
ASHTON COAL PROJECT

FLORA AND FAUNA (BIODIVERSITY)
MANAGEMENT PLAN

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1 INTRODUCTION

This Flora and Fauna (Biodiversity) Management Plan (FFMP) has been prepared to address the management and mitigation of potential impacts of the Ashton Coal Project (ACP) to aquatic and terrestrial flora and fauna.

This FFMP supersedes the previously approved ACOL Flora and Fauna Management Plan (Rev C, 2006) and encompasses the requirements of the ACP development approval following the Bowmans Creek Diversion modification (DA 309-11-2001-MOD6) and the Conservation Agreement.

This FFMP is intended to address Condition 3.46 of DA 309-11-2001 (as amended), refer to **Appendix A**.

1.1 BACKGROUND

Development consent for the ACP was granted to Ashton Coal Operations Pty Limited (ACOL) on 11 October 2002. On 24 December 2010 the Minister for Planning approved a modification (DA 309-11-2001 MOD 6) to the existing development consent under Section 75W of Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The modification includes diverting Bowmans Creek to enable more efficient mining of underlying coal resources by longwall extraction. The impacts of the diversion and revised longwall mine layout on flora and fauna are described in the Bowmans Creek Diversion Environmental Assessment (Evans and Peck, 2009).

A Conservation Agreement (dated 16 September 2010) was made between ACOL and the NSW Minister for the Environment under the *National Parks and Wildlife Act 1974* (NP&W Act). The Conservation Agreement covers a parcel of land equal to 65.66 hectares in the south east of the ACP site (the southern woodland voluntary conservation area). The Conservation Agreement, together with the environmental management plans for the ACP site, constitutes the Plan of Management for the conservation area required by the development consent.

1.2 SCOPE

This Flora and Fauna (Biodiversity) Management Plan (FFMP) describes the measures to be implemented to manage and mitigate the potential impacts of the ACP on:

- Threatened and protected flora and fauna species, populations and communities; and
- Terrestrial and aquatic biodiversity values.

The FFMP outlines procedures for clearing or disturbing vegetation/habitats and monitoring remnant habitats. It also contains protocols for the identification and management of impacts on flora and fauna. The strategies outlined within this FFMP apply to both the underground and open cut mining operations.

The FFMP has been developed in consultation with the Office of Environment and Heritage (OEH) (formerly the Department of Environment, Climate Change and Water (DECCW)), Singleton Council and the Department of Trade and Investment, Regional Infrastructure and Services (DTIRIS) (formerly the Department of Industry and Investment), and is to be approved by Department of Planning and Infrastructure (DP&I) (correspondence shown in **Appendix B**).

1.3 RELATED DOCUMENTS

This FFMP forms part of the ACOL Environmental Management Strategy (EMS). The following management plans and documents are of relevance to the management of habitats at the ACP:

- Rehabilitation Management Plan;
- Landscape and Revegetation Management Plan;
- Land Management Plan; and
- Bushfire Management Plan.

1.4 STRUCTURE OF THIS REPORT

The remainder of this FFMP is structured as follows:

- Section 2: Outlines the **objectives** of this management plan and sets out the **performance measures** and **performance indicators** relevant to the management of threatened species, populations and their habitats within the ACP.
- Section 3: **Describes** the threatened species and populations known, or considered likely to occur within the ACP. Also includes a brief description of existing habitats.
- Section 4: **Details** the proposed methodology for the monitoring of flora and fauna within the ACP.
- Section 5: **Details** the principles of threatened species habitat management within the ACP.
- Section 6: **Outlines** the proposed management and monitoring actions relevant to the management of habitat and monitoring of impacts.
- Section 7: **Summarises** the responsibilities, reporting and auditing processes under this FFMP.
- Appendix A Lists relevant development consent requirements.
- Appendix B Copies of relevant correspondence from statutory agencies.
- Appendix C Provides the Vegetation Clearance Protocol for all clearing activities carried out within the ACP.
- Appendix D Summary of relevant measures contained within the Conservation Agreement.

2 OBJECTIVES & PERFORMANCE

2.1 OBJECTIVES

Objectives under the ACOL EMS and development consent for the ecological values of the site are to:

- Maintain existing areas of vegetation not affected by surface mining as viable habitat through the control of weeds, feral animals and management of grazing regimes to promote natural regeneration;
- Rehabilitate the study area to provide an environment that is equal to, or better than, the pre-mining environment and is available for threatened species that may inhabit the area by improving connectivity between remnants, rehabilitating mined areas and controlling feral animals;
- Minimise impacts or environmental consequences to threatened species, threatened populations, endangered ecological communities and their habitats; and
- Manage and, where possible, enhance habitat quality of the aquatic and riparian ecosystem within Bowmans Creek (existing and diversion).

2.2 PERFORMANCE MEASURES

Detailed performance indicators for subsidence impacts to threatened flora and fauna and biodiversity values have been developed for the ACP in accordance with consent condition 3.9 and are presented in **Table 1**.

Monitoring will be used to assess the impact of the ACP against the performance measures and indicators detailed in **Table 1**. If monitoring and assessment indicates that a performance indicator has been exceeded, or likely to be exceeded, ACOL will implement the contingency measures outlined in **Section 7.1**.

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Table 1: Performance Measures

Criteria	Performance Measure A	Indicator of Success B	Key Assessment Considerations C
General			
Weed Control	Weeds controlled in accordance with the requirements of the relevant legislation and weed/land management authorities.	Weed densities and sprawl across the site broadly comparable to (or less than) previous surveys. Surveys confirm that all areas targeted during previous years weed control program had been controlled with limited regrowth.	<ol style="list-style-type: none"> 1) Does the monitoring and assessment indicate that a performance measure or development consent condition has been exceeded, or likely to be exceeded? 2) Does this exceedance increase the risk for any of the ecological issues (species, populations, communities or habitats) under investigation? 3) What is the nature of the risk? <ul style="list-style-type: none"> • habitat loss; • habitat connectivity/fragmentation; • structural diversity; • species diversity; • increased predation (feral animals); • competition for resources and weed invasion; and • Increased fire frequencies. 4) What are the potential factors that may have contributed to the risk i.e. subsidence, inadequate management measure? 5) What actions, if any are required to mitigate and/or minimise the potential for future impacts and monitor the long term impacts of the exceedance?
Feral Animal Control	Feral animal control using appropriate means for any declared pest species known on the ACP. Annually, prior to fox breeding season or as required.	Feral animals managed so that they do not have deleterious impacts on threatened species, threatened populations, endangered ecological communities or their habitats. Monitoring confirms no increase in the fox population and all active rabbit warrens are ripped or fumigated upon detection.	
Bush Fire Management	Vegetation managed to control fuel loads. Maintain the ecological integrity of managed remnants.	Indicators described in Bushfire Management Plan.	
Aboriginal cultural heritage	Rehabilitation does not compromise Aboriginal cultural heritage relics or values.	Harm to Aboriginal objects is avoided and where this is not possible is undertaken in accordance with an appropriate permit.	
Terrestrial Biodiversity/Habitat Values			
Vegetation Diversity	Vegetation communities removed (or reduced) in an area are replaced with similar communities and dominant species composition.	Species diversity to be broadly comparable to reference sites over time. As a measure of present diversity onsite, quantitative data collected (18 sample sites) has identified 91 native flora species as being endemic. These species will form the lowest	<ol style="list-style-type: none"> 1) Does the monitoring and assessment indicate that a performance measure or development consent condition has been exceeded, or likely to be exceeded? 2) What is the nature of the exceedance?

Criteria	Performance Measure A	Indicator of Success B	Key Assessment Considerations C
	Revegetation works will be undertaken in line with the recommendations of the monitoring programs and relevant scientific research.	benchmark for rehabilitation of floristic diversity. At least 30% of the areas disturbed for emplacement areas will be re-established as bushland.	<ul style="list-style-type: none"> • habitat loss • habitat connectivity/fragmentation • structural diversity • species diversity • seed bank and recruitment of juveniles • key habitat elements (i.e. hollows, nesting habitat) • key abiotic resources (i.e. water availability) • increased predation (feral animals) • competition for resources and weed invasion <p>3) What are the potential factors that may have contributed to the risk i.e. subsidence, inadequate management measure or climatic conditions?</p> <p>4) What actions, if any are required to mitigate and/or minimise the potential for future impacts and monitor the long term impacts?</p>
Effective habitat linkages to surrounding vegetated lands	The rehabilitation program enhances habitat linkages across the site and with surrounding vegetated lands in keeping with the Synoptic Plan.	Corridors developed as per the Rehabilitation Strategy (Evans & Peck 2009) and Landscape Restoration Report (AECOM 2009) to create a mosaic of agricultural land and wildlife habitat.	
Ecosystem health	<p>The vegetation community structure (both physical and biological) is rehabilitated to promote a condition comparable to the local vegetation in pre-mining reference sites.</p> <p>Structural complexity scores will be achieved by sampling complexity using a modified vegetation complexity assessment method as first developed by Newsome and Catling (1979). This quantitative data will be compared with data sets from reference sites to assess community structure.</p>	<p>Projected foliage cover and plant species diversity at all key strata levels is broadly comparable to, or better than, pre-mining reference sites (annual monitoring to begin three years after commencement of rehabilitation activities to allow shrubs, grasses and herbs to reach a stage and density where identification of the species may occur).</p> <p>Viable hollow bearing limbs and stags are salvaged and not burnt, to augment and reconstruct faunal habitat.</p> <p>Nest boxes and roosts are installed within existing and rehabilitated habitats and monitored to confirm their suitability for use by local fauna.</p>	
	Land function of disturbed land is rehabilitated to provide recovery in complexity with time.	Positive trends in heterogeneity against land function metrics including: vegetation mosaics; ground cover; leaf litter and organic matter; soil depth and quality; shading; water flow paths and microhabitats.	
	Existing habitat is protected from degradation by grazing and unnecessary vehicle movements.	Key habitat areas fenced or signposted to prevent the uncontrolled entry of livestock and to minimise vehicular traffic.	

Criteria	Performance Measure A	Indicator of Success B	Key Assessment Considerations C
Southern woodland conservation area	Manage the southern woodland voluntary conservation area in accordance with the Conservation Agreement.	Specific management practices are incorporated into the site protocols and surveys indicate that species diversity is comparable to pre-mining reference sites.	
Aquatic and Riparian Biodiversity			
Aquatic Ecosystem health and biodiversity	Manage the impact of the ACP on aquatic habitat quality and biodiversity relative to the condition in the catchment.	Macroinvertebrate species diversity, SIGNAL scores and fish diversity in streams and pools experience no change as a result of mining.	<ol style="list-style-type: none"> 1) Does the monitoring and assessment indicate that a performance measure or development consent condition has been exceeded, or likely to be exceeded? 2) Does this exceedance increase the risk for aquatic and/or riparian habitats? 3) What is the nature of the risk? <ul style="list-style-type: none"> • stream health (SIGNAL scores) • macro invertebrate diversity • fish diversity • water quality • habitat connectivity/fragmentation • fish passage • structural elements • groundwater 4) Investigate site specific changes against upstream and downstream reference sites. What are the potential factors that may have contributed to the consequence i.e. subsidence, inadequate management measure or climatic conditions? 5) What are the potential impacts on the long term viability of the aquatic and riparian habitats? 6) Has the habitat connectivity been affected?
		Water quality parameters are similar to reference sites or within the default range for lowland rivers set by ANZECC (2000) guidelines for the maintenance of aquatic ecological function.	
Habitat extent and linkages	The aquatic and riparian ecosystem within Bowmans Creek is managed and where possible enhanced.	Corridors developed as per the Rehabilitation Strategy (Evans & Peck 2009) and Landscape Restoration Report (AECOM 2009) to create a mosaic of agricultural land and wildlife habitat.	<ol style="list-style-type: none"> 1) What actions, if any are required to mitigate and/or minimise the potential for future impacts?
	To identify changes in riparian vegetation composition and structure occurring along Bowmans Creek over time.	<p>Projected foliage cover and plant species diversity at all key strata levels is broadly comparable to, or better than, pre-mining reference sites.</p> <p>No evidence of dieback or loss of previously healthy riparian trees within pre-mining reference sites (<10%).</p>	
	Ensure fish passage and aquatic ecology of diversion sections is maintained and where possible enhanced.	Fish passage and aquatic ecology of diversion sections to be same or better than pre-construction baseline conditions and in line with trends exhibited in the retained sections of the creek using macro-invertebrate diversity, (SIGNAL index, species lists and RCE scores).	

Criteria	Performance Measure A	Indicator of Success B	Key Assessment Considerations C
Groundwater Dependant Ecosystems (GDE)	To monitor the health and viability of the GDE over time and obtain data to assist with future regeneration and rehabilitation of the River Red Gum population on site.	Comparative health assessments indicate that compared to a reference site, no overall decline in tree health is being observed.	
Threatened species, Populations and Endangered Ecological Communities			
Endangered population	<p>The overall River Red Gum Population to be managed so that the long term viability of the local population is not directly impacted by mining.</p> <p>The health of established River Red Gum individuals will be maintained until project completion.</p>	<p>Established area of planted River Red Gum to achieve a co-dominant status in regeneration areas as outlined in the rehabilitation strategy to an area equalling 10.48 ha.</p> <p>Comparative health assessments indicate that compared to a reference site, no overall decline in tree health is observed. Recruitment of juveniles and seed bank establishment is improved above pre-mining conditions.</p> <p>Comparative assessment of groundwater, surface water, stream water and soil moisture conditions relative to reference control sites does not show relationships between changes in these conditions onsite and a reduction in River Red Gum health.</p>	<p>2) Does the monitoring and assessment indicate that a performance measure or development consent condition has been exceeded, or likely to be exceeded?</p> <p>3) Does this exceedence increase the risk for any threatened species, populations, communities or their habitats?</p> <p>4) What is the nature of the risk?</p> <ul style="list-style-type: none"> • habitat loss • habitat connectivity/fragmentation • home range size • structural diversity/elements • species diversity • migration • seed bank and recruitment of juveniles • key habitat elements (i.e. hollows) • key abiotic resources (i.e. water availability) • increased predation (feral animals) • competition for resources and weed invasion • Increased fire frequencies
Threatened species	Threatened fauna species and their habitats are not adversely impacted.	<p>Terrestrial fauna and habitat monitoring shows that the numbers of threatened species and the health (including recruitment) of significant populations are not declining and results are comparable or improved from the baseline surveys.</p> <p>Monitoring shows that individuals are progressively expanding into new home ranges.</p> <p>Monitoring shows that key habitat features (foraging, nesting, refuge habitat) and structural complexity within remnant and rehabilitated/ compensatory habitat areas are not declining and results are comparable with the pre-mining surveys.</p>	<p>5) What are the potential factors that may have contributed to the risk i.e. subsidence, inadequate management measure or climatic conditions?</p> <p>6) What actions, if any are required to mitigate and/or minimise the potential for future impacts and monitor the long term impacts?</p>

Criteria	Performance Measure A	Indicator of Success B	Key Assessment Considerations C
	<p>Ensure that any threatened fauna or flora that have not been identified in the EIS, but which may inhabit the site, are identified as early as practicable.</p>	<p>New listings and new threatened species identified during the bi-annual monitoring program are assessed for impacts and any management recommendations are incorporated into future relevant management plans.</p>	

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3 EXISTING ENVIRONMENT

3.1 THREATENED SPECIES

A detailed flora and fauna impact assessment was conducted for the ACP EIS (HLA, 2001), with additional surveys and biannual monitoring reports conducted in accordance with the development consent conditions and statutory requirements. A riparian and aquatic ecology assessment report was also prepared for the Bowmans Creek Diversion EA (MPR, 2009). These surveys identify 20 threatened flora and fauna species and populations likely to occur within the ACP (refer to **Table 2** and **Figure 1**).




Table 2: Threatened Flora and Fauna

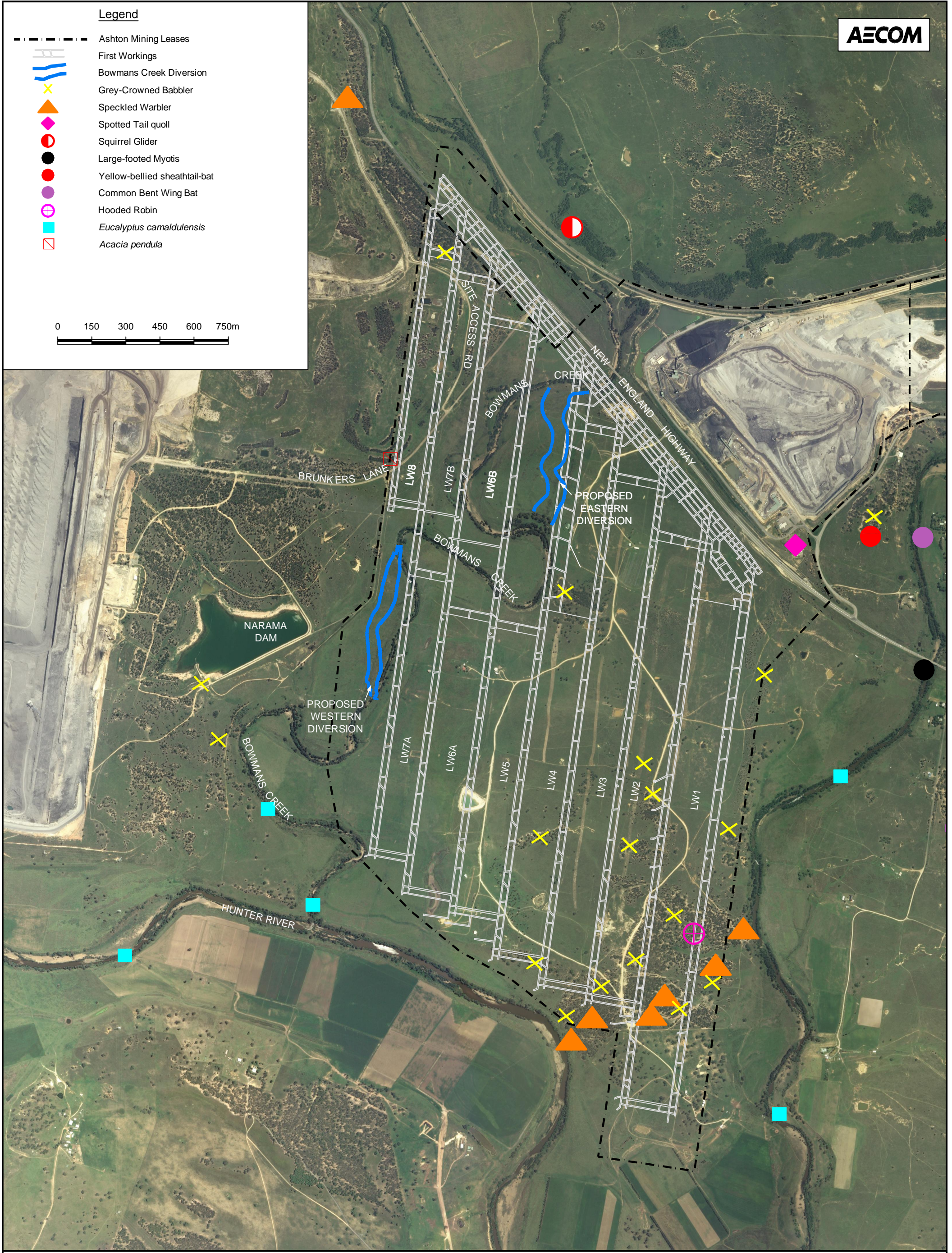
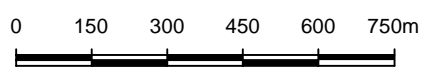
Population or Species	TSC Act	EPBC Act	Lifecycle/seasonal limitations
River Red Gum (<i>Eucalyptus camaldulensis</i>) population in the Hunter Catchment	E	-	No seasonal limitations. Seed collection Spring.
Green and Golden Bell Frog <i>Litoria aurea</i>	E1	V	Breeds in summer when conditions are warm and wet.
Giant Burrowing Frog <i>Heleioporus australiacus</i>	V	V	Breeds mainly in Autumn, but has been recorded calling throughout the year immediately before or following heavy rain.
Hooded Robin <i>Melanodryas cucullata cucullata</i>	V	-	Requires structurally diverse habitats. Breed between July and November and may raise several broods.
Grey-crowned Babbler <i>Pomatostomus temporalis temporalis</i>	V	-	Breed between July and February. Nests are maintained year round and used as a dormitory for roosting each night.
Speckled Warbler <i>Pyrrholaemus sagittatus</i>	V	-	Breed between August and January. Nests are located in a slight hollow in the ground or the base of a low dense plant.
Turquoise Parrot <i>Neophema pulchella</i>	V	-	Nests in tree hollows, logs or posts, from August to December.
Flame Robin <i>Petroica phoenicea</i>	V		Breeds in spring to late summer. Nests are often near the ground and are built in sheltered sites, such as shallow cavities in trees, stumps or banks.
Diamond Firetail <i>Stagonopleura guttata</i>	V		Feeds exclusively on the ground. Breeds between August and January.
Spotted Harrier <i>Circus assimilis</i>	V		Breeds spring (or sometimes autumn), with young remaining in the nest for several months.
Black-breasted Buzzard <i>Hamirostra melanosternon</i>	V		Breeds from August to October near water in a tall tree.
Little Eagle <i>Hieraaetus morphnoides</i>	V		Breeds during spring, and young fledge in early summer. Nests in tall living trees within a remnant patch, where pairs build a large stick nest in winter.

Population or Species	TSC Act	EPBC Act	Lifecycle/seasonal limitations
Large-eared Pied Bat <i>Chalinolobus dwyeri</i>	V	V	Females have been recorded raising young in maternity roosts from November through to January.
Spotted-tail Quoll <i>Dasyurus maculatus</i>	V	E	Breeding season between April - August. The gestation period is 3 weeks and juveniles become independent at 18 weeks.
Eastern Bentwing-bat <i>Miniopterus schreibersii oceanensis</i>	V	-	Maternity caves are used annually in spring and summer.
Squirrel Glider <i>Petaurus norfolkensis</i>	V	-	Gives birth in autumn/winter and again in spring/summer if conditions are favourable. Dispersal at 12 months.
Grey-headed Flying-fox <i>Pteropus poliocephalus</i>	V	V	Annual mating commences in January and a single young is born each October or November. Does not roost within woodland, may forage in spring to autumn, depending on flowering.
Yellow-bellied Sheath-tail Bat <i>Saccolaimus flaviventris</i>	V	-	Breeding has been recorded from December to mid-March, when a single young is born.
Large-footed myotis <i>Myotis macropus</i>	V	-	In NSW, females have one young each year usually in November or December.
Eastern freetail-bat <i>Mormopterus norfolkensis</i>	V	-	Roost mainly in tree hollows but will also roost under bark or in man-made structures.

E = Endangered; V = Vulnerable

Legend

-  Ashton Mining Leases
-  First Workings
-  Bowmans Creek Diversion
-  Grey-Crowned Babbler
-  Speckled Warbler
-  Spotted Tail quoll
-  Squirrel Glider
-  Large-footed Myotis
-  Yellow-bellied sheath-tail-bat
-  Common Bent Wing Bat
-  Hooded Robin
-  *Eucalyptus camaldulensis*
-  *Acacia pendula*



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3.2 RIPARIAN AND TERRESTRIAL HABITATS

Terrestrial habitats across the ACP include riparian corridors, floodplain pasture, flood terraces, upland forest, woodland remnants, and pasture with scattered trees. The majority of this habitat is characterised by natural regeneration sourced from the small number of remnant mature trees.

The isolated mature hollow-bearing trees and stags provide potential shelter and breeding habitat for a number of bird and arboreal mammal species. Fallen logs and leaf litter provide shelter and breeding habitat for small ground-dwelling mammals and reptiles with the grassy understorey and fallen timber providing suitable foraging substrate for the threatened grey-crowned babbler, speckled warbler and hooded robin.

The riparian habitats along Bowmans and Glennies Creek form part of a fragmented corridor south along the Hunter River and Wollombi Brook. This corridor is likely to be important for fauna movement from the surrounding area into vegetation and habitats of Wollemi National Park on the southern ranges of the Hunter Valley.

The Voluntary Conservation Area encompasses existing habitat within the south east of the ACP, is also referred to as the Southern Woodland. In accordance with the Development Consent active underground mining will be undertaken in this area over the life of the ACP, where ever possible surface disturbance will be kept to a minimum in accordance with the Conservation Agreement. This area consists of remnant woodland habitat which has been set aside as a conservation area under a commitment made in the original ACP Environmental Impact Statement (HLA, 2001) and in accordance with development consent condition no. 3.30.

3.3 AQUATIC HABITATS

Bowmans Creek is about 56km long and the headwaters are located in the Little Brothers Range, at an elevation of about 650m Australian Height Datum (AHD). The lower section of the creek within the ACP is 4.5km long located between the New England Highway and the Hunter River confluence (Evans and Peck, 2009). There is variable flow in this section of the creek and it is generally perennial, although surface flows can cease during severe droughts. The Bowmans Creek floodplain has been previously disturbed by cattle grazing, weed encroachment, vegetation clearing and rubbish dumping.

As described by Marine Pollution Research (MPR, 2009), Bowmans Creek within the ACP provides the following important ecological functions:

- Fish passage between the Hunter River and other upper catchment tributaries upstream of the New England Highway is available intermittently owing to the variable flow and shallow nature of some of the creek sections that dry out, or where surface water flow is through cobbles, thus isolating pools;
- Off-line fish refuge habitat during extended Hunter River flood events;
- Fish nesting habitat in the form of gravel bars in pools; and
- A complex of aquatic ecological habitats (cobble and sediment pools and riffles, rock bar pools) with varying depths and aquatic/emergent plants to support a complex assemblage of aquatic macro invertebrate fauna.

Glennies Creek is approximately 45km long and flows from its headwaters at Mount Royal to the Hunter River. It is a perennial creek that provides environmental and compensatory base-flow to the Hunter River from the Glennies Creek Dam storage at Lake St Clair. It is deeply incised into its channel throughout the ACP and consequently the banks are generally steep and in some cases unstable. Other than at the New England Highway road bridge there are

minimal rocky outcrops instream, with the channel comprising several long pools more or less permanently connected with their downstream ends. Glennies Creek within the ACP provides valuable fish habitat and supports permanent flow throughout its length. A number of native fish species and platypus are known to inhabit the area. Aquatic vegetation is present throughout the creek length and there are no significant impediments to fish or platypus migration through the ACP (MPR, 2009).

No species of fish or aquatic invertebrates listed under the NSW *Fisheries Management Act 1994* or the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) were recorded in any of the Bowmans Creek or Glennies Creek monitoring surveys to date. The coastal river freshwater catfish (*Tandanus tandanus*) has been recorded in Bowmans Creek. While not listed as a threatened species, this species' distribution and abundance has been significantly reduced throughout the southern parts of its known range and will be included as a target species within the aquatic ecology monitoring and management practices. In most of the Murray-Darling basin, it has been listed as an endangered population, so there is interest in the health of other NSW populations.

3.4 GROUNDWATER DEPENDANT ECOSYSTEMS

No Groundwater Dependant Ecosystems (GDE) have been reported to date within those parts of the alluvium that are predicted to be impacted during mining activities.

The River Red Gum Population (refer to **Figure 1**) is expected to be largely dependent on surface water flows, with limited seasonal recharge to an extent on groundwater baseflows through extending their roots into the water table. There are no impacts predicted on alluvial groundwater levels in this area.

4 MONITORING METHODOLOGY

In accordance with the development consent, ACOL has conducted bi-annual monitoring within the southern woodland voluntary conservation area since 2005 and Bowmans Creek since 2007. This monitoring provides information that is useful in assessing the continued survival and management of the native flora and fauna within the study area. Monitoring will continue until the completion of underground mining within the extraction area.

The aim of the monitoring program is to:

- Ensure that existing areas of vegetation not affected by mining are maintained as viable habitats;
- Ensure that the rehabilitation of the study area provides an environment that is equal to, or better than, the pre-mining environment and is available for threatened species that may inhabit the area; and
- Monitor any impacts attributable to the development, and assess the benefit of restoration works.

4.1 EXPERIMENTAL DESIGN OF PERFORMANCE SYSTEM

Any monitoring plan is underpinned by spatial-temporal replication to enable comparative contrasts and to evaluate whether or not an event has changed the environment, to determine which components are adversely affected, and to estimate the magnitude of the impact.

This design is often referred to as a Before–After Control-Impact (BACI) design. This is a classic method for measuring the potential impact of a defined event. Impacts can be analysed by measuring conditions before a planned activity and then comparing the findings to those conditions measured after. Studies may also make use of an unaffected or control site for comparisons. The riparian vegetation and aquatic ecology monitoring designs within the ACP incorporate the use of control sites located both up and downstream from the mining areas while the terrestrial fauna monitoring design uses the southern woodland voluntary conservation area and the northern woodland as a control/reference site (refer to **Figures 3-5**).

All monitoring within the FFMP is based on an asymmetrical design which is common when the impact sites are difficult to replicate (such as a mine). Trend analysis can then be used to help assess whether there is a functional relationship between sites. Potential trend analysis to detect change include analysis of variance (ANOVA), analysis of similarities (ANOSIM), permutational multivariate analysis of variance (PERMANOVA), principal component analysis (PCA) and multicriteria analysis (MCA).

4.2 TERRESTRIAL FAUNA MONITORING AND ANALYSIS

The locations of the current monitoring sites are shown in **Figure 2**. The location of the monitoring sites will be adjusted as necessary when revegetation and key habitat corridors become established (refer to **Figure 2**).

The methods to be utilised during the bi-annual survey periods include:

- Timed observations of bird species at specific locations within the woodland and corridors. Each survey will be conducted over an appropriate interval time (15 - 60 minutes depending on patch size) during periods of high activity i.e. early morning or early evening. Records will include species and counts of individuals. Birds recorded outside the survey period will be documented as 'opportunistic' observations.

- Targeted surveys for grey-crowned babbler, hooded robin and speckled warbler will be undertaken within both retained and revegetated habitats, including mapping of roosts and nests (where possible all nest and den trees will be permanently marked in the field for easy relocation and monitoring) and counts of individuals. Surveys will be carried out in both breeding and non-breeding seasons and will cover the all areas of potential habitat within the subsidence impact area.
- All roost and nest boxes will be visually inspected for damage and identification of any species occupying the boxes. During the inspection:
 - Exotic species, including starlings, common mynas and bees, will be removed;
 - Ants will be discouraged using talcum powder, where necessary; and
 - Damaged boxes will be repaired or replaced.
- Trapping of small and arboreal mammals at established locations in the retained/revegetated woodland areas and key wildlife corridors to the south of the New England Highway. Traps will be set for a minimum four consecutive nights and hair tubes for a minimum of 10 consecutive nights.
- Five randomly located reptile survey transects including 10 pitfall traps will be conducted during the survey period. The transects will be 50m long and 10m wide following MacNally and Brown (2001). Each of the transects will be surveyed diurnally over a timed period (10 minutes). Where a reptile species is observed an active search of that particular location will be undertaken.
- Amphibians will be monitored at set aquatic locations by listening for breeding choruses within a week of significant rainfall each season during mild conditions. If no rainfall has been recorded for the season the survey must take place in the last week of the season and will include both diurnal and nocturnal searches in areas of suitable habitat including the Hunter River.
- Transects used for landscape function analysis and arboreal trapping transects will also be used for ant assemblage surveys. When ant nests or foraging ants are identified, they will be collected, treated with ethanol (in the lab) and identified to genera level following the methods identified in Shattuck 2009.
- Opportunistic sightings and secondary indications (scats, scratches, diggings, tracks etc) of fauna will be noted and include:
 - Spotlighting and anabat surveys over a minimum of two non-consecutive nights;
 - Searching in suitable habitat for herpetofauna (reptiles and frogs);
 - Searches for whitewash, prey remains and regurgitation pellets from owls;
 - Checks for raptor nests;
 - Checks of trees for scratches consistent with arboreal mammals; and
 - Searches for scats of mammals.

The analysis of the monitoring data will relate the results back to benchmarks, so that if variation in biodiversity parameters is recorded, appropriate changes can be considered.

Assessment will look at relationships between landscape condition, health, diversity and abundance of the fauna assemblages in the area. This will also provide valuable data that can be used in other projects on the site and in the region.

Analysis of the data set will primarily involve the comparison of years by dominance curves (Abundance/Biomass Comparison or ABC curves). Phylogenetic structure is also recognised as being an important component of assessing the overall biodiversity of an area and will be incorporated into the monitoring reports. For example an assemblage comprising a group of closely related species is generally regarded as less 'biodiverse' than an assemblage of the same number of more distantly related species. Another aspect of the taxonomic structure is the 'evenness' of the distribution of taxa ie. are some taxa over-represented and others under-represented?

Landscape Function Analysis (LFA) will also be undertaken to provide improved insight into the condition and stability of the retained habitats in comparison to impact areas. LFA monitors the water driven resources of an area and uses indicators to determine sustainability indexes, which will be plotted over time.

4.3 RIPARIAN VEGETATION MONITORING

The riparian surveys will continue (biannually) for the life of the mine and up to 5 years after secondary extraction activities are complete.

The methodology used for the riparian vegetation surveys will be the same as the baseline assessment (ERM, 2006) and will be altered as necessary to incorporate the Bowmans Creek diversion. The baseline monitoring locations are shown in **Figure 4** and include a total of twelve transects and twelve quadrats. GPS Coordinates for each site are also provided in **Table 3**.

Table 3: Riparian Vegetation Monitoring Sites

Site Name	GPS Coordinates (MGA56)		Size/Length
Quadrats			
Quadrat 1	318451E, 6406641N		20m x 20m
Quadrat 2	318040E, 6406444N		20m x 20m
Quadrat 3	317939E, 6405720N		20m x 20m
Quadrat 4	317678E, 6405915N		20m x 20m
Quadrat 5	317983E, 6405907N		20m x 20m
Quadrat 6	317998E, 6406355N		20m x 20m
Quadrat 7	317145E, 6404501N		20m x 20m
Quadrat 8	315780E, 6404963N		20m x 20m
Quadrat 9	317375E, 6404990N		20m x 20m
Quadrat 10	317303E, 6404928N		20m x 20m
Quadrat 11	317009E, 6404491N		20m x 20m
Quadrat 12	317200E, 6404276N		20m x 20m
Transects			
	Start	Finish	
Transect 1	318380E, 6406653N	318260E, 6406640N	200m
Transect 2	318258E, 6405901N	318277E, 6405690N	200m
Transect 3	317569E, 6405917N	317583E, 6405744N	200m
Transect 4	317783E, 6405854N	317954E, 6405728N	200m
Transect 5	317865E, 6406044N	317876E, 6406193N	100m
Transect 6	318055E, 6406531N	318139E, 6406633N	200m
Transect 7	316971E, 6404533N	316864E, 6404664N	200m
Transect 8	317347E, 6405041N	317443E, 6405142N	200m
Transect 9	317494E, 6405343N	317444E, 6405216N	200m
Transect 10	316991E, 6405077N	316801E, 6405000N	200m
Transect 11	317080E, 6404053N	317112E, 6404201N	200m
Transect 12	317129E, 6404155N	317249E, 6404259N	200m

Source: ERM, 2006

These sites provide representative sample locations within the mining footprint as well as upstream and downstream control points. The following attributes will be noted at each site during the surveys:

- Dominant and sub-dominant species within each structural layer;
- Percentage cover of each structural layer;
- Level of disturbance and conditional rating;
- Evidence of regeneration; and
- Each site will also be photographed to allow visual comparison and identify any long term trends in riparian vegetation.

4.4 REHABILITATION MONITORING

Revegetated areas will be monitored following the methodologies outlined within the annual Rehabilitation Monitoring Program which compares the progress of the rehabilitation sites against a set of completion criteria obtained from measurement made in areas of remnant woodland and grassland communities in the local area.

Statistical analysis within established rehabilitated tree plots will be conducted annually three years after commencement of rehabilitation activities. This is to allow the seed bank to germinate, enabling shrubs, grasses and herbs to reach a stage and density where identification of the species may occur.

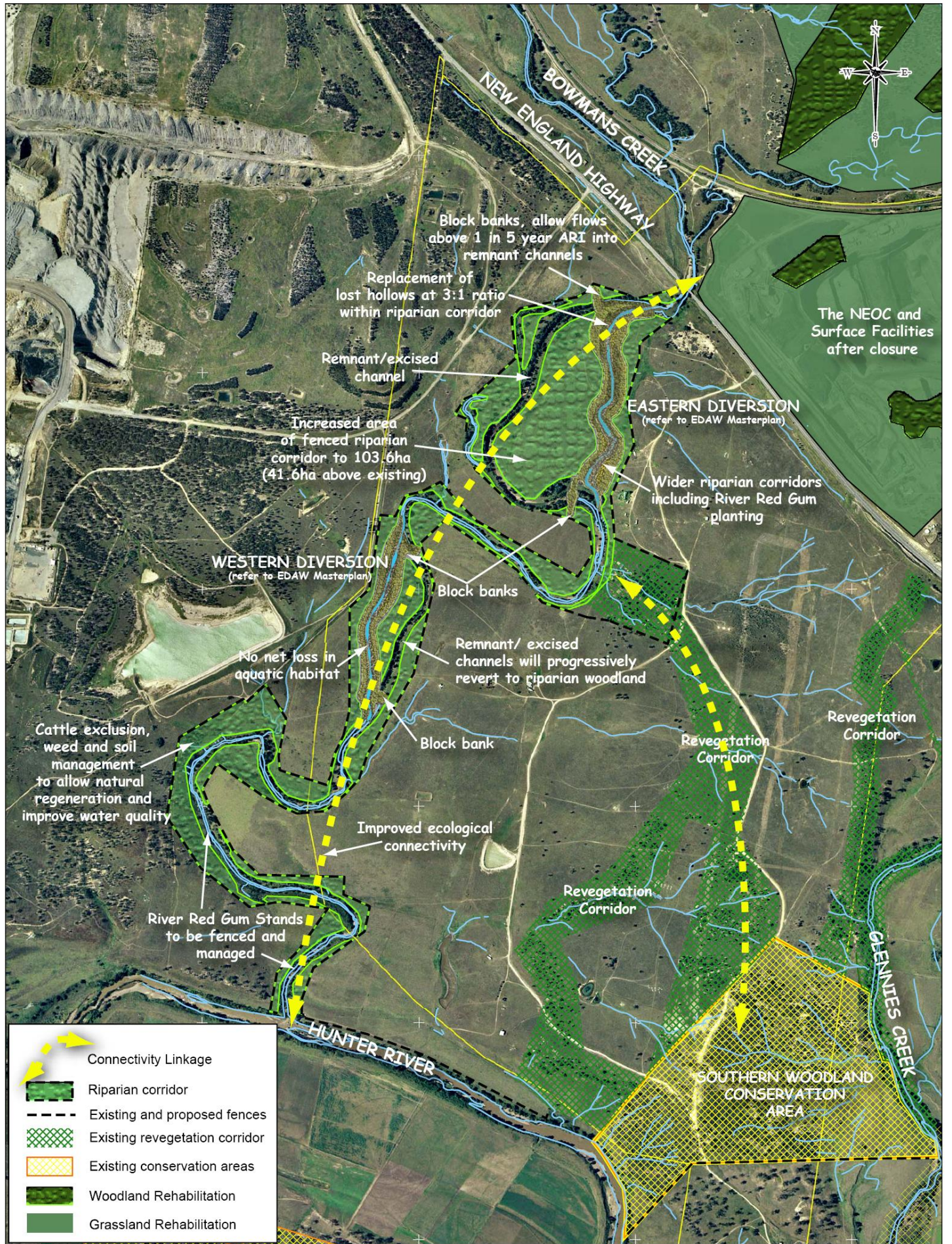
Landscape Function Analysis (LFA) will be undertaken within open cut rehabilitation monitoring. This method uses indicators to define the soil type and ten assessed parameters (e.g. soil, grass and litter cover). These indicators are then used to determine Sustainability indexes, which will be plotted over time. This will help to establish the success of site management and rehabilitation works, and will provide information to guide any corrective action.

4.5 RIVER RED GUM POPULATION MONITORING

River Red Gum monitoring programs include:

- bi-annual monitoring of River Red Gum populations to include visual surveys of ground surface disturbance and tree health;
- bi-annual monitoring of ground water in adjacent piezometers, soil moisture and leaf area index (LAI) at existing stands of River Red Gum and reference sites;
- an estimation of projected foliage cover of mature River Red Gum trees using vertical photographs;
- records of the site water balance, especially as overall site LAI increases during regeneration; and
- monitoring of rainfall and streamflow data and comparison with evapotranspiration rates and LAI changes.

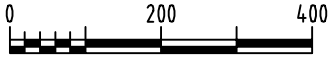
Measurements of the health of *E. camaldulensis* will follow the methods of Thornburn and Walker (1994) and will use reference sites for comparison.



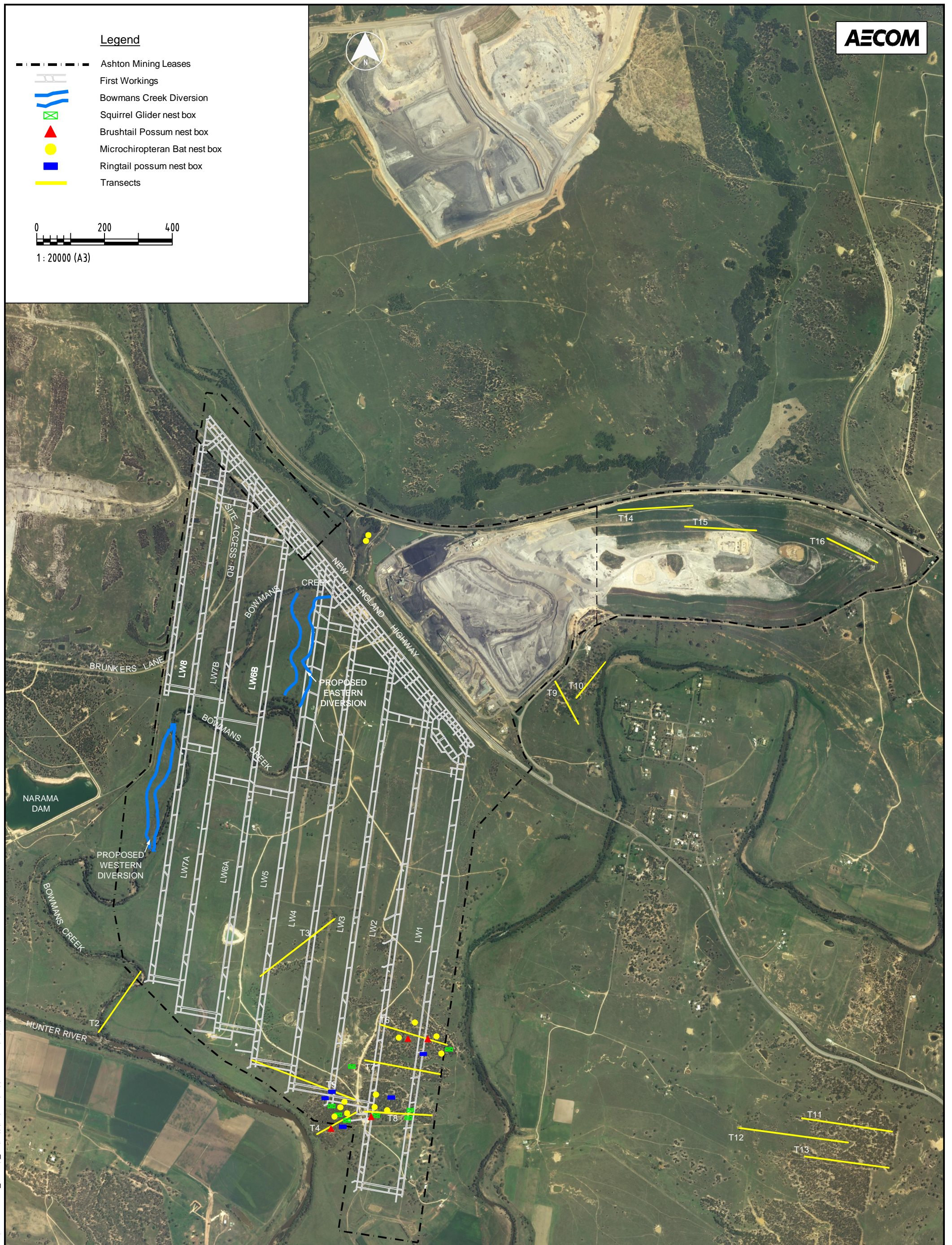
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Legend

-  Ashton Mining Leases
-  First Workings
-  Bowmans Creek Diversion
-  Squirrel Glider nest box
-  Brushtail Possum nest box
-  Microchiropteran Bat nest box
-  Ringtail possum nest box
-  Transects



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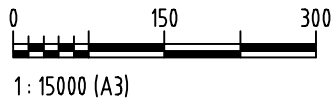


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Legend

- Ashton Mining Leases
- ACOL First Workings
- Bowmans Creek Diversion
- Quadrants (Control)
- Transects (Control)
- Quadrants (Impact)
- Transects (Impact)



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4.6 AQUATIC ECOLOGY MONITORING PROGRAM

Aquatic fauna and habitat, stream health and water quality will be monitored at established locations along Bowmans Creek and Glennies Creek in order to detect any possible mining or diversion related impact over the life of the mine (**Figure 5**).

The location of the monitoring sites will be adjusted as necessary to provide up and downstream reference sites. New long term monitoring sites will also be established along Bowmans Creek in the new creek sections and in each of the diversion channels to monitor developing aquatic attributes against existing habitat attributes (MPR, 2009). Temporary sites will also be established on the Hunter River (pre and post subsidence) if Longwall 1 is full length.

Pre-mining aquatic monitoring has been completed and provides measureable baseline data to assess:

- Impacts on existing communities along the creeks from subsidence and potential breakout points along the channel.
- Impacts to fish, fish passage, macroinvertebrates, water quality and aquatic habitat.

Water Quality

- The monthly water quality monitoring at the existing 'whole of mine' sites will be utilised. The location of the monitoring sites within Bowmans Creek will be adjusted as the creek diversions come on line.
- Field water quality (both chemical and physical) monitoring during the bi-annual aquatic ecology monitoring program will be continued and will include depth profile monitoring of field water quality parameters for EC, Temp, pH, turbidity, DO.
- Additional periodic field monitoring of the water quality within the excised portions of the creek will be undertaken.
- In regards to surface water flows, the NOW weir gauge provides adequate data to enable the interpretation of any changes in Bowmans Creek.

Aquatic Ecology (stream health)

Stream health is monitored in spring and autumn at a number of locations along creeklines including sites upstream, downstream and between the proposed Bowmans Creek diversion channels (see **Figure 5**) to assess the stream health against the pre-mining benchmarks (MPR, 2009).

The stream health monitoring includes:

- Macro-invertebrate sampling using AusRivAS protocols for collection and taxonomy.
- Fish sampling using bait traps set overnight plus direct observations and incidental captures during macro-invertebrate sampling. Data used to produce fish species lists per site per season;
- Site habitat diversity assessment using existing RCE method and site photo referencing;
- Metered and profiled water quality (EC, Temp, pH, turbidity, DO). Data are used to provide specific season between-site comparisons to aid interpretation of site aquatic biota differences for that season.

Additional fish trapping sites will be established throughout the creek to monitor fish passage during times when the creek has sufficient flow to allow fish passage and to monitor pool refuge areas during low/no flow periods.

Sampling of short-term post mining sites will be incorporated into the above bi-annual surveys to assess impacts to fish, fish passage, macro invertebrates, aquatic and riparian habitat. These post mining surveys enable direct assessment of mining impacts on individual pools as mining proceeds and to facilitate the interpretation of the long-term monitoring results. These surveys will be undertaken twice within one year of the longwall passing beneath Bowmans Creek. At least one survey of the short-time monitoring sites will also be undertaken prior to mining to allow direct comparison. Any decision to continue monitoring the short term sites beyond the two post-mining studies would be made on a site by site basis and only if there were evidence of localised mining or diversion related impacts.

Analysis

The AusRivAS derived macroinvertebrate data are used to compile site species diversity indices (i.e., number of macroinvertebrate taxa at each site) and site pollution sensitivity indices (using the Stream Invertebrate Grade Number Average Level (SIGNAL) biotic index). It is based on average sensitivity to disturbance of the aquatic macroinvertebrates present within a sample. Higher scores generally indicate healthier aquatic conditions as follows:

- SIGNAL Index > 6 = Healthy Unimpaired
- SIGNAL Index 5 – 6 = Mildly Impaired
- SIGNAL Index 4 – 5 = Moderately Impaired
- SIGNAL Index < 4 = Severely Impaired

Changes in SIGNAL index can be used to identify trends in overall ecological health of each site and also make comparisons between sites. The baseline indices over a number of survey periods are provided in **Table 4** below.

Table 4: Aquatic Ecology Performance Indicators (MPR, 2010)

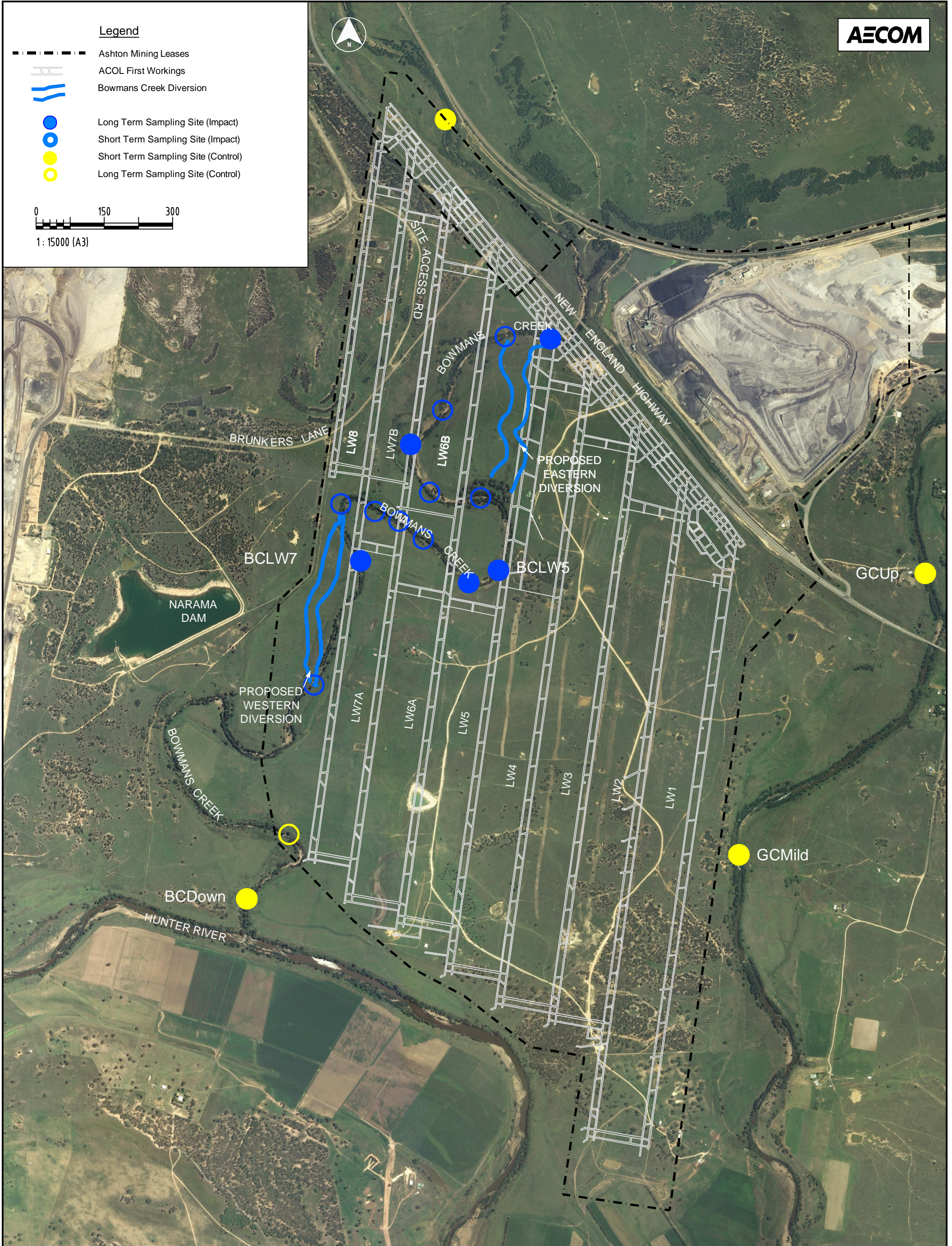
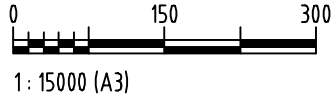
Season	Au07	Sp07	Au08	Sp08	Au09	Sp09	Au10
Bowmans Creek							
	N=4	N=4	N=4	N=6	N=6	N=6	N=6
Total number of invertebrate taxa	25	30	32	37	44	46	40
Mean number of taxa	14	17	18.8	18.8	19.8	21.2	17.5
SE creek number of taxa	2.5	1.9	1.1	1.8	1.9	2.6	2.4
Site SIGNAL Scores	2.95	3.64	4	3.93	3.75	3.55	3.61
Glennies Creek							
	N=4	N=4	N=4	N=6	N=6	N=6	N=6
Total number of invertebrate taxa	34	42	42	34	41	33	36
Mean number of taxa	19	22.6	24.2	20.8	24	21	22
SE creek number of taxa	3.6	1	0.5	0.4	0.8	0.6	2.1
Site SIGNAL Scores	3.71	3.8	3.9	3.74	3.95	3.71	3.98

SE: Standard Error of Means

In regards to the Bowmans Creek diversion, the expectation will be that individual indices will show an increase over time against the Bowmans Creek baseline data (approximately 2.5 years). Over this initial settlement period the trigger for possible corrective action would be decreasing or static indices. In this case the aquatic ecologist will first investigate the causes and once established make recommendations for either further investigations and/or remediation measures.

Legend

- Ashton Mining Leases
- ACOL First Workings
- Bowmans Creek Diversion
- Long Term Sampling Site (Impact)
- Short Term Sampling Site (Impact)
- Short Term Sampling Site (Control)
- Long Term Sampling Site (Control)



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5 HABITAT MANAGEMENT FOR THREATENED SPECIES

The southern woodland voluntary conservation area is known habitat of the grey-crowned babbler, hooded robin and speckled warbler and will be managed under the Plan of Management. This habitat is expected to improve as the woodland naturally regenerates and provides structural diversity through all strata levels, additional areas are revegetated with species that are typical of the area and as weeds and feral grazers/predators are managed. Any increase in habitat size and structural diversity also contributes to the long term viability of the local breeding populations of these vulnerable species.

Long term post mining land use objectives within the ACP are to create a mosaic of agricultural land and wildlife habitat. This will be achieved by limiting stock access to riparian and revegetated habitats and by allowing the continued grazing of stock within some woodland units once they have been established. The retention of fencing will allow the rotation of grazing within woodland units allowing the regeneration process to be controlled in the long term and to aid in bushfire hazard reduction by grazing.

The open cut area will be a mixture of grazing land and trees in clumps incorporating several dams to capture water from the emplacement areas. Trees in clumps will be fenced to restrict cattle access until maturity. Subsidised areas south of the highway will be predominantly improved pasture with isolated stands of trees, riparian vegetation along waterways and the southern woodland voluntary conservation area.

In order to minimise risk of impacts on the threatened species listed in **Table 2**, the following habitat enhancement and protection measures will also be implemented:

- As described within the Vegetation Clearance Protocol (**Appendix C**), where possible hollow branches will be relocated to the southern woodland voluntary conservation area to provide a supplementary habitat resource for hollow dependent fauna such as gliders and microchiropteran bats. Woody debris from smaller trees will be placed along the bunds or in small piles or strips within woodland to increase shelter and foraging opportunities for native fauna including the threatened grey-crowned babbler, hooded robin and speckled warbler.
- Floodplain grassy habitat will be created on the areas of fill by selective planting to enhance foraging habitat for woodland birds, bats and flying foxes. These areas will be fenced off and incorporated into the ACOL habitat corridor system and include perch sites for the hooded robin and dead timber left on the ground in open woodland areas. Collection of fallen timber will be prohibited.
- Remnant habitat north of the New England Highway will be used to form riparian and vegetation corridors. The eastern emplacement will be rehabilitated as a matter of priority.
- The overall River Red Gum population will be enhanced by planting on the stream and upper banks of the Bowmans Creek diversions. Stock exclusion (fencing) will aim to improve recruitment of juveniles and a seed bank will be established from mature trees on site.
- Existing habitats within the creek north and south of the New England Highway will be limited to weed control and revegetation to enhance wildlife movement along the riparian corridor.
- The riparian habitats associated with the Bowmans Creek diversion have been designed to include long term viable habitats for threatened species and will be incorporated into the overall dedicated conservation area for ACP.

The specific actions undertaken will be consistent with the Recovery Plans for these Threatened Species in accordance with the TSC Act 1995.

5.1 HABITAT REINSTATEMENT FOR THE GREEN AND GOLDEN BELL FROG

Management of existing habitats

Whilst the existing habitats within Bowmans Creek will not be actively managed for the green and golden bell frog, the clean water dams at the eastern toe of the emplacement will be vegetated and managed in such a way to filter sediments and to create refuge opportunities for this species. For example cumbungi (*Typha* sp.) can be used to trap sediment and to provide foraging and resting habitat, while a mixture of sedges, rushes, floating plants (excluding species that are likely to cover the water surface such as Nardoo (*Marsilea* sp.) and *Azolla* sp.) and the strategic placement of rock piles and woody debris will provide refuge for the species outside of the breeding stages of their lifecycle.

Habitat Creation

It is proposed that a series of weed-free and *Gambusia*-free habitat ponds with salinity levels between 2 and 4 ppt will be constructed along (but not inline) with Bowmans Creek. This area is nearest to the closest known population of green and golden bell frog (Narama) and the species would have direct connectivity to the constructed ponds via creek corridors (PEA *pers. com.*).

The placement of tall shrubs and trees near the aquatic habitats will be designed so as not to shade the aquatic habitat, therefore maintaining basking opportunities. Where the ponds are within pasture that is grazed, efforts will be made to restrict stock to defined access points to manage water quality. With the exception of designated watering areas stock will be excluded from at least 20m from the high water mark, allowing vegetation to establish and provide foraging and refuge opportunities. If Mosquito Fish are detected, ponds may be drained.

Foraging habitat and dispersal corridors will be maintained as open woodland with sparse/moderate groundcover interspersed with refuge habitat ie. rock piles and fallen timber. Where pasture becomes dense along the edges of the ponds or between clusters of ponds cattle may be temporarily introduced into the area to assist in maintaining a sparse ground cover as preferred by this species.

Detailed design will be undertaken following a review of the current studies being undertaken at the University of Newcastle. These studies are aimed towards assisting later rehabilitation and restoration trials proposed for parts of Kooragang Island and the Hunter generally, as well as for state-wide conservation initiatives.

5.2 FERAL ANIMAL CONTROL

A feral animal control program will be initiated within the ACP. The control plan will be centred on culling by professional shooters that may be supplemented by baiting where required. This approach has been selected because of the lack of selectivity of baiting (i.e. impacts on non-target species) and the removal of unnecessary suffering on the part of culled animals due to poisoning. The ACOL property is open and easily accessible to contract shooters allowing high levels of population control. Professional shooters are also the preferred feral animal control by surrounding landholders allowing for better coordination of control programs within the district. Where it is determined that baiting is required, it is proposed that baits be buried in circular patches of fine sand so species taking the bait can be identified. If a native species is suspected of taking the bait the baiting program will be suspended pending review of alternatives in consultation with agencies such as DPI (Agriculture division and Forests NSW), Rural Lands Protection Board, and OEH. The program will be annual, prior to the breeding cycle of foxes (*Vulpes vulpes*) and also on a need basis if an increase in the fox population is detected. It is proposed that active rabbit warrens be ripped or fumigated upon detection.

6 MANAGEMENT ACTIONS AND RESPONSIBILITIES

The actions that ACOL undertakes to fulfil the consent conditions outlined **Appendix A** are summarised in **Table 5**. These actions have been categorised into:

- Monitoring;
- Management; and
- Incident Response.

Procedures for flora and fauna monitoring and threatened species habitat management are detailed in **Section 4** and **Section 5** respectively. Vegetation clearance protocols are detailed in **Appendix C**.

A guiding set of criteria / protocols has been developed to establish the circumstances under which mitigation measures would be required. A proposed Trigger Action Response Plan (TARP) for biodiversity is presented in **Table 6**.

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Table 5: Flora and Fauna (Biodiversity) Management Actions and Responsibilities

Item	Action	Trigger/Timing	Responsibility
1.0	Monitoring		
1.01	Collect baseline data prior to the commencement of the underground mining operations, to be used to monitor the impact of the operations on the aquatic ecosystem health.	Completed prior to commencement of underground mining operations.	Environment and Community Relations Manager
1.02	Collect baseline data from temporary monitoring sites on the Hunter River prior to the commencement of Longwall 1, to be used to monitor the impact of the operations on the aquatic ecosystem health.	Prior to mining Longwall 1 (if longwall 1 to be full length).	Environment and Community Relations Manager
1.03	Visual inspection of the area immediately behind the longwall face passage as outlined within Extraction Land Management Plan, including a visual inspection of mapped nest and den trees to identify if any are a risk of damage or failure.	Fortnightly	Environment and Community Relations Manager
1.04	Undertake terrestrial fauna and habitat monitoring in accordance with the monitoring methodology outlined in Section 4 . If no rainfall has been recorded for the season, the amphibian survey must take place in the last week of the season.	Bi-annually	Environment and Community Relations Manager
1.05	Undertake monitoring of the River Red Gum population at existing stands and reference sites as outlined within Section 4 and Table 1 to monitor the health and viability of these potentially groundwater dependant ecosystems over time and obtain data to assist with future regeneration and rehabilitation of the River Red Gum population on site.	Bi-annually	Environment and Community Relations Manager
1.06	Conduct a research program to test roost box preference based on design, positioning and colour of the artificial roost. As many arboreal roosting and denning species may take several years to utilise artificial dens and roosts, roost and den box design and positioning will be re-evaluated every five years if targeted species are not using the boxes.	To be incorporated into the bi-annual monitoring program.	Environment and Community Relations Manager
1.07	Undertake aquatic fauna and habitat monitoring at established locations along Bowmans Creek in accordance with the monitoring methodology outlined in Section 4 and Table 1 to assess the long term stability of ecosystems against the pre-mining benchmarks.	Bi-annually during mine operations and for at least 5 years following the completion of longwall mining under Bowmans Creek or until no significant impact can be confirmed.	Environment and Community Relations Manager
1.08	Establish additional long-term stream monitoring sites in the excised sections of Bowmans Creek and in each of the diversion channels to monitor developing aquatic habitat attributes against existing habitat attributes.	Prior to commencement of the Bowmans Creek diversion works.	Environment and Community Relations Manager

Item	Action	Trigger/Timing	Responsibility
1.09	Undertake monthly water quality monitoring program, with the location of monitoring sites within Bowmans Creek to be adjusted as the creek diversions come on line (refer to Water Management Plan).	Monthly	Environment and Community Relations Manager
1.10	Undertake vegetation surveys within established rehabilitated tree plots annually three years after commencement of rehabilitation activities, in accordance with monitoring methods outlined in Section 4 .	Post-mine operations and rehabilitation.	Environment and Community Relations Manager
1.11	Undertake bi-annual weed monitoring surveys within the Bowmans Creek riparian corridor immediately following the commencement of rehabilitation works.	Bi-annually during mine operations and for at least 5 years following the completion of longwall mining under Bowmans Creek.	Environment and Community Relations Manager
1.12	Conduct field assessment of the areas overlying longwalls at the completion of each mining pass, to ascertain the extent of subsidence impacts on excised creek and riparian channel ecosystems. Where required, targeted riparian or habitat enhancement/protection measures will be recommended.	On completion of each longwall panel.	Underground Mining Engineer / Environment and Community Relations Manager
1.13	Conduct post-mining aquatic monitoring to assess impacts to fish, fish passage, macroinvertebrates and aquatic habitat, and impacts to existing communities along Bowmans Creek from subsidence.	Bi-annually during mine operations and for at least 5 years following the completion of longwall mining under Bowmans Creek.	Environment and Community Relations Manager
1.14	Conduct pre and post-mining aquatic monitoring to assess impacts to aquatic habitat, and impacts to existing communities along the Hunter River from subsidence.	Prior to and on completion of mining Longwall 1 (if longwall 1 to be full length).	Environment and Community Relations Manager
2.0	Management		
2.01	Undertake seed collection in accordance with OEH guidelines and relevant licences. <i>Collection of River Red Gum seeds requires a licence under the TSC Act.</i>	Spring, or when available.	Environment and Community Relations Manager
2.02	Conduct pre-clearance inspections in accordance with the Vegetation Clearance Protocol (Appendix C).	Prior to any clearing between March and June during the life of the mine.	Environment and Community Relations Manager
2.03	Provide replacement hollows or nesting boxes in the southern woodland voluntary conservation area and within the riparian corridor, as detailed in the Vegetation Clearance Protocol (Appendix C).	During all vegetation clearing activities.	Environment and Community Relations Manager

Item	Action	Trigger/Timing	Responsibility
2.04	Utilise hollow limbs, felled trees and woody debris from clearing activities to provide habitat, shelter and foraging opportunities for relocated animals and to restore aquatic ecosystems, as described in the Vegetation Clearance Protocol (Appendix C).	During all vegetation clearing activities.	Environment and Community Relations Manager
2.05	Undertake weed control and revegetation within the creek north and south of the New England Highway to enhance wildlife movement along the riparian corridor. <i>As existing ponds and adjacent pools are likely to be continually colonised by mosquito fish and carp, it is no longer practicable to manage these for the threatened green and golden bell frog.</i>	Ongoing	Environment and Community Relations Manager
2.06	Vegetate the clean water dams at the eastern toe of the emplacement area in such a way to filter sediments and to create refuge opportunities for the green and golden bell frog (refer to Section 5.1).	Ongoing	Environment and Community Relations Manager
2.07	Implement feral animal control programs within the ACP area as described in Section 5.2 .	Ongoing	Environment and Community Relations Manager
2.08	Fence the Bowmans Creek riparian zones (around diversions, the excised creek and the remaining creek) to exclude stock and provide stock watering points away from the protected riparian zones.	Following construction of the diversion works	Environment and Community Relations Manager
2.09	Increase the existing riparian vegetated strip widths along Bowmans Creek such that the eastern diversion is planted out to a minimum of 93m and the western diversion is planted out to a minimum of 75m (Figure 2). Incorporate these expanded width riparian zones into the existing vegetation and terrestrial corridor system.	Construction of Bowmans Creek diversions.	Environment and Community Relations Manager
2.10	Provide habitat offsets associated with the Bowmans Creek diversions (Figure 2), including 15.7 hectares of combined aquatic and riparian habitat, and 58.7 hectares of mixed riparian woodland and grassy floodplain woodland.	Construction of Bowmans Creek diversions.	Environment and Community Relations Manager
2.11	Provide fish-friendly riffle and rock bar structures, resting pools to assist fish migration, and cobble bottom pools suitable for catfish nesting in the Bowmans Creek diversions. Fish passage will be maintained in the diverted creek sections under at least moderate flow conditions.	Construction of diversions.	Environment and Community Relations Manager
2.12	Enhance the River Red Gum population by planting on the stream and upper banks of the Bowmans Creek diversions. Stock exclusion (fencing) will be provided to improve recruitment of juveniles.	Ongoing	Environment and Community Relations Manager
2.13	Manage the southern woodland voluntary conservation area in accordance with the Conservation Agreement. Specific management practices applicable to the conservation area are provided in Appendix D and these have been incorporated into relevant site protocols.	Ongoing	Environment and Community Relations Manager
2.14	Vehicle access will be restricted to formed trails for access to private property, management purposes as approved by OEHL, fire fighting and/or any emergency requirements.	Ongoing	Environment and Community Relations Manager

Item	Action	Trigger/Timing	Responsibility
2.15	Maintain a free draining landform as detailed in the Extraction Land Management Plan.	Ongoing	Environment and Community Relations Manager
2.16	If subsidence induced pond formation occurs in the excised creek sections, riparian vegetation will be managed.	Detection of pond formation in excised creek sections.	Environment and Community Relations Manager/ UG Mining Engineer
2.17	Permanent marking of all nest and den trees within the subsidence impact area.	Prior to mining Longwall 1.	Environment and Community Relations Manager
3.0	Incident Response		
3.01	Injured terrestrial animals that are found prior to or during clearing activities will be cared for in accordance with the Animal Ethics and Care Committee permit.	If injured terrestrial animals are found prior to or during clearing activities.	Environment and Community Relations Manager
3.02	In the event of the detection of the masked owl or other threatened species within any habitat areas to be cleared, all clearing work will cease and further investigations will take place, in accordance with the Vegetation Clearing Protocol provided in Appendix C .	Detection of a threatened species within any habitat areas to be cleared.	Environment and Community Relations Manager
3.03	Where perceptible impacts to terrestrial and aquatic habitat are noted, the following procedure will be followed and reported in accordance with Table 1 and Table 6 : <ul style="list-style-type: none"> Undertake additional investigation to ascertain the actual cause (mine related or other); Assess the impact against the performance measures and indicators detailed in Table 1 and Table 6; If mine related, consult relevant government agencies; Develop and implement a specific response plan to prevent further impacts; and Undertake remediation as required. 	Perceptible impacts noted during monitoring activities or exceedance of Performance Indices.	Underground Mining Engineer / Environment and Community Relations Manager
3.04	Pre-clearance surveys (as part of ground disturbance permits) shall be used to identify the presence of any threatened species within construction or operations facilities at the ACP. Upon detection of a threatened species; <ul style="list-style-type: none"> An assessment will be undertaken regarding whether the species is a critical stage of its life cycle; and Works will not recommence until the species has vacated the habitat or can be relocated. Animals (non-breeding) will not be relocated without the consent of the OEH (breeding animals will not be disturbed).	Upon detection of a threatened species.	Underground Mining Engineer / Environment and Community Relations Manager

Item	Action	Trigger/Timing	Responsibility
3.05	Any disturbance planned or created, outside that allowed by the ground disturbance permits, will be reported to the Environment and Community Relations Manager as soon as practicable.	Any disturbance planned or created, outside that allowed by GDP.	All site personnel
3.06	In the event that it is not practical to maintain a free draining landform, an assessment will be undertaken into the suitability of creating a permanent wetland or stock watering point with due consideration given to the: <ul style="list-style-type: none"> • Overall rehabilitation and final land use objectives of the ACP; • Use of riparian revegetation techniques (stock exclusion and provision of edge and emergent vegetation); • Feasibility of providing sustainable wetland habitat and its potential to support threatened species; • Impacts to terrestrial threatened species and /or loss of agricultural land; and • Risk of inrush into the underground workings. 	Areas of ponding that are unable to be practically drained or filled to create a free-draining landform.	Underground Mining Engineer, Environment Officer
3.07	Restoration of creek water quality/quantity using a supply of good quality make-up water.	If any significant deterioration in water quality or quantity is identified as a result of monitoring.	Underground Mining Engineer / Environment and Community Relations Manager
3.08	Provision of engineering solutions for den or nest trees identified during the monitoring surveys that are at risk of damage, i.e. shoring up the tree and the ground with anchors and/or ground works.	In response to outcomes of monitoring.	Environment and Community Relations Manager
3.09	If a den or nest tree appears to be failing and an engineering solution is not possible, apply for NPWS licence to relocate the nests and undertake relocation actions.	In response to outcomes of monitoring.	Environment and Community Relations Manager

Table 6: Flora and Fauna (Biodiversity) Trigger Action Response Plan (TARP)

Aspect	Method /Parameters / Frequency	Purpose	Trigger	Response	Responsibility
Flora and Fauna – Terrestrial					
Terrestrial Fauna and habitat	<p>Biannual fauna and habitat monitoring surveys, including targeted searches for threatened species as outlined in Section 4.</p> <p>Amphibian surveys - concurrent with surveys above, or if no rainfall has been recorded for the season, the amphibian survey must take place in the last week of the season.</p>	To assess the continued survival and management of the native flora and fauna within the study area.	<p>Terrestrial fauna and habitat monitoring shows that the numbers of threatened species and the health (including recruitment) of significant populations are declining and results are not comparable or improved from the baseline surveys.</p> <p>Monitoring shows that key habitat features (foraging, nesting, refuge habitat) and structural complexity within remnant and rehabilitated/compensatory habitat areas are declining and are not comparable or improved from the baseline surveys.</p> <p>Where overall monitoring trends indicate a negative impact to species diversity or abundance.</p>	<p>Investigate in accordance with the key considerations in Table 1.</p> <p>Develop strategy to ensure viability of local population is maintained or enhanced (may include provision of additional habitat resources i.e. nest boxes, ground logs/hollows, provision of compensatory habitat, additional weed/feral animal control).</p>	Environment and Community Relations Manager

Aspect	Method /Parameters / Frequency	Purpose	Trigger	Response	Responsibility
Riparian vegetation	Biannual monitoring of transects and quadrats along Bowmans Creek (includes both control and impact sites) as shown in Figure 4 , noting dominant and sub-dominant species, percentage cover of each structural layer, level of disturbance and condition rating, evidence of regeneration, presence of noxious or environmental weeds, and targeted searches for threatened flora species. Each site to be also monitored via photographic record.	To identify changes in vegetation composition and structure occurring along Bowmans Creek over time.	Dieback or loss of small number of riparian trees (>10%)	Consider leaving in place (as roosts or perches for bats / birds of prey) or use of stags for use in diversions (e.g. to create woody debris) or within revegetation area as habitat for small ground-dwelling mammals and reptiles.	Environment and Community Relations Manager
			Decline in species diversity or condition, relative to a control site, over time. For example: Project foliage cover and species number at any key strata level no longer broadly comparable to a control site or pre-mining condition.	Investigate site specific changes against upstream and downstream reference sites. If changes mirrored in reference sites, investigate possible regional, climatic or seasonal basis for deterioration based in the first instance. Compare observations to predicted impacts in EA (i.e. some change in riparian vegetation is anticipated following construction of diversion). If within predictions, or a result of regional, seasonal or climatic conditions - no further action other than reporting in biannual reports and AEMR. If site specific deterioration is not able to be linked to other site changes (i.e. not regional, seasonal, climatic), and outside that predicted in the EA investigate links between site changes, water quality and habitat quality changes and check against groundwater monitoring trends. Reference should be made to the key considerations in Table 1 . If causes determined to be site specific initiate reporting procedures. Investigate possible links with mining then develop mitigation measures and/or action plan as necessary.	Environment and Community Relations Manager

Aspect	Method /Parameters / Frequency	Purpose	Trigger	Response	Responsibility
River Red Gum Population	<p>Biannual monitoring of River Red Gum populations including visual surveys of ground surface disturbance and tree health; monitoring of ground water, soil moisture and leaf area index (LAI) at existing stands of River Red Gum and reference sites; an estimation of projected foliage cover of mature River Red Gum trees.</p> <p>Monitoring of rainfall and streamflow data for comparison with evapotranspiration rates and LAI changes.</p>	To provide important information in the management of existing stands of River Red Gum and improve the success of regeