodland and derived grasslands. 	Section 6.5.1
Revegetation, Seeds and Tube Stock	
<ul style="list-style-type: none"> The BMP will describe a seed and tube stock supply strategy including calculation of the amount and species of seed and tube stock required each year and how the seed and tube stock will be sourced and managed to meet the demand. 	Section 6.5.1
<ul style="list-style-type: none"> The BMP will describe procedures for strategic and long term seed collection, management and storage following the relevant Florabank guidelines. The BMP will describe procedures for sowing seed (e.g. appropriate sowing depths). 	Sections 6.4 and 6.5.1
<ul style="list-style-type: none"> The BMP will favour natural regeneration in the derived grasslands and woodland areas over seeding or planting in the first instance followed by seeding or planting if required. 	Section 6.5.1
<ul style="list-style-type: none"> The BMP will provide for the preferential use of local endemic (adapted) species, however consideration would be given to the use of a high quality seed source further from the site over a low quality more local seed source. 	Section 6.5.1
<ul style="list-style-type: none"> The BMP will provide application rates for seeds as well as planting densities for tube stock to avoid excessive shading. 	Section 6.5.1

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Table B-2 (Continued)
Implementation Plan for the Box-Gum Woodland in the Offset Area

Actions for Implementing the Biodiversity Offset Strategy in the BMP	Section
<ul style="list-style-type: none"> The BMP will focus on increasing woodland patch size within the offset area and aim to enhance ecological connectivity. 	Section 6.5.1
<ul style="list-style-type: none"> The BMP will describe that seed and tube stock used in revegetation will include a variety of grasses, low shrubs, mid-sized shrubs and tall trees to create structurally diverse habitat. 	Section 6.5.1
<ul style="list-style-type: none"> The BMP include sowing of Kangaroo Grass (as this species is known to out-compete annual grass weeds and provide inter tussock spaces for a diversity of groundcover species [e.g. wildflowers]). 	Section 6.5.1
<ul style="list-style-type: none"> The BMP will aim to include a wide diversity of species in the seed mix. 	Section 6.5.1
<ul style="list-style-type: none"> The BMP will include provision to review the need for kangaroo control measures. 	Section 6.14
Maintenance	
<ul style="list-style-type: none"> The BMP will include provision to assess vegetation density and undertake ecological thinning (e.g. through selective clearance or fire) if necessary. 	Sections 6.5.1, 6.5.2 and 6.14
<ul style="list-style-type: none"> The BMP will provide measures to improve understorey diversity (e.g. replanting, causing disturbance through fire or grazing). 	Section 6.14
<ul style="list-style-type: none"> The BMP will provide for selective use of slow-release native plant fertiliser to promote plant growth (if required). 	Section 6.5.1
<ul style="list-style-type: none"> The BMP will provide an option for using tree guards to protect young seedlings from browsing or grazing native animals. 	Section 6.14
<ul style="list-style-type: none"> The BMP will describe how the growth and survival of the vegetation sown or planted will be monitored. 	Section 6.13
<ul style="list-style-type: none"> The BMP will include hygiene protocols to minimise the risk of plant diseases (i.e. restricting site access). 	Section 6.14
<ul style="list-style-type: none"> The BMP will describe a restriction of clearing (unless for ecological thinning, maintenance or access for monitoring). 	Section 6.5.2
Habitat Features	
<ul style="list-style-type: none"> The BMP will not permit firewood collection. 	Section 4.5
Weed Management	
<ul style="list-style-type: none"> The BMP will provide the following weed management options and the relevant situations where they would be applied: <ol style="list-style-type: none"> Nutrient management (e.g. exclusion of grazing livestock which add nutrients). Controlled burns during spring to reduce annual and perennial grass weeds (not broadleaf exotics). Physical Removal (e.g. removing weeds by felling or pulling). Targeted and timely herbicide application. 	Section 6.7
<ul style="list-style-type: none"> The BMP will provide methods for the use of herbicides (minimised through spot-spraying, basal spraying, stem injection or cut and paint application methods). 	Section 6.7

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Table B-2 (Continued)
Implementation Plan for the Box-Gum Woodland in the Offset Area

Actions for Implementing the Biodiversity Offset Strategy in the BMP	Section
<i>Feral Animal Management</i>	
<ul style="list-style-type: none"> The BMP will describe procedures to prevent, monitor and control feral animals (including feral pigs, goats, rabbits and foxes). 	Section 6.8
<i>Fire Management</i>	
<ul style="list-style-type: none"> The BMP will describe measures to prevent fires, such as maintaining fire breaks and access (i.e. no controlled burns would be undertaken whilst vegetation is establishing). 	Section 6.11
<ul style="list-style-type: none"> The BMP will prescribe any controlled burns in patches of Box-Gum Woodland CEEC (existing woodland) to be no less than 5 years and then to occur in spring or autumn burns depending on a range of factors. 	Section 6.11
<ul style="list-style-type: none"> The BMP will schedule for maintenance of fire breaks and fire trails. 	Section 6.11
<ul style="list-style-type: none"> The BMP will provide a schedule for assessing fuel loads. 	Section 6.11
<ul style="list-style-type: none"> The BMP will provide an option for using controlled grazing to reduce biomass or controlled burns of derived grasslands. 	Section 6.11
<i>General</i>	
<ul style="list-style-type: none"> The BMP will describe that vehicle access will be predominantly restricted to designated tracks to minimise ground disturbance (e.g. compaction). 	Section 6.10
<ul style="list-style-type: none"> The BMP will include a description of the Community Consultative Committee. 	Section 8.5

Source: Whitehaven (2014b)

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OFFSET AREA – VEGETATION DESCRIPTIONS

(Source: FloraSearch, 2011)

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Table 0-1: Community 1. Narrow-leaved Ironbark – White Box – White Cypress Pine Shrubby Open Forest

No. of quadrats: 8
No. of spot samples: 2
Landscape position: This community principally occupies hilly terrain. It is the dominant community in the western block with smaller occurrences in the southern block and on the higher ridgetops of the central range.
<p>Dominant species</p> <p>Trees: The community is dominated by Narrow-leaved Ironbark (<i>Eucalyptus crebra</i>), White Cypress Pine (<i>Callitris glaucophylla</i>) and White Box (<i>Eucalyptus albens</i>) in various proportions. On sites with shallow or skeletal soils, Hill Red Gum (<i>Eucalyptus dealbata</i>) may be locally common.</p> <p>Shrubs: Characteristic and common shrubs of Community 1 are Cough Bush (<i>Cassinia laevis</i>), <i>Cassinia quinquefaria</i>, Sticky Daisy-bush (<i>Olearia elliptica</i>), Hoary Guinea Flower (<i>Hibbertia obtusifolia</i>), Urn-heath (<i>Melichrus urceolatus</i>), Large Tick-trefoil (<i>Desmodium brachypodum</i>), Velvet Mock Olive (<i>Notelaea microcarpa</i> var. <i>microcarpa</i>), Sticky Hop Bush (<i>Dodonaea viscosa</i> subsp. <i>angustifolia</i>) and Poison Pimelea (<i>Pimelea neo-anglica</i>). Shrubs may form sparse to dense thickets throughout the community.</p> <p>Ground covers: Ground cover tends to be relatively sparse in this community. The most frequent species are Bristly Cloak Fern (<i>Cheilanthes distans</i>), Poison Rock Fern (<i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>), Native Carrot (<i>Daucus glochidiatus</i> Form F), Yellow Burr-daisy (<i>Calotis lappulacea</i>), Cudweed (<i>Euchiton sphaericus</i>), Cobbler's Tack (<i>Glossocardia bidens</i>), Fuzzweed (<i>Vittadinia cuneata</i> var. <i>hirsuta</i>), Small St. John's Wort (<i>Hypericum gramineum</i>), Kidney Weed (<i>Dichondra repens</i>), <i>Geranium</i> sp., <i>Galium leptogonium</i>, Wattle Mat-rush (<i>Lomandra filiformis</i> subsp. <i>filiformis</i>), Many-flowered Mat-rush (<i>Lomandra multiflora</i>), Purple Wire-grass (<i>Aristida personata</i>), Wallaby Grass (<i>Austrodanthonia racemosa</i> var. <i>obtusata</i>), Speargrass (<i>Austrostipa scabra</i> subsp. <i>scabra</i>), Barbwire Grass (<i>Cymbopogon refractus</i>), Slender Bottle-washers (<i>Enneapogon gracilis</i>), Brown's Lovegrass (<i>Eragrostis brownii</i>), Paddock Lovegrass (<i>Eragrostis leptostachya</i>) and Two Coloured Panic (<i>Panicum simile</i>).</p> <p>Introduced species: Introduced species are infrequent in Community 1, the most common being Common Centaury (<i>Centaureum erythraea</i>).</p>
Equivalent Biometric Vegetation Type (DECCW 2008): White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion.
Equivalent NSWVCA Vegetation Type (Benson et al. 2010): Narrow-leaved Ironbark - Cypress Pine - White Box shrubby open forest in the Brigalow Belt South and Nandewar Bioregions (NSWVCA community 592).
<p>Variants: Community 1 has four variants on the study area:</p> <p>Community 1a: Regeneration of Community 1 dominated by dense, even-aged White Cypress Pine.</p> <p>Community 1b: Semi-cleared and regenerating. Regeneration of Community 1 including all typical canopy dominants.</p> <p>Community 1c: Derived Native Grassland from Community 1.</p> <p>Community 1d: Grassland dominated by exotics. Derived from Community 1, but invaded by Coolatai Grass (<i>Hyparrhenia hirta</i>).</p>



Plate 1. Community 1 (Quadrat 17)



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Plate 2. Community 1a (Quadrat 6)



Plate 3. Community 1b (Quadrat 5)

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Table 0-2: Community 2. White box – White Cypress Pine Shrubby Woodland

<p>No. of quadrats: 5</p> <p>No. of spot samples: 5</p>
<p>Landscape position: Community 2 is the dominant community on the steep slopes of the central range. It also occurs sparingly on steep south-facing slopes and gully sides in the south of the western block and in the southern block. It also occurs in steep-sided gullies in grassland areas of the north-east block.</p>
<p>Dominant species</p> <p>Trees: Community 2 is dominated by White Box (<i>Eucalyptus albens</i>) and White Cypress Pine (<i>Callitris glaucophylla</i>). Other tree species that may occur include Hill Gum (<i>Eucalyptus dealbata</i>) on steep rocky slopes at the northern end of the central ridge, occasional small patches of Narrow-leaved Ironbark (<i>Eucalyptus crebra</i>) throughout the communities range and Rough-barked Apple (<i>Angophora floribunda</i>) which may associate with the community on steep sheltered west facing slopes of the central range and in gully lines.</p> <p>Shrubs: This community is characterised by high but variable levels of shrubs. The shrubs tend to be most abundant on south or west facing slopes and in steep-sided gullies. The most frequent shrubs are similar to those in Community 1 and include Cough Bush (<i>Cassinia laevis</i>), <i>Cassinia quinquefaria</i>, Sticky Daisy-bush (<i>Olearia elliptica</i>), Hoary Guinea Flower (<i>Hibbertia obtusifolia</i>), Urn-heath (<i>Melichrus urceolatus</i>), Large Tick-trefoil (<i>Desmodium brachypodium</i>), Western Silver Wattle (<i>Acacia decora</i>), Velvet Mock Olive (<i>Notelaea microcarpa</i> var. <i>microcarpa</i>), Sticky Hop Bush (<i>Dodonaea viscosa</i> subsp. <i>angustifolia</i>) and Poison Pimelea (<i>Pimelea neo-anglica</i>).</p> <p>Ground covers: The groundcover is generally relatively sparse, although can be more dense on north facing gully sides. Common species include Bristly Cloak Fern (<i>Cheilanthes distans</i>), Small St. John's Wort (<i>Hypericum gramineum</i>), Kidney Weed (<i>Dichondra repens</i>), Smooth Darling-pea (<i>Swainsona galegifolia</i>), <i>Oncinocalyx betchei</i>, Wattle Mat-rush (<i>Lomandra filiformis</i> subsp. <i>filiformis</i>), Blueberry Lily (<i>Dianella longifolia</i>), Purple Wire-grass (<i>Aristida personata</i>), Speargrass (<i>Austrostipa scabra</i> subsp. <i>scabra</i>), Barbwire Grass (<i>Cymbopogon refractus</i>) and Two Coloured Panic (<i>Panicum simile</i>).</p> <p>Introduced species: Few introduced species occur in Community 2. Common Prickly Pear (<i>Opuntia stricta</i>) is widespread in low numbers.</p>
<p>Equivalent Biometric Vegetation Type (DECCW 2008): White Box – White Cypress Pine shrubby open forest of the Nandewar and Brigalow Belt South Bioregions.</p>
<p>Equivalent NSWVCA Vegetation Type (Benson et al. 2010): White Box - White Cypress Pine shrubby hills open forest mainly in the Nandewar Bioregion (NSWVCA community 588).</p>
<p>Variants: Community 2 has four variants on the study area:</p> <p>Community 2a: Regeneration of Community 2 dominated by dense, even-aged White Cypress Pine.</p> <p>Community 2b: Semi-cleared and regenerating. Regeneration of Community 2 including all typical canopy dominants.</p> <p>Community 2c: Native Grassland derived from Community 2.</p> <p>Community 2d: Grassland dominated by exotics. Derived from Community 2, but invaded by Coolatai Grass (<i>Hyparrhenia hirta</i>).</p>



Plate 4. Community 2 (Quadrat 16)

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Table 0-3: Community 3. White Box – White Cypress Pine Grassy Woodland

No. of quadrats: 6
<p>Landscape position: Community 3 occupies gently sloping terrain principally in the north-east block. Most of Community 3 has been cleared historically and is now mainly a derived native grassland. Scattered remnants of the mature community occur within the grassland in the north, and around its margins. Small patches of mature Community 3 occur close to Maules Creek in the east of the southern block, along with some derived grasslands.</p>
<p>Dominant species</p> <p>Trees: Mature examples of Community 3 are dominated by White Box (<i>Eucalyptus albens</i>) with White Cypress Pine (<i>Callitris glaucophylla</i>).</p> <p>Shrubs: Shrubs are uncommon and scattered in this community. The main species recorded were Small-leaf Bluebush (<i>Maireana microphylla</i>) and Poison Pimelea (<i>Pimelea neo-anglica</i>). Less common were Western Silver Wattle (<i>Acacia decora</i>), Cooba (<i>Acacia salicina</i>) and Sticky Hop-bush (<i>Dodonaea viscosa</i> subsp. <i>angustifolia</i>).</p> <p>Ground covers: Ground covers tend to be dense in this community, especially in the derived grasslands. The dominant species include Poison Rock Fern (<i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>), Native Carrot (<i>Daucus glochidiatus</i> Form F), Common Everlasting (<i>Chrysocephalum apiculatum</i>), Carrot Weed (<i>Cotula australis</i>), Cymbonotus sp., Cudweed (<i>Euchiton sphaericus</i>), Cotton Fireweed (<i>Senecio quadridentatus</i>), A Vittadinia (<i>Vittadinia muelleri</i>), Kidney Weed (<i>Dichondra repens</i>), Native Geranium (<i>Geranium solanderi</i> subsp. <i>solanderi</i>), Goodenia sp., Ferny Buttercup (<i>Ranunculus pumilio</i>), Common Woodruff (<i>Asperula conferta</i>), Purple Wire-grass (<i>Aristida personata</i>), Speargrass (<i>Austrostipa scabra</i> subsp. <i>scabra</i>), Windmill Grass (<i>Chloris truncata</i>), Queensland Bluegrass (<i>Dichanthium sericeum</i>), Paddock Lovegrass (<i>Eragrostis leptostachya</i>), Two Coloured Panic (<i>Panicum simile</i>) and Slender Rat's Tail Grass (<i>Sporobolus creber</i>). The grasses tend to dominate the grassland forms of this community, especially Queensland Bluegrass, Windmill Grass, Purple Wiregrass, Paddock Lovegrass and Slender Rat's Tail Grass.</p> <p>Introduced species: The grassland forms of this community have been heavily grazed in the past and support relatively high numbers of introduced species including Saffron Thistle (<i>Carthamus lanatus</i>), Skeleton Weed (<i>Chondrilla juncea</i>), Flaxleaf Fleabane (<i>Conyza bonariensis</i>), Smooth Catsear (<i>Hypochaeris glabra</i>), Flatweed (<i>Hypochaeris radicata</i>), Proliferous Pink (<i>Petrorhagia nanteuilii</i>), Burr Medic (<i>Medicago polymorpha</i>), Narrow-leaved Clover (<i>Trifolium angustifolium</i>), Common Centaury (<i>Centaureum erythraea</i>), Sweet Briar (<i>Rosa rubiginosa</i>) and <i>Verbena caracasana</i>.</p>
<p>Equivalent Biometric Vegetation Type (DECCW 2008): White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions.</p>
<p>Equivalent NSWVCA Vegetation Type (Benson et al. 2010): White Box - White Cypress Pine shrub grass hills woodland in the Brigalow Belt South and Nandewar Bioregions (NSWVCA community 435).</p>
<p>Variants: Community 3 has two variants on the study area:</p> <p>Community 3c: Native Grassland derived from Community 3.</p> <p>Community 3d: Grassland dominated by exotics. Derived from Community 3, but invaded by Coolatai Grass (<i>Hyparrhenia hirta</i>).</p>



Plate 5. Community 3 (Quadrat 20)



Plate 6. Community 3c (Quadrat 23)

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Table 0-4: Community 5. Bracteate Honeymyrtle Low Riparian Forest

<p>No. of quadrats: 2</p> <p>No. of spot samples: 1</p>
<p>Landscape position: Community 5 occurs along the riparian zone of Teatree Gully and its major tributaries on the west side of the central range.</p>
<p>Dominant species</p> <p>The dominant and most characteristic species of this community is Bracteate Honeymyrtle which forms dense thickets over the creek providing close to 100% foliage cover. Below the dense, ten-metre high canopy is an open grassy understory with scattered shrubs.</p> <p>Trees: Emergent or overhanging trees include principally Rough-barked Apple (<i>Angophora floribunda</i>). White Box (<i>Eucalyptus albens</i>), Kurrajong (<i>Brachychiton populneus</i>) and White Cypress Pine (<i>Callitris glaucophylla</i>) are also commonly present.</p> <p>Low trees: Bracteate Honeymyrtle (<i>Melaleuca bracteata</i>) is dominant and Velvet Mock Olive (<i>Notelaea microcarpa</i> var. <i>microcarpa</i>) may also be present.</p> <p>Shrubs: Shrubs are usually sparsely distributed. The most characteristic species in this community is Tree Violet (<i>Meliccytus dentatus</i>). Other shrubs may include Cough Bush (<i>Cassinia laevis</i>), Sticky Daisy-bush (<i>Olearia elliptica</i>), Large Tick-trefoil (<i>Desmodium brachypodium</i>) and Sticky Hop Bush (<i>Dodonaea viscosa</i> subsp. <i>angustifolia</i>).</p> <p>Vines: Vines are more common in this community than others on the study area and include Headache Vine (<i>Clematis glycinoides</i>) and Wombat Berry (<i>Eustrephus latifolius</i>).</p> <p>Creepers: Native Raspberry (<i>Rubus parvifolius</i>) is a scrambler that is largely confined to this community. Love Creeper (<i>Glycine clandestina</i>) and Glycine (<i>Glycine tabacina</i>) are widespread species that may also be present.</p> <p>Ground covers: The groundcover in this community tends to be dense and grassy. Heavy shading provided by Bracteate Honeymyrtle creates a humid environment favouring species such as Sickie Fern (<i>Pellaea falcata</i>), Barbwire Weed (<i>Nyssanthes diffusa</i>), Stinging Nettle (<i>Urtica incisa</i>), Tussock Grass (<i>Poa labillardierei</i>), Weeping Grass (<i>Microlaena stipoides</i>) and Creeping Beard Grass (<i>Oplismenus imbecillis</i>). More widespread species that are also common include Poison Rock Fern (<i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>), Kidney Weed (<i>Dichondra repens</i>), <i>Geranium</i> sp., Trailing Speedwell (<i>Veronica plebeia</i>), <i>Carex incomitata</i>, Spiny-headed Mat-rush (<i>Lomandra longifolia</i>), Many-flowered Mat-rush (<i>Lomandra multiflora</i>), Wallaby Grass (<i>Austrodanthonia racemosa</i> var. <i>obtusata</i>) and Slender Bamboo Grass (<i>Austrostipa verticillata</i>).</p> <p>Introduced species: Community 5 often has large infestations of Greater Beggar's Ticks (<i>Bidens subalternans</i>). Flaxleaf Fleabane (<i>Conyza bonariensis</i>) and Sweet Briar (<i>Rosa rubiginosa</i>) may also be present.</p>
<p>Equivalent Biometric Vegetation Type (DECCW 2008): Bracteate Honey Myrtle riparian low forest/shrubland of rich soil depressions in the Brigalow Belt South Bioregion.</p>
<p>Equivalent NSWVCA Vegetation Type (Benson et al. 2010): Bracteate Honey Myrtle riparian low forest/shrubland of rich soil depressions in the Brigalow Belt South Bioregion (NSWVCA community 112).</p>
<p>Variants: None.</p>



Plate 7. Community 5 (Quadrat 11)

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Table 0-5: Community 7. Silver-leaved Ironbark – Narrow-leaved Ironbark – White Box Shrubby Open Forest

<p>No. of quadrats: 2</p> <p>No. of spot samples: 8</p>
<p>Landscape position: Community 7 occupies undulating to hilly terrain, mainly in the southern half of the southern block and in the south-west corner of the western block.</p>
<p>Dominant species</p> <p>Trees: The most characteristic species of this community is Silver-leaved Ironbark (<i>Eucalyptus melanophloia</i>) which associates commonly with Narrow-leaved Ironbark (<i>Eucalyptus crebra</i>) and White Cypress Pine (<i>Callitris glaucophylla</i>). White Box (<i>Eucalyptus albens</i>) is a less common associate.</p> <p>Shrubs: Most examples of this community on the study area have rather sparse shrub and groundcover layers. The most frequently encountered shrubs are Cough Bush (<i>Cassinia laevis</i>), Sticky Daisy-bush (<i>Olearia elliptica</i>), Hoary Guinea Flower (<i>Hibbertia obtusifolia</i>), Urn-heath (<i>Melichrus urceolatus</i>), Large Tick-trefoil (<i>Desmodium brachypodum</i>), Western Silver Wattle (<i>Acacia decora</i>), Velvet Mock Olive (<i>Notelaea microcarpa</i> var. <i>macrocarpa</i>) and Poison Pimelea (<i>Pimelea neo-anglica</i>).</p> <p>Ground covers: The sparse groundcover includes Bristly Cloak Fern (<i>Cheilanthes distans</i>), Kidney Weed (<i>Dichondra repens</i>), Wattle Mat-rush (<i>Lomandra filiformis</i> subsp. <i>filiformis</i>), Many-flowered Mat-rush (<i>Lomandra multiflora</i>), Purple Wire-grass (<i>Aristida personata</i>), Speargrass (<i>Austrostipa scabra</i> subsp. <i>scabra</i>), Barbwire Grass (<i>Cymbopogon refractus</i>) and Paddock Lovegrass (<i>Eragrostis leptostachya</i>).</p> <p>Introduced species: Introduced species are uncommon in Community 7. Common Prickly Pear (<i>Opuntia stricta</i>) is the most frequent.</p>
<p>Equivalent Biometric Vegetation Type (DECCW 2008): White Box - White Cypress Pine - Silver-leaved Ironbark shrubby open forest of the Nandewar Bioregion.</p>
<p>Equivalent NSWVCA Vegetation Type (Benson et al. 2010): White Box - Cypress Pine - Silver-leaved Ironbark shrub grass open forest / woodland of the northern Brigalow Belt South and Nandewar Bioregions (NSWVCA community 597).</p>
<p>Variants: Community 7 has three variants on the study area:</p> <p>Community 7b: Semi-cleared and regenerating. Regeneration of Community 7 including all typical canopy dominants.</p> <p>Community 7c: Native Grassland derived from Community 7.</p> <p>Community 7d: Grassland dominated by exotics. Derived from Community 7, but invaded by Coolatai Grass (<i>Hyparrhenia hirta</i>).</p>



Plate 8. Community 7 (Quadrat 3)

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Table 0-6: Community 8. Yellow Box – Rough-barked Apple Grassy Woodland

No. of quadrats: 2
Landscape position: Community 8 occurs on alluvial flats, side gullies, lower hill slopes and some ridge tops close to Maules Creek, mainly in the southern block.
<p>Dominant species</p> <p>Trees: The dominant and characteristic tree species is Yellow Box (<i>Eucalyptus melliodora</i>), usually in association with Rough-barked Apple and White Cypress Pine (<i>Callitris glaucophylla</i>).</p> <p>Shrubs: Shrubs are sparse in this community and may include Cough Bush (<i>Cassinia laevis</i>), <i>Cassinia quinquefaria</i>, Hoary Guinea Flower (<i>Hibbertia obtusifolia</i>), Urn-heath (<i>Melichrus urceolatus</i>), Large Tick-trefoil (<i>Desmodium brachypodum</i>) and Velvet Mock Olive (<i>Notelaea microcarpa</i> var. <i>microcarpa</i>).</p> <p>Creepers: Frequent creepers are Slender Tick-trefoil (<i>Desmodium varians</i>), Love Creeper (<i>Glycine clandestina</i>) and Glycine (<i>Glycine tabacina</i>).</p> <p>Ground covers: Ground cover is usually moderate to dense and commonly includes Poison Rock Fern (<i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>), Stinking Pennywort (<i>Hydrocotyle laxiflora</i>), Native Carrot (<i>Daucus glochidiatus</i> Form F), Yellow Burr-daisy (<i>Calotis lappulacea</i>), Cudweed (<i>Euchiton sphaericus</i>), Cobbler's Tack (<i>Glossocardia bidens</i>), <i>Picris angustifolia</i> subsp. <i>caolorum-henricorum</i>, Cotton Fireweed (<i>Senecio quadridentatus</i>), <i>Sigesbeckia australiensis</i>, Vernonia (<i>Vernonia cinerea</i>), Fuzzweed (<i>Vittadinia cuneata</i> var. <i>cuneata</i>), Sprawling Bluebell (<i>Wahlenbergia gracilis</i>), Climbing Saltbush (<i>Einadia nutans</i> subsp. <i>linifolia</i>), Small St. Johns Wort (<i>Hypericum gramineum</i>), Kidney Weed (<i>Dichondra repens</i>), <i>Geranium</i> sp., Austral Bugle (<i>Ajuga australis</i>), Creeping Mint (<i>Mentha saturoides</i>), Slender Flat-sedge (<i>Cyperus gracilis</i>), Many-flowered Mat-rush (<i>Lomandra multiflora</i>), Blueberry Lily (<i>Dianella longifolia</i>), Purple Wire-grass (<i>Aristida personata</i>), Speargrass (<i>Austrostipa scabra</i> subsp. <i>scabra</i>), Wallaby Grass (<i>Austrodanthonia racemosa</i> var. <i>obtusata</i>) Queensland Bluegrass (<i>Dichanthium sericeum</i>), Weeping Grass (<i>Microlaena stipoides</i>) and Barbwire Grass (<i>Cymbopogon refractus</i>).</p> <p>Introduced species: Introduced species were not common and included mainly Greater Beggar's Ticks (<i>Bidens subalternans</i>), Common Prickly Pear (<i>Opuntia stricta</i>) and Flaxleaf Fleabane (<i>Conyza bonariensis</i>).</p>
Equivalent Biometric Vegetation Type (DECCW 2008): Yellow Box – Blakely's Red Gum grassy woodland of the Nandewar Bioregion.
Equivalent NSWVCA Vegetation Type (Benson et al. 2010): Yellow Box grassy woodland on lower hillslopes and valley flats in the southern NSW Brigalow Belt South Bioregion (NSWVCA community 437).
Variants: Community 8 has one variant on the study area:
Community 8c: Native Grassland derived from Community 8.



Plate 9. Community 8 (Quadrat 12)

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Table 0-7: Community 9. River Oak – River Red Gum Riparian Forest

No. of spot samples: 3
Landscape position: Community 9 occurs in the riparian zone along Maules Creek.
<p>Dominant species</p> <p>Trees: River Oak (<i>Casuarina cunninghamiana</i>) is the dominant tree species, occurring continuously along the creek from the north to the south of the 'Willeroi' property. In places where the flow path is wide and little incised, a broad riparian zone may support a broad band of River Oak forest whose dense canopy provides heavy shading of the ground. Where the channel is narrower and more incised, River Oak forms a narrow band on each side of the watercourse, often with River Red Gum (<i>Eucalyptus camaldulensis</i>). Other tree species that frequently occur with River Oak are Rough-barked Apple (<i>Angophora floribunda</i>) and Yellow Box (<i>Eucalyptus melliodora</i>).</p> <p>Low Trees: Black Tea-tree (<i>Melaleuca bracteata</i>) commonly occurs below the River Oaks on the edge of the creek bank. Velvet Mock Olive (<i>Notelaea microcarpa</i> var. <i>microcarpa</i>) occurs regularly in Community 9.</p> <p>Shrubs: Shrubs are generally sparsely distributed in River Oak forest. Tree Violet (<i>Melicytus dentatus</i>) is a characteristic species and Poison Pimelea (<i>Pimelea neo-anglica</i>) is a regular associate.</p> <p>Ground covers: The groundcover in Community 9 is dominated by shade and moisture dependent grasses and herbs including Barbwire Weed (<i>Nyssanthes diffusa</i>), Kidney Weed (<i>Dichondra repens</i>), Native Geranium (<i>Geranium solanderi</i> subsp. <i>solanderi</i>), Stinging Nettle (<i>Urtica incisa</i>), Stiff Flat-sedge (<i>Cyperus vaginatus</i>), Spiny-headed Mat-rush (<i>Lomandra longifolia</i>), Slender Bamboo Grass (<i>Austrostipa verticillata</i>), Couch (<i>Cynodon dactylon</i>), Erect Hedgehog Grass (<i>Echinopogon intermedius</i>), Weeping Grass (<i>Microlaena stipoides</i>) and Tussock (<i>Poa labillardierei</i>).</p> <p>Introduced species: The moist fertile soil conditions of the riparian zone favour a wide range of introduced species including Narrow-leaved Cotton Bush (<i>Gomphocarpus fruticosus</i>), Cobblers Pegs (<i>Bidens pilosa</i>), Common Sowthistle (<i>Sonchus oleraceus</i>), Skeleton Weed (<i>Chondrilla juncea</i>), Stinking Roger (<i>Tagetes minuta</i>), Noogoora Burr (<i>Xanthium occidentale</i>), Mexican Tea (<i>Chenopodium ambrosioides</i>), Hop Clover (<i>Trifolium campestre</i>), Common Chickweed (<i>Stellaria media</i>), Lamb's Tongues (<i>Plantago lanceolata</i>), Sweet Briar (<i>Rosa rubiginosa</i>) and <i>Verbena caracasana</i>.</p>
Equivalent Biometric Vegetation Type (DECCW 2008): River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions (Benson 84).
Equivalent NSWVCA Vegetation Type (Benson et al. 2010): River Oak - Rough-barked Apple - Red Gum - Box riparian tall woodland (wetland) of the Brigalow Belt South and Nandewar Bioregions (NSWVCA community 84).
Variants: Community 9 has one variant on the study area:
Community 9c: Native Grassland derived from Community 9.



Plate 10. Community 9 (Maules Creek)

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Table 0-8: Community 10. Rough-barked Apple Riparian Forb/Grass Open Forest

<p>No. of spot samples: 2</p>
<p>Landscape position: Community 10 occurs mainly on alluvial soils next to the riparian zone, on flood terraces and adjoining lower slopes along Maules Creek and Teatree Gully.</p>
<p>Dominant species</p> <p>Trees: The trees most characteristic of this community are Rough-barked Apple (<i>Angophora floribunda</i>) and Blakely's Red Gum (<i>Eucalyptus blakelyi</i>). White Box (<i>Eucalyptus albens</i>), White Cypress Pine (<i>Callitris glaucophylla</i>) and occasional Kurrajong (<i>Brachychiton populneus</i>) also occur.</p> <p>Low Trees: The main low trees are Cooba (<i>Acacia salicina</i>) and Velvet Mock Olive (<i>Notelaea microcarpa</i> var. <i>macrocarpa</i>).</p> <p>Shrubs: Shrubs are relatively infrequent and may include Sticky Daisy-bush (<i>Olearia elliptica</i>), Large Tick-trefoil (<i>Desmodium brachypodum</i>), <i>Hovea apiculata</i>, Sticky Hop Bush (<i>Dodonaea viscosa</i> subsp. <i>angustifolia</i>) and Poison Pimelea (<i>Pimelea neo-anglica</i>).</p> <p>Vines: <i>Jasminum suavisimum</i> is a sporadic vine in Community 10.</p> <p>Ground covers: Community 10 characteristically has a dense grassy ground layer with a variety of native forbs including Poison Rock Fern (<i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>), Native Geranium (<i>Geranium solanderi</i> subsp. <i>solanderi</i>), Slender Bamboo Grass (<i>Austrostipa verticillata</i>), Cotton Fireweed (<i>Senecio quadridentatus</i>), <i>Sigesbeckia australiensis</i>, Small St. John's Wort (<i>Hypericum gramineum</i>), Smooth Darling-pea (<i>Swainsona galegifolia</i>), <i>Acaena agnipila</i>, Stiff Flat-sedge (<i>Cyperus vaginatus</i>), Many-flowered Mat-rush <i>Lomandra multiflora</i>), Blueberry Lily (<i>Dianella longifolia</i>), Purple Wire-grass (<i>Aristida personata</i>), Red Grass (<i>Bothriochloa</i> sp.), Plump Windmill Grass (<i>Chloris ventricosa</i>), Forest Hedgehog Grass (<i>Echinopogon ovatus</i>), Paddock Lovegrass (<i>Eragrostis leptostachya</i>) and Slender Rat's Tail Grass (<i>Sporobolus creber</i>).</p> <p>Introduced species: Introduced species are not common in this community except for Coolatai Grass (<i>Hyparrhenia hirta</i>) in some places along Teatree Creek. The more common introduced species include Narrow-leaved Cotton Bush (<i>Gomphocarpus fruticosus</i>), Greater Beggar's Ticks (<i>Bidens subalternans</i>), Flaxleaf Fleabane (<i>Conyza bonariensis</i>), Tall Fleabane (<i>Conyza sumatrensis</i>), Smooth Catsear (<i>Hypochaeris glabra</i>), Proliferous Pink (<i>Petrorhagia nanteuillii</i>), Common Centaury (<i>Centaureum erythraea</i>) and Sweet Briar (<i>Rosa rubiginosa</i>).</p>
<p>Equivalent Biometric Vegetation Type (DECCW 2008): Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion</p>
<p>Equivalent NSWVCA Vegetation Type (Benson et al. 2010): Rough-barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South West Slopes and Brigalow Belt South Bioregions (NSWVCA community 281).</p>
<p>Variants: None.</p>

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OFFSET RISK ASSESSMENT

The following risk assessment considers impact of risks from management actions in the BOA. The risk model is based on the WHC Risk Matrix. In addition to TCM policy, this risk assessment addresses DPIE Offset Principle 6 to manage ‘uncertainties and risks associated with actions such as revegetation’.

Risk is defined as the effect of uncertainty on objectives (Standards Australia 2009). The likelihood of risk occurring and the level of impact of that risk are used to assess each risk and inform management responses (**Table D-1**). The higher the risk score, the more urgent the response. A ‘critical’ classification denotes risks that significantly exceed the risk acceptance threshold. Immediate attention is required to stop the job. ‘High’ risks exceed the risk acceptance threshold. Additional risk control measures required. If further risk control measures are not practicable the responsible Manager must sign off. A ‘moderate’ risk meets the acceptance threshold. Additional control measures could be implemented to control risks further, with active monitoring of risk control measures required. ‘Low’ risks are below the risk acceptance threshold. No additional control measures are required, however, monitoring of risks may be needed.

		CONSEQUENCE					
		Insignificant	Minor	Medium	Major	Catastrophic	
		1	2	3	4	5	
LIKELIHOOD	Almost Certain	A	Moderate	High	High	Critical	Critical
	Likely	B	Moderate	Moderate	High	High	Critical
	Occasional	C	Low	Moderate	High	High	High
	Unlikely	D	Low	Low	Moderate	Moderate	High
	Rare	E	Low	Low	Moderate	Moderate	High

Figure D-1: Risk Assessment of Non-Achievement of Management Plan Objectives

To address the risks identified in **Table D-1** the Manager will:

- Educate TCM staff, contractors and neighbouring properties of the BOA objectives and location
- Avoid potential impacts by following the recommended protocol in this BMP for each management action
- Mitigate potential impacts by regular monitoring (**Section 6.13**) and applying corrective action under an adaptive management framework
- Report incidences and responses in the Annual Report (**Section 8.2**) to facilitate managerial review and if necessary trigger systemic change of practice

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Table 0-1: Risk Assessment

Risk Factor (Hazard)	Impact (Risk)	Before Management			Action/Control/Risk Mitigation Measure	After Management		
		Likelihood	Consequence	Risk		Likelihood	Consequence	Risk Level
Substrate	Poor soil chemistry – depleted soil nutrients	B	4	M	<ul style="list-style-type: none"> selective use of slow-release fertiliser to promote plant growth (if required); and reuse timber/hollow logs salvaged during vegetation clearance. 	C	4	L
	Poor soil chemistry - elevated soil nutrients	B	4	M	<ul style="list-style-type: none"> nutrient reduction options (e.g. crash grazing periodically to remove nutrients locked in weeds) 	C	4	L
	Erosion and sedimentation	B	4	M	<ul style="list-style-type: none"> targeted revegetation along drainage lines and scalded areas to minimise risk of erosion; restriction of livestock access to erosion prone areas (e.g. along watercourses); locate new offset area management infrastructure (e.g. access roads) in stable locations; and maximise the re-use of existing infrastructure (e.g. access roads). 	C	4	L
	Soil compaction - inhibits germination of seeds or growth of seedlings	B	4	M	<ul style="list-style-type: none"> vehicle access will be predominantly restricted to designated tracks; livestock will be excluded from areas undergoing active revegetation; and site preparation in cleared land (e.g. ripping or use of spiked rollers) and (where relevant) in derived grassland (e.g. use of spiked rollers). 	C	4	L
	Ground disturbance	C	4	L	<ul style="list-style-type: none"> vehicle access will be predominantly restricted to designated tracks; fencing and signage around the perimeter of the offset area; and low disturbance revegetation techniques in existing Box-Gum Woodland and derived grasslands. 	D	4	L

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**Table D-1 (Continued)
Risk Assessment**

Risk Factor (Hazard)	Impact (Risk)	Before Management			Action/Control/Risk Mitigation Measure	After Management		
		Likelihood	Consequence	Risk		Likelihood	Consequence	Risk Level
Clearing	Incidental clearing, fragmentation and fire-wood collection	C	4	L	<ul style="list-style-type: none"> restriction of clearing; firewood collection not permitted; fencing and signage around the perimeter of the offset area; locate new offset area management infrastructure (e.g. access roads) preferentially in cleared land; and maximise the re-use of existing infrastructure (e.g. access roads). 	D	4	L
Livestock	Grazing by cattle – ground disturbance, remove or destroy seeds, seedlings or plantings	C	2	H	<ul style="list-style-type: none"> restrict livestock access to erosion prone areas (e.g. along watercourses); livestock will be excluded from areas undergoing active revegetation; restrict livestock access to areas not already subject to grazing; management of livestock to maintain groundcover and diversity of native plants; restrict livestock access to protect plants that are known to be sensitive to grazing; and controlled grazing management. 	D	3	L
Introduced flora species (weeds)	Weed invasion – perennial and annual grasses, perennial herbs, annual and biennial herbs and woody weeds	C	2	H	<ul style="list-style-type: none"> provide application rates for seeds as well as planting densities for tube stock to avoid excessive shading; weed management; sowing of Kangaroo Grass; and lightly graze derived grasslands in times of suitable climatic conditions for weed growth. 	D	3	L

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**Table D-1 (Continued)
Risk Assessment**

Risk Factor (Hazard)	Impact (Risk)	Before Management			Action/Control/Risk Mitigation Measure	After Management		
		Likelihood	Consequence	Risk		Likelihood	Consequence	Risk Level
Herbicide	Excessive herbicides – may have negative effects on native species	C	4	L	<ul style="list-style-type: none"> herbicides minimised through spot-spraying, basal spraying, stem injection or cut and paint application methods. 	C	4	L
Impacts from Animals (exotics and grazing native animals)	Grazing by feral pigs and goats	B	3	H	<ul style="list-style-type: none"> procedures to prevent, monitor and control feral animals; and option for using tree guards to protect young seedlings. 	B	5	L
	Rabbits and hares	B	3	H	<ul style="list-style-type: none"> procedures to prevent, monitor and control feral animals. 	B	5	L
	Grazing native fauna species (e.g. kangaroos)	B	4	M	<ul style="list-style-type: none"> option for using tree guards to protect young seedlings. provision to review the need for kangaroo control measures. 	B	5	L
	Feral foxes	B	3	H	<ul style="list-style-type: none"> procedures to prevent, monitor and control feral animals. 	B	5	L
	Deer	C	4	L	<ul style="list-style-type: none"> provide monitoring of deer and feral cats and control (if required). 	B	5	L
	Feral Cat	B	4	M	<ul style="list-style-type: none"> provide monitoring of deer and feral cats and control (if required). 	B	5	L
Fire	Uncontrolled bushfire	B	2	H	<ul style="list-style-type: none"> maintaining fire breaks and access; schedule for maintenance of fire breaks and fire trails; schedule for assessing fuel loads; and option for using controlled grazing to reduce biomass. 	D	3	L

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**Table D-1 (Continued)
Risk Assessment**

Risk Factor (Hazard)	Impact (Risk)	Before Management			Action/Control/Risk Mitigation Measure	After Management		
		Likelihood	Consequence	Risk		Likelihood	Consequence	Risk Level
Floristics	Poor diversity in the seed mix or tube stock	C	3	M	<ul style="list-style-type: none"> procedures for strategic and long term seed collection, management and storage ; procedures for sowing seed (e.g. appropriate sowing depths); and favour natural regeneration in the derived grasslands and woodland areas over seeding or planting in the first instance followed by seeding or planting if required. 	D	3	L
	Unsuitable species in the seed mix or tube stock	C	3	M	<ul style="list-style-type: none"> preferential use of local endemic (adapted) species, or the use of a high quality seed source further from the site over a low quality more local seed source; and favour natural regeneration in the derived grasslands and woodland areas over seeding or planting in the first instance followed by seeding or planting if required. 	D	3	L
	Shortage of sufficient seed or tube stock	C	3	M	<ul style="list-style-type: none"> a seed and tube stock supply strategy to meet demand. 	D	3	L
	Poor understorey diversity	C	3	M	<ul style="list-style-type: none"> application rates for seeds as well as planting densities for tube stock; preferential use of local endemic (adapted) species, or the use of a high quality seed source further from the site over a low quality more local seed source; provision to assess vegetation density and undertake ecological thinning (e.g. through selective clearance or fire) if necessary; measures to improve understorey diversity (e.g. replanting, causing disturbance through fire or grazing); and wide diversity of species in the seed mix. 	D	3	L

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**Table D-1 (Continued)
Risk Assessment**

Risk Factor (Hazard)	Impact (Risk)	Before Management			Action/Control/Risk Mitigation Measure	After Management		
		Likelihood	Consequence	Risk		Likelihood	Consequence	Risk Level
	Over-collection of seed for revegetation purposes	C	3	M	<ul style="list-style-type: none"> a seed and tube stock supply strategy to meet demand; and provide for the preferential use of local endemic (adapted) species, or the use of a high quality seed source further from the site over a low quality more local seed source. 	D	3	L
Native plant growth	Poor native plant growth/germination	C	3	M	<ul style="list-style-type: none"> describe procedures for strategic and long term seed collection, management and storage ; describe procedures for sowing seed (e.g. appropriate sowing depths); describe how livestock will be excluded from areas undergoing active revegetation; provide application rates for seeds as well as planting densities for tube stock to avoid excessive shading; favour natural regeneration in the derived grasslands and woodland areas over seeding or planting in the first instance followed by seeding or planting if required; and preferential use of local endemic (adapted) species, or the use of a high quality seed source further from the site over a low quality more local seed source. 	C	4	L
	Dense overstorey and midstorey revegetation	C	3	M	<ul style="list-style-type: none"> include provision to assess vegetation density and undertake ecological thinning (e.g. through selective clearance or fire) if necessary. 	C	4	L
	Dense grass cover	C	3	M	<ul style="list-style-type: none"> provide measures to improve understorey diversity (e.g. replanting, causing disturbance through fire or grazing). 	C	4	L
	Disease (e.g. <i>Phytophthora cinnamomi</i>)	C	4	L	<ul style="list-style-type: none"> include hygiene protocols to minimise the risk of plant diseases (i.e. restricting site access). 	C	4	L

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**Table D-1 (Continued)
Risk Assessment**

Risk Factor (Hazard)	Impact (Risk)	Before Management			Action/Control/Risk Mitigation Measure	After Management		
		Likelihood	Consequence	Risk		Likelihood	Consequence	Risk Level
	Fungi or pathogens – may cause germination failure (seeds)	C	4	L	<ul style="list-style-type: none"> provide for the preferential use of local endemic (adapted) species, or the use of a high quality seed source further from the site over a low quality more local seed source. 	C	4	L
Fauna habitat	Lack of suitable vegetation for foraging and/or roosting	C	4	L	<ul style="list-style-type: none"> include the planting (in appropriate soil landscapes) of a variety of box, ironbark and gum eucalypt species which are all known to occur in the Leard State Forest or offset area planting of Acacia species, including both tree and shrub varieties including shrub varieties; planting of a variety of native shrubs; and describe that seed and tube stock used in revegetation will include a variety of grasses, low shrubs, mid-sized shrubs and tall trees to create structurally diverse habitat. 	C	4	L
Weather	Drought	C	3	M	<ul style="list-style-type: none"> growth and survival of the vegetation sown or planted will be monitored; provide a mechanism to reduce livestock grazing during drought periods; include provision to review the need for kangaroo control measures; and describe procedures to prevent, monitor and control feral animals. 	C	4	L
	Wind	C	4	L	<ul style="list-style-type: none"> option for using tree guards to protect young seedlings from browsing or grazing native animals. 	C	4	L

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**WILLEROI WEST FLORA AND FAUNA MONITORING – SURVEY CO-ORDINATES
(AMBS, 2017)**

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Table 0-1: Willeroi West Flora and Fauna Survey Co-ordinates¹

Site	Easting	Northing
Flora		
VS40-1	243933	6625864
VS40-2	243958	6625861
VS40-3	243946	6625796
VS41-1	243780	6625966
VS41-2	243756	6625978
VS41-3	243728	6625990
VS42-1	244299	6628029
VS42-2	244341	6628044
VS42-3	244364	6627948
VS43-1	244461	6628433
VS43-2	244378	6628427
VS43-3	244436	6628347
VS44-1	243123	6628319
VS44-2	243096	6628324
VS44-3	243076	6628378
VS45-1	243160	6628522
VS45-2	243191	6628528
VS45-3	243217	6628541
VS46-1	243012	6628978
VS46-2	242983	6628983
VS46-3	242949	6628987
VS47-1	242830	6629902
VS47-2	242860	6629924
VS47-3	242885	6629949
Fauna		
FT01	243637	6626045
FT02	244034	6626819
FT03	243935	6629739
FT04	242724	6629909
FT05	243006	6628916
FT06	241555	6628590

¹ Note three photo-points are used for each monitoring site, ie at each end, and at the approximate midpoint, of the 50m line dissecting the monitoring plot.

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WILLEROI WEST BASELINE CONDITION REPORT

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The following report has been prepared from *Maules Creek Coal Mine and Tarrawonga Coal Mine: Flora and Habitat Monitoring of Offset Areas – 2017* (AMBS, 2017a), *Fauna Monitoring of the Maules Creek and Tarrawonga Mine Offset Areas – Spring 2017* (AMBS, 2017b) and *Bird Surveys in the Maules Creek and Tarrawonga Coal Mine Offset Areas – Winter 2017* (AMBS, 2017c), with the monitoring methods and results extracted to create a Baseline Condition Report specific to the Willeroi West offset area.

Eight flora and six fauna monitoring sites were established in the Tarrawonga Mine offset property (Willeroi) to meet BMP requirements and to complement experimental design of the monitoring program in the Maules Creek Mine offsets.

Flora Monitoring Methods

Flora monitoring took place on 24 – 27 October 2017. At each site three 20 x 50 m plots were established and surveyed. Plots were placed at least 50 m apart. Plot configuration was consistent with the BioBanking Assessment Methodology (OEH 2014). Each plot was bisected by a 50 m transect line, running north to south, with each end of the transect line marked with a permanent star picket. A 20 m x 20 m sub-plot was marked within and at the origin (southern end) of the plot. The location of the southern picket was recorded using a GPS. Data collection expanded upon the BioBanking Assessment Methodology (OEH 2014), using additional survey methods and attributes. Attributes that were recorded in the 20 x 50 m plots are described in **Table F-1** and attributes recorded in the 20 x 20 m sub-plot in **Table F-2**.

Table 0-1: Attributes Recorded in 20 x 50 m Plots

Habitat Surveys – Observational and Site Features			
Number	Attribute	Assessment Techniques	Activity Undertaken
1	Site location	Waypoints	Waypoints recorded at the southern post of the plot.
2	Site photographs	North to south and south to north along transect.	Camera place on top of star picket. Photograph centred on the 50m transect tape. No person or equipment in image.
3	Habitat Feature: Tree Hollows	Count 20 x 50m plot	Count all hollows >5cm - 10cm occurring in plot. Count all hollows >10cm occurring in plot. Record comments where applicable. If absent record as zero.
4	Habitat Feature: Fallen timber	Count 20 x 50m plot	Count all fallen timber >10cm diameter and >50cm in length occurring in plot. Estimate combined length. Record comments where applicable. If absent record as zero.
5	Proximity to water	Observation General area	Record in metres type and distance of standing and ephemeral water occurring <500m from the site. This includes dams, streams and drainage lines. Record comments where applicable. If absent record as zero.
6	Proximity to rocks, caves and overhangs	Observation General area	Record in metres distance to large habitat rocks, caves or overhangs occurring <300m from the site. Record comments where applicable. If absent record as zero.
7	Evidence of extensive erosion or waterlogging disturbing native vegetation	Observation General area	Record in metres distance to erosion or waterlogging occurring <300m from the site. Record comments where applicable. If absent record as zero.

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**Table F-1 (Continued)
Attributes Recorded in 20 x 50 m Plots**

Habitat Surveys – Observational and Site Features			
Number	Attribute	Assessment Techniques	Activity Undertaken
8	Dense stands of regeneration (<i>Callitris glaucophylla</i>) that may require thinning	Observation General area	Record presence or absence of dense stands of <i>Callitris glaucophylla</i> occurring within or directly adjacent to the plot. Record comments where applicable. If absent record as zero.
9	Evidence of past disturbance	Observation 20 x 50m plot	Record presence or absence of disturbance and document disturbance type. This include, but is not limited to, fire, logging, tree thinning, roads/tracks, grazing. If absent record as zero.
10	Dieback of Eucalypts that could be due to water stress	Observation 20 x 50m plot	Record presence or absence of Eucalypt dieback and description of site topography. Record comments where applicable. If absent record as zero.
11	Presence/absence of Noisy Miners	Observations/Call identification General area	Record presence or absence of Noisy Miners and/or Yellow-eared Miners if not distinguishable. Record comments where applicable. If absent record as zero.
12	Presence/absence of other Honeyeaters	Observation/Call identification General area	Record presence or absence of other Honeyeaters. Record habitat and comments where applicable. If absent record as zero.
13	Evidence of disturbance by pest animals.	Observation 20 x 50m plot	Record presence or absence of pest animals. Evidence includes sighting, scats, tracks or obvious grazing. This includes but is not limited to livestock, fox, rabbit, deer, pigs, goats. Record comments where applicable. If absent record as zero.
14	Presence of flowering Eucalypts	Observation 20 x 50m plot	Record presence or absence of flowering Eucalypts. Where flowering occurs record species and proportion of site containing the flowering species (e.g. <i>Eucalyptus crebra</i> <5%). Record comments where applicable. If absent record as zero.
15	Regeneration of canopy species	Observation 20 x 50m plot	Record presence or absence of canopy species regeneration. Where possible record species and proportion of site containing the regenerating species (i.e. <i>Eucalyptus crebra</i> 5-15%). Record comments where applicable. If absent record as zero.
16	Overall vegetation condition (Resilience)	Observation 20 x 50m plot	Record vegetation condition on a scale of 1-4, where 1 is Very Poor and 4 is Good. (e.g. Good: <10% weed and/or healthy strata and high assemblage diversity. Moderate: 10-30% weed and/or minor stratum dieback and moderate assemblage diversity. Poor: 30-80% weed and/or moderate stratum dieback and low assemblage diversity. Very Poor: >80% weed and/or extensive stratum dieback /extremely reduced diversity)
17	Notes	Observations	Description of distinct site features including soil, unique disturbance, unusual vegetation, landscape and land use history.

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**Table F-1 (Continued)
Attributes Recorded in 20 x 50 m Plots**

Habitat Surveys – Observational and Site Features			
Number	Attribute	Assessment Techniques	Activity Undertaken
18	Native overstorey cover (NOS)	At 10 points along a 50 m transect	Record height of highest layer in metres. Record health of overstorey (on a 1-3 scale in which 1 is poor and 3 is good). Record projected foliage cover directly over the selected point and within the boundaries of a confined shape (e.g. 5cm tube).
19	Native midstorey cover (NMS)	At 10 points along a 50 m transect	Record height of highest layer in metres. Record health of midstorey (on a 1-3 scale in which 1 is poor and 3 is good). Record projected foliage cover directly over the selected point and within the boundaries of a confined shape (e.g. 5cm tube).
20	Exotic overstorey and midstorey cover	At 10 points along a 50m transect	Record height of highest layer in metres. Record health of midstorey (on a 1-3 scale in which 1 is poor and 3 is good). Record projected foliage cover directly over the selected point and within the boundaries of a confined shape (e.g. 5cm tube).
21	Native ground cover (grasses)	At 50 points along a 50m transect	Record occurrence or hit at each point. Record only one hit, even if multiple "hits" of native grasses occur at the point.
22	Native ground cover (forb)	At 50 points along a 50m transect	Record occurrence or hit at each point. Record only one hit, even if multiple "hits" of native grasses occur at the point.
23	Native ground cover (other)	At 50 points along a 50m transect	Record occurrence or hit at each point. Record only one hit, even if multiple "hits" of native ground covers occur at the point. Cryptogams to be included as a native other.
24	Exotic ground cover	At 50 points along a 50m transect	Record occurrence or hit at each point. Record only one hit, even if multiple "hits" of exotic species occur at the point.
25	Native woody species <1m	At 50 points along a 50m transect	Native species with a woody stem less than 1 m in height. Includes shrubs too small to meet native midstorey criteria.
26	Overall site cover: Cryptogam cover	Average within 20x20m plot	Record cryptogam as a percentage of the site. Record in 5% increments. Cryptogams occurring on soil and rocks are included in the assessment.
27	Overall site cover: Rock Cover	Average within 20x20m plot	Record rock cover as a percentage of the site. Record in 5% increments.
28	Overall site cover: Bare ground	Average within 20x20m plot	Record bare ground as a percentage of the site. Record in 5% increments. Bare ground excludes rocks.
29	Overall site cover: Litter	Average within 20x20m plot	Record litter cover as a percentage of the site. Record in 5% increments. Litter cover includes all dead material but excludes cryptogams and rocks.
30	Structural Assessment: Canopy	Average within 20x20m plot	Record percentage cover of Vegetation canopy. Canopy is classified as vegetation >8 metres high. Record the height range of canopy species in metres.
31	Structural Assessment: Midstorey 1	Average within 20x20m plot	Record percentage cover of Mid 1 vegetation. Mid 1 is classified as vegetation <8 and >5 metres. Record the height range of Mid 1 species in metres.
32	Structural Assessment: Midstorey 2	Average within 20x20m plot	Record percentage cover of Mid 2 vegetation. Mid 2 is classified as vegetation <5 and >1 metres. Record the height range of Mid 2 species in metres.

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Table 0-2: Attributes Recorded in 20 x 50 m Plots

Floristic Survey and Structural Features			
Number	Attribute	Assessment Techniques	Activity Undertaken
33	Structural Assessment: Ground layer	Average within 20x20m plot	Record percentage cover of living ground layer vegetation. The ground layer is classified as vegetation <1metre. Record the height range of ground layer species in centimetres.
34	Tree Species Size Classing	Count within 20 x 20m sub-plot	Record size classes of all tree species present. The classes include <1m,1-2m,2-5m,5-10m,10-15m,15-20m,20-25m,25-30m,>30m. Count the number of each species which occurs within each class. Record the total number of each species as the sum of all records. Only plants rooted within the plot. Only tree canopy species.
35	Flora species richness	Count within 20 x 20m sub-plot	Record presence of all flora species within subplot. Record with sample identification and field name where applicable. Identify specimens using floristic keys.

Flora Monitoring Results

Native plant species (NPS) richness ranged from 56 to 95 across all plots (**Table 0-3**). Evidence of overstorey regeneration was present in 17 out of 24 plots. The regenerating areas were largely composed of *Callitris* and *Eucalyptus* species. Sites VS41 and VS43 contained the tallest overstorey trees (14m). VS43 was found to contain the tallest midstorey regenerating individuals with the health of overstorey and midstorey compositions recorded highest on site VS43-3 (2-3).

No exotic species were found within regenerating midstorey canopy (**Table 0-4**). Site VS47 showed the highest native grass cover (50%) and highest exotic ground cover (25%), compared to other sites. The most native forbs were found on sites VS42 and VS41 (26), and the most native woody plants on site VS43 (1) .

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Table 0-3: Flora Monitoring Results – Structural Part 1

Site number	NPS	Over-storey regeneration (1=y, 0=n)	Over-storey regeneration (% of site)	Regenerating species name	NOS Height (m) (Avg records)	NOS Health (P=1, M=2, G=3) 3 highest	NOS % (Avg 10 records)	NMS Height (m) (Avg records)	NMS Health (P, M, G) (Avg records) (P=1, M=2, G=3)	NMS % (Avg 10 records)
VS40-1	56	1.00	5-15%	<i>Callitris glaucophylla, Eucalyptus melliodora, Angophora floribunda</i>	0.00	0.00	0.00	6.00	3.00	4.00
VS40-2	60	1.00	<5%	<i>Callitris glaucophylla, Eucalyptus melliodora</i>	0.00	0.00	0.00	0.00	0.00	0.00
VS40-3	66	1.00	<5%	<i>Eucalyptus melliodora</i>	0.00	0.00	0.00	0.00	0.00	0.00
VS41-1	94	1.00	<5%	<i>Callitris glaucophylla, Angophora floribunda</i>	0.00	0.00	0.00	0.00	0.00	0.00
VS41-2	90	1.00	<5%	<i>Callitris glaucophylla</i>	0.00	0.00	0.00	0.00	0.00	0.00
VS41-3	86	1.00	5-15%	<i>Callitris glaucophylla, Eucalyptus albens, Angophora floribunda, Brachychiton populneus</i>	14.00	3.00	1.50	7.00	3.00	1.00
VS42-1	72	1.00	<5%	<i>Callitris glaucophylla, Eucalyptus melliodora</i>	0.00	0.00	0.00	0.00	0.00	0.00
VS42-2	60	1.00	15-25%	<i>Callitris glaucophylla</i>	0.00	0.00	0.00	0.00	0.00	0.00
VS42-3	59	1.00	15-25%	<i>Callitris glaucophylla, Eucalyptus albens</i>	11.00	3.00	3.00	6.00	3.00	8.00
VS43-1	90	1.00	25-50%	<i>Callitris glaucophylla, Eucalyptus albens</i>	10.00	3.00	3.00	4.00	3.00	5.00
VS43-2	88	1.00	>50%	<i>Callitris glaucophylla, Eucalyptus albens, Angophora floribunda, Brachychiton populneus</i>	9.00	2.00	3.00	6.25	2.00	9.00

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**Table F-3 (Continued)
Flora Monitoring Results - Structural Part 1**

Site number	NPS	Over-storey regeneration (1=y, 0=n)	Over-storey regeneration (% of site)	Regenerating species name	NOS Height (m) (Avg records)	NOS Health (P=1, M=2, G=3) 3 highest	NOS % (Avg 10 records)	NMS Height (m) (Avg records)	NMS Health (P, M, G) (Avg records) (P=1, M=2, G=3)	NMS % (Avg 10 records)
VS43-3	78	1.00	25-50%	<i>Callitris glaucophylla, Angophora floribunda, Brachychiton populneus</i>	14.00	3.00	7.00	2.80	3.00	1.50
VS44-1	80	1.00	<5%	<i>Callitris glaucophylla</i>	0.00	0.00	0.00	0.00	0.00	0.00
VS44-2	85	0.00			0.00	0.00	0.00	0.00	0.00	0.00
VS44-3	95	1.00	<5%	<i>Callitris glaucophylla</i>	0.00	0.00	0.00	0.00	0.00	0.00
VS45-1	83	0.00			0.00	0.00	0.00	0.00	0.00	0.00
VS45-2	68	0.00			0.00	0.00	0.00	0.00	0.00	0.00
VS45-3	78	1.00	<5%	<i>Callitris glaucophylla</i>	0.00	0.00	0.00	0.00	0.00	0.00
VS46-1	71	0.00			0.00	0.00	0.00	0.00	0.00	0.00
VS46-2	69	0.00			0.00	0.00	0.00	0.00	0.00	0.00
VS46-3	71	1.00	<5%	<i>Callitris glaucophylla</i>	0.00	0.00	0.00	4.00	3.00	2.00
VS47-1	71	0.00			0.00	0.00	0.00	0.00	0.00	0.00
VS47-2	67	1.00	<5%	<i>Callitris glaucophylla, Brachychiton populneus</i>	0.00	0.00	0.00	5.50	3.00	1.00
VS47-3	59	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00

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Table 0-4: Flora Monitoring Results – Structural Part 2

Site Number	Exotic % cover mid/canopy (Avg 10 records)	Sum NG hits	Avg Native ground cover (grass) # hits/50	Sum NF hits	Avg Native ground cover (forb) # hits/50	Sum NO hits	Avg Native ground cover (other) #hits/50	Sum exotic hits	Avg Exotic plant cover # hits/50	Sums NWS hits	Avg native woody species (NWS) <1m #hits/50
VS40-1	0.00	41.00	0.82	23.00	0.46	2.00	0.04	3.00	0.06	0.00	0.00
VS40-2	0.00	36.00	0.72	32.00	0.64	8.00	0.16	7.00	0.14	0.00	0.00
VS40-3	0.00	46.00	0.92	16.00	0.32	10.00	0.20	5.00	0.10	0.00	0.00
VS41-1	0.00	44.00	0.88	18.00	0.36	1.00	0.02	5.00	0.10	0.00	0.00
VS41-2	0.00	35.00	0.70	26.00	0.52	1.00	0.02	9.00	0.18	0.00	0.00
VS41-3	0.00	29.00	0.58	14.00	0.28	1.00	0.02	1.00	0.02	0.00	0.00
VS42-1	0.00	23.00	0.46	30.00	0.60	3.00	0.06	8.00	0.16	0.00	0.00
VS42-2	0.00	34.00	0.68	21.00	0.42	3.00	0.06	4.00	0.08	0.00	0.00
VS42-3	0.00	16.00	0.32	26.00	0.52	0.00	0.00	0.00	0.00	3.00	0.06
VS43-1	0.00	31.00	0.62	13.00	0.26	9.00	0.18	5.00	0.10	1.00	0.02
VS43-2	0.00	26.00	0.52	9.00	0.18	5.00	0.10	10.00	0.20	1.00	0.02
VS43-3	0.00	26.00	0.52	4.00	0.08	9.00	0.18	3.00	0.06	3.00	0.06
VS44-1	0.00	41.00	0.82	22.00	0.44	2.00	0.04	9.00	0.18	0.00	0.00
VS44-2	0.00	37.00	0.74	9.00	0.18	16.00	0.32	8.00	0.16	2.00	0.04

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**Table F-4 (Continued)
Flora Monitoring Results – Structural Part 2**

Site Number	Exotic % cover mid/canopy (Avg 10 records)	Sum NG hits	Avg Native ground cover (grass) # hits/50	Sum NF hits	Avg Native ground cover (forb) # hits/50	Sum NO hits	Avg Native ground cover (other) #hits/50	Sum exotic hits	Avg Exotic plant cover # hits/50	Sums NWS hits	Avg native woody species (NWS) <1m #hits/50
VS44-3	0.00	42.00	0.84	8.00	0.16	5.00	0.10	14.00	0.28	0.00	0.00
VS45-1	0.00	47.00	0.94	5.00	0.10	2.00	0.04	14.00	0.28	0.00	0.00
VS45-2	0.00	32.00	0.64	20.00	0.40	0.00	0.00	7.00	0.14	1.00	0.02
VS45-3	0.00	45.00	0.90	10.00	0.20	2.00	0.04	18.00	0.36	0.00	0.00
VS46-1	0.00	34.00	0.68	19.00	0.38	0.00	0.00	8.00	0.16	0.00	0.00
VS46-2	0.00	35.00	0.70	19.00	0.38	0.00	0.00	5.00	0.10	0.00	0.00
VS46-3	0.00	40.00	0.80	9.00	0.18	0.00	0.00	3.00	0.06	0.00	0.00
VS47-1	0.00	50.00	1.00	13.00	0.26	17.00	0.34	25.00	0.50	0.00	0.00
VS47-2	0.00	48.00	0.96	8.00	0.16	4.00	0.08	33.00	0.66	0.00	0.00
VS47-3	0.00	49.00	0.98	21.00	0.42	0.00	0.00	22.00	0.44	0.00	0.00

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Neither hollow bearing trees nor cracks bearing habitat were recorded across the sites. No standing dead timber was found. Fallen tree logs were found in just under half of the sites (42%) (**Table 0-5**).

Table 0-5: Habitat Flora Results

Site number	Hollows 5-10cm	# hollows >10cm	# cracks with habitat potential	Standing dead timber (>8m)	# fallen logs >10cm diameter and 50cm length	length of fallen logs (m)	Proximity to water (m)	Proximity to rocks, caves, overhangs
VS40-1	0	0	0	0	12	6	NA	Unknown
VS40-2	0	0	0	0	0	0	NA	Unknown
VS40-3	0	0	0	0	30	15	NA	Unknown
VS41-1	0	0	0	0	4	7	100 w to farm dam	800m west
VS41-2	0	0	0	0	3	3	100 w to farm dam	800m west
VS41-3	0	0	0	0	8	21	100 w to farm dam	800m west
VS42-1	0	0	0	0	12	6	NA	Unknown
VS42-2	0	0	0	0	4	2	NA	Unknown
VS42-3	0	0	0	0	10	5	NA	Unknown
VS43-1	0	0	0	0	0	0	100m E to Maules Ck	1.5km E
VS43-2	0	0	0	0	3	5	100m E to Maules Ck	1.5km E
VS43-3	0	0	0	0	0	0	100m E to Maules Ck	1.5km E
VS44-1	0	0	0	0	0	0	1-2Km to Maules Ck	3km N
VS44-2	0	0	0	0	0	0	1-2Km to Maules Ck	3km N
VS44-3	0	0	0	0	0	0	1-2Km to Maules Ck	3km N

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**Table F-5 (Continued)
Habitat Flora Results**

Site number	Hollows 5-10cm	# hollows >10cm	# cracks with habitat potential	Standing dead timber (>8m)	# fallen logs >10cm diameter and 50cm length	length of fallen logs (m)	Proximity to water (m)	Proximity to rocks, caves, overhangs
VS45-1	0	0	0	0	0	0	NA	Unknown
VS45-2	0	0	0	0	2	1	NA	Unknown
VS45-3	0	0	0	0	0	0	NA	Unknown
VS46-1	0	0	0	0	0	0	150m SW to farm dam	approx. 3 Km N
VS46-2	0	0	0	0	0	0	150m SW to farm dam	approx.. 3 Km N
VS46-3	0	0	0	0	0	0	150m SW to farm dam	approx.. 3 Km N
VS47-1	0	0	0	0	0	0	NA	Unknown
VS47-2	0	0	0	0	0	0	NA	Unknown
VS47-3	0	0	0	0	0	0	NA	Unknown

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Fauna Monitoring Methods

Vertebrate fauna surveys were undertaken at six survey sites in the Tarrawonga offset area (four sites in remnant vegetation and two sites in revegetation areas). The surveys were undertaken from 6 to 14 November 2017 and 27 November to 1 December 2017.

At each remnant vegetation survey site, survey techniques included harp traps, ultrasonic call recording, spotlighting, call-playback, diurnal bird surveys and hand searches. Remote cameras were deployed at each site on the first field trip and collected at the end of the second field trip. Frog and tadpole surveys were also undertaken in suitable habitat (not necessarily in the same sites as the other sampling techniques). Opportunistic observations of signs of nocturnal birds and other fauna were noted throughout the field survey period.

Fauna survey techniques implemented within the revegetation areas included diurnal bird surveys, reptile surveys, spotlighting, camera traps and ultrasonic call detectors (Anabat). Harp traps were not used as these areas currently have no flyways, and call playback for owls was not undertaken, as owls that respond (if any) are likely to be coming from other areas, i.e. areas that are more wooded than the revegetation domains.

Harp Traps

At each standard survey site, two harp traps were deployed for two nights (i.e. four harp trap nights per site in total). Traps were checked each morning within three hours of dawn. Any captured microbats were placed in a calico bag, identified, and released at dusk the same day. Ultrasonic Call Recording (Anabat). At each standard survey site and revegetation site, two Anabat units (either Anabat Express or Anabat SD2) were deployed for two nights. Anabat Express units were set to the automatic 'night only' recording mode. Anabat SD2 units were programmed to operate between 18:30 and 07:30 hours. The sensitivity was set to between seven and eight and the data division ratio was set to eight.

Camera Traps

At each standard survey site and revegetation site, two remote cameras (Scout Guard) were deployed and left in-situ for a minimum of 14 days and nights. At each site, one camera was baited with universal bait and one was baited with a tin of sardines. The bait was placed approximately 2-3 m from the camera. Cameras were programmed to record three images each time they were triggered.

Reptile Search

At each standard survey site and revegetation site, active searches of potential reptile habitats were undertaken. At each site two 30 person-minute searches (i.e. a total of 60 person minutes per site in total) were undertaken on different days. Searches were undertaken between 10:00 and 13:00 hours wherever possible.

Call-Playback

At each standard survey site, call-playback was undertaken on two nights (non-consecutive when possible). During each survey an initial five-minute listening period was followed by five minutes call-playback and five minutes of listening for each species. Species included in the call-playback survey were the Masked Owl (*Tyto novaehollandiae*) and Barking Owl (*Ninox connivens*). Spotlighting of the surrounds was performed at the conclusion of the call-playback survey.

Spotlighting

At each standard survey site and revegetation site, spotlighting was undertaken on two nights (non-consecutive when possible). The survey involved two people walking a 200 m transect and identifying

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vertebrate fauna observed within 50 m of either side. Each survey was performed for 60 person-minutes. The survey site order was changed for some sites on the second evening in order to limit the effects of temperature on survey results.

Bird Survey

Winter and spring baseline bird surveys were conducted in 2017 (AMBS, 2017a; 2017b).

Field surveys in winter took place over an 8-day period in late July, across 81 sites. Each site was surveyed for a minimum of 5 minutes to record the target species, Swift Parrot (*Lathamus discolor*), as well as indicator species (blossom feeding lorikeets and friarbirds) and assess relevant habitat. Of the 112 bird species recorded, nine were listed as threatened under the NSW *Threatened Species Conservation Act* 1995 within the study area. No Swift Parrots were recorded during these surveys.

In spring, diurnal bird surveys were undertaken on two separate mornings within three hours of dawn. Each standard survey and revegetation site was assessed for 20 minutes. Surveyors slowly walked a transect approximately 200 m long and identified all birds observed or heard within and outside of a two-hectare area. Of the 87 bird species recorded, eight were listed as threatened under the NSW *Threatened Species Conservation Act* 1995 in the study area (**Table 0-1**).

Frog and Tadpole Search

At each frog site, a short listening period was undertaken (approximately three minutes), followed by spotlight searches for 30 person-minutes, on two separate evenings. All amphibian species observed or heard were identified and recorded. Tadpole searches were undertaken on one occasion at each tadpole site for a minimum of 30 person-minutes. During the surveys, visual searches were undertaken for 15 minutes, followed by up to ten sweeps of the waterbody using a hand-held dip net.

Limitations

A summary of the limitations or modifications to the surveys included: Remote camera monitoring at fifteen sites recorded images for less than the target survey effort (i.e. 28 camera nights). At fourteen sites this was due to the memory cards filling up with photos of moving groundcover, and mostly impacted revegetation sites. Most sites were only reduced by a few nights each (FST02- 20 nights, FST04 - 25 nights), with the exception of sites that had greater grass cover (FST03 17 nights, FST05 9 nights). Due to malfunctioning Anabat detectors the number of Anabat nights was reduced to one at FST04 however this was compensated for by setting up two Anabats for one night later in the survey.

Thunderstorms were recorded in the afternoon of 6 November. Moderate to strong winds were recorded in the early evening of 6 November.

Weather conditions

Weather conditions within the offset areas during the survey period were generally warm to very warm during the day (20.0°C to 33.4°C) and cold to mild at night (6.1°C to 20.1°C). The survey conditions were dry for most of the active survey periods. Approximately 30-50 mm of rainfall were recorded mid-November between the two active survey periods (**Table 0-6**). Localized showers occurred within the last days of surveys.

The rainfall total for the three months before surveys began was 102.2 mm at Teston South AWS.

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Table 0-6: Climate Data During the Survey Period

Date	Teston South AWS			Barraba Post Office		
	Temp Max (°C)	Temp Min (°C)	Rainfall (mm)	Temp Max (°C)	Temp Min (°C)	Rainfall (mm)
6/11/17	29.8	16	3.4	27.8	8.9	8.0
7/11/17	26.2	6.5	0.2	24.6	6.1	2.2
8/11/17	25.9	14.9	-	25.9	11.0	-
9/11/17	27.3	11.6	-	26.4	9.0	-
10/11/17	27.5	16	-	27.0	8.2	-
11/11/17	28.2	14.8	-	27.0	8.0	-
12/11/17	27.8	15.8	-	27.6	7.5	-
13/11/17	28.7	12.3	-	27.7	10	-
14/11/17	28.4	11.9	-	27.1	8.9	-
15/11/17	29.6	14.5	-	No data	9.6	-
16/11/17	25.7	17.8	9.2	27.9	No data	-
17/11/17	29.2	15.7	29.4	29.0	12.0	15.4
18/11/17	20.1	15.9	21.8	20.0	15.0	7.0
19/11/17	26.6	15.9	3.6	25.9	14.0	16.0
20/11/17	27.6	14	-	26.5	10.1	2.0
21/11/17	25.9	16	2.8	26.7	10.5	-
22/11/17	28	15.1	1.4	No data	9.0	-
23/11/17	26.8	12.9	0.2	No data	No data	-
24/11/17	30.3	12.6	-	No data	No data	-
25/11/17	32.8	15	-	No data	No data	-
26/11/17	33.4	17.9	-	32.3	No data	-
27/11/17	25.7	19.6	0.2	No data	8.9	-
28/11/17	31.5	14.7	-	31.6	12.6	-
29/11/17	28.8	19	11.4	No data	17.5	-
30/11/17	29.1	20.1	0.2	No data	No data	-
01/12/17	32.3	18	-	No data	No data	-

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Fauna Monitoring Results

One hundred and fifty one fauna species were found across the six fauna monitoring sites (including six amphibians, 87 birds, 36 mammals and 22 reptiles). Fifteen threatened species were identified, including eight birds, four microbats and one arboreal mammal.. Eight species of invasive fauna were recorded (Common Starling, Cat, Goat, Dog, Pig, Deer, Rat and Fox) at varying frequencies across all six sites (**Table 0-1**).

Table 0-1: Fauna Monitoring Results

Scientific Name	Common Name	FST01	FST02	FST03	FST04	FST05	FST06
Amphibia							
<i>Crinia signifera</i>	Common Eastern Froglet	2					
<i>Limnodynastes dumerilii</i>	Eastern Banjo Frog				1		
<i>Litoria latopalmata</i>	Broad-palmed Frog			5			36
<i>Litoria peronii</i>	Peron's Tree Frog			3			16
<i>Litoria rubella</i>	Desert Tree Frog			1			
<i>Litoria wilcoxii</i>	Wilcox's Frog						1
Aves							
<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater	2	1	3	4	1	
<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill				1		
<i>Acanthiza lineata</i>	Striated Thornbill						4
<i>Acanthorhynchus tenuirostris</i>	Eastern Spinebill	1					2
<i>Aegotheles cristatus</i>	Australian Owlet-Nightjar	2	2	3	1		11
<i>Alisterus scapularis</i>	Australian King-parrot			3			
<i>Anthochaera carunculata</i>	Red Wattlebird			2		5	
<i>Aprosmictus erythropterus</i>	Red-winged Parrot	3	1	3			

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**Table F-7 (Continued)
Fauna Monitoring Results**

Scientific Name	Common Name	FST01	FST02	FST03	FST04	FST05	FST06
<i>Aquila audax</i>	Wedge-tailed Eagle				1		1
<i>Artamus cyanopterus cyanopterus</i>	Dusky Woodswallow	10			2		
<i>Artamus superciliosus</i>	White-browed Woodswallow	1					
<i>Cacatua galerita</i>	Sulphur-crested Cockatoo		1		7	1	
<i>Cacomantis flabelliformis</i>	Fan-tailed Cuckoo			2			1
<i>Cacomantis variolosus</i>	Brush Cuckoo		2				
<i>Centropus phasianinus</i>	Pheasant Coucal		1				
<i>Chalcites basalis</i>	Horsfield's Bronze-Cuckoo	1					
<i>Chalcites osculans</i>	Black-eared Cuckoo		1				
<i>Chenonetta jubata</i>	Australian Wood Duck			6			
<i>Chthonicola sagittata</i>	Speckled Warbler				2		2
<i>Cincloramphus mathewsi</i>	Rufous Songlark	3		6	10	2	
<i>Climacteris picumnus victoriae</i>	Brown Treecreeper (eastern subspecies)	2	4	3			
<i>Cocomantis pallidus</i>	Pallid Cuckoo	1					
<i>Colluricincla harmonica</i>	Grey Shrike-thrush			1			
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike				1	3	
<i>Coracina tenuirostris</i>	Cicadabird	1	2				

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**Table F-7 (Continued)
Fauna Monitoring Results**

Scientific Name	Common Name	FST01	FST02	FST03	FST04	FST05	FST06
<i>Cormobates leucophaeus</i>	White-throated Treecreeper	2	1				3
<i>Coturnix pectoralis</i>	Stubble Quail					1	
<i>Cracticus nigrogularis</i>	Pied Butcherbird					2	
<i>Cracticus torquatus</i>	Grey Butcherbird			1			1
<i>Dacelo novaeguineae</i>	Laughing Kookaburra	7	1				3
<i>Daphoenositta chrysoptera</i>	Varied Sittella		6				
<i>Dicaeum hirundinaceum</i>	Mistletoebird		1	1	1		1
<i>Eolophus roseicapillus</i>	Galah		8	2		14	
<i>Eopsaltria australis</i>	Eastern Yellow Robin	3	2				3
<i>Eudynamys orientalis</i>	Eastern Koel		1				
<i>Eurostopodus mystacalis</i>	White-throated Nightjar	1		1			
<i>Eurystomus orientalis</i>	Dollarbird		1	1			
<i>Falco cenchroides</i>	Nankeen Kestrel					1	
<i>Falcunculus frontatus</i>	Crested Shrike-tit	1					
<i>Geopelia humeralis</i>	Bar-shouldered Dove			1			
<i>Geopelia striata</i>	Peaceful Dove				2		
<i>Gerygone fusca</i>	Western Gerygone	2			1		

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**Table F-7 (Continued)
Fauna Monitoring Results**

Scientific Name	Common Name	FST01	FST02	FST03	FST04	FST05	FST06
<i>Gerygone olivacea</i>	White-throated Gerygone		3				3
<i>Glossopsitta concinna</i>	Musk Lorikeet				7		
<i>Glossopsitta pusilla</i>	Little Lorikeet	2	6	25			
<i>Grallina cyanoleuca</i>	Magpie-lark			3	2		
<i>Gymnorhina tibicen</i>	Australian Magpie	2	1	6	2	2	1
<i>Hirundo neoxena</i>	Welcome Swallow	1					
<i>Hirundo nigricans</i>	Tree Martin	2					
<i>Lichenostomus chrysops</i>	Yellow-faced Honeyeater		9				10
<i>Lichenostomus fuscus</i>	Fuscous Honeyeater	34	4				
<i>Lichenostomus leucotis</i>	White-eared Honeyeater	4	1	1			2
<i>Lichenostomus virescens</i>	Singing Honeyeater	1		2		1	
<i>Malurus cyaneus</i>	Superb Fairy-wren	1	9	4	1		6
<i>Manorina melanocephala</i>	Noisy Miner		3	2	4		
<i>Melanodryas cucullata cucullata</i>	Hooded Robin (south-eastern form)	1					1
<i>Melithreptus lunatus</i>	White-naped Honeyeater		6				
<i>Microeca fascinans</i>	Jacky Winter	2	1		1		
<i>Myiagra inquieta</i>	Restless Flycatcher		2				
<i>Myiagra rubecula</i>	Leaden Flycatcher		2				
<i>Neophema pulchella</i>	Turquoise Parrot	2	2	1	3		

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Fauna Monitoring Results**

Scientific Name	Common Name	FST01	FST02	FST03	FST04	FST05	FST06
<i>Ninox novaeseelandiae</i>	Southern Boobook			1		1	3
<i>Ocyphaps lophotes</i>	Crested Pigeon			6		1	
<i>Oriolus sagittatus</i>	Olive-backed Oriole	1	1				
<i>Pachycephala pectoralis</i>	Golden Whistler		1				
<i>Pachycephala rufiventris</i>	Rufous Whistler	6	6	2	1	1	3
<i>Pardalotus punctatus</i>	Spotted Pardalote	1			1		4
<i>Petroica goodenovii</i>	Red-capped Robin				1		
<i>Phaps chalcoptera</i>	Common Bronzewing	2		4	2		6
<i>Philemon corniculatus</i>	Noisy Friarbird	3	5	8	1		
<i>Platycercus elegans</i>	Crimson Rosella			2			
<i>Platycercus eximius</i>	Eastern Rosella			3	3		
<i>Plectorhyncha lanceolata</i>	Striped Honeyeater	4	2	4	4		1
<i>Podargus strigoides</i>	Tawny Frogmouth	4	2	1			2
<i>Psephotus haematonotus</i>	Red-rumped Parrot			2			
<i>Rhipidura albiscarpa</i>	Grey Fantail		1				1
<i>Rhipidura leucophrys</i>	Willie Wagtail	16	3	4		2	3
<i>Scythrops novaehollandiae</i>	Channel-billed Cuckoo						1
<i>Sericornis frontalis</i>	White-browed Scrubwren						2
<i>Smicromis brevirostris</i>	Weebill						3

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**Table F-7 (Continued)
Fauna Monitoring Results**

Scientific Name	Common Name	FST01	FST02	FST03	FST04	FST05	FST06
<i>Stagonopleura guttata</i>	Diamond Firetail		1				
<i>Strepera graculina</i>	Pied Currawong				1		2
<i>Struthidea cinerea</i>	Apostlebird			1	15		
<i>Sturnus vulgaris*</i>	Common Starling			1			
<i>Todiramphus sanctus</i>	Sacred Kingfisher	3	4	4		1	
<i>Turnix varia</i>	Painted Button-quail		1				
<i>Zosterops lateralis</i>	Silvereye	4					
Mammalia							
<i>Murid</i>			1				
<i>Unidentified</i>	unidentified small mammal	2		1		3	
<i>(Microchiroptera suborder)</i>	unidentified microbat	6	15				
<i>Acrobates sp. (previously pygmaeus)</i>	unidentified Feathertail Glider	1	1				
<i>Austronomus australis</i>	White-striped Free-tailed Bat	2	1	4	3	2	7
<i>Canis lupus*</i>	Domestic Dog	2					
<i>Capra hircus*</i>	Goat	2	2		3	1	3
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	1	2	1		1	
<i>Chalinolobus gouldii</i>	Gould's Wattled Bat	1	1	1	1	1	1

	TARRAWONGA OPEN CUT OPERATIONS	Document Owner:	Group Superintendent - Biodiversity
		Document Approver:	TAR Environmental Superintendent
		Issue:	2.8
		Last Revision Date:	16 August 2022
		Revision Period:	5 Years
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**Table F-7 (Continued)
Fauna Monitoring Results**

Scientific Name	Common Name	FST01	FST02	FST03	FST04	FST05	FST06
<i>Chalinolobus morio</i>	Chocolate Wattled Bat	1	2	1	1	1	1
<i>Dama dama</i> *	Fallow Deer				2		
<i>Felis catus</i> *	Cat				4		
<i>Macropod sp.</i>	unidentified macropod	2			2	1	17
<i>Macropus giganteus</i>	Eastern Grey Kangaroo	9		10	22	14	2
<i>Macropus robustus</i>	Common Wallaroo	1		2		2	6
<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing-bat			1			1
<i>Mormopterus (Ozimops) petersi</i>	Inland Free-tailed Bat	1	1	1	1	1	1
<i>Mormopterus (Ozimops) planiceps</i>	South-eastern Free-tailed Bat	1	2	2	1	1	1
<i>Mormopterus sp.</i>	unidentified Mormopterus				1		
<i>Nyctophilus corbeni</i>	Corben's Long-eared Bat		1				
<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat		6	14			
<i>Nyctophilus gouldi</i>	Gould's Long-eared Bat	1	1	1			
<i>Nyctophilus sp.</i>	unidentified Nyctophilus	1	1	1	1	1	1
<i>Petaurus norfolcensis</i>	Squirrel Glider		1		1		
<i>Pseudocheirus peregrinus</i>	Common Ringtail Possum		10	3	1		1
<i>Rattus rattus</i> *	Black Rat	1					1

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**Table F-7 (Continued)
Fauna Monitoring Results**

Scientific Name	Common Name	FST01	FST02	FST03	FST04	FST05	FST06
<i>Rhinolophus megaphyllus</i>	Eastern Horseshoe Bat	1			1		1
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat		1		1		1
<i>Scotorepens balstoni</i>	Inland Broad-nosed Bat	1	1	2	1		1
<i>Scotorepens greyii/Scotorepens unnamed</i>	Little Broad-nosed Bat/Central-eastern Broad-nosed Bat	1	1	1			1
<i>Sus scrofa</i> *	Pig	2	4	6	16		20
<i>Tachyglossus aculeatus</i>	Short-beaked Echidna						1
<i>Trichosurus vulpecula</i>	Common Brushtail Possum	13	19	1	1		6
<i>Vespadelus darlingtoni</i>	Large Forest Bat	13	9	5			2
<i>Vulpes vulpes</i> *	Red Fox	3	3	1	1	1	3
<i>Wallabia bicolor</i>	Swamp Wallaby	3	1	2	3		2
Reptilia							
<i>Amphibolurus muricatus</i>	Jacky Lizard		1				
<i>Anomalopus leuckartii</i>	Two-clawed Worm-skink	1	1	2			3
<i>Carlia vivax</i>	Tussock Rainbow-skink			6			
<i>Cryptoblepharus pulcher</i>	Elegant Snake-eyed Skink				1		
<i>Ctenotus robustus</i>	Robust Ctenotus	1	1				
<i>Delma plebeia</i>	Leaden Delma						3
<i>Diporiphora nobbi</i>	Nobbi			2			
<i>Egernia cunninghami</i>	Cunningham's Skink			2			

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**Table F-7 (Continued)
Fauna Monitoring Results**

Scientific Name	Common Name	FST01	FST02	FST03	FST04	FST05	FST06
<i>Egernia striolata</i>	Tree Skink	6					1
<i>Eulamprus quoyii</i>	Eastern Water-skink			2			
<i>Geckonid</i>	unidentified Gecko						1
<i>Gehyra dubia</i>	Dubious Dtella	1	1				
<i>Hemiergis talbingoensis</i>	Eastern Three-toed Earless Skink	1					
<i>Heteronotia binoei</i>	Bynoe's Prickly Gecko						1
<i>Lygisaurus foliorum</i>	Tree-base Litter-skink	2					1
<i>Morethia boulengeri</i>	South-eastern Morethia Skink		2	5			
<i>Nebulifera robusta</i>	Robust Velvet Gecko		2		1		1
<i>Pogona barbata</i>	Bearded Dragon		1	6	1		
<i>Pseudonaja textilis</i>	Eastern Brown Snake		1				
<i>Strophurus sp.</i>	unidentified Strophurus				1		
<i>Strophurus williamsi</i>	Eastern Spiny-tailed Gecko				5		
<i>Underwoodisaurus milii</i>	Thick-tailed Gecko			4			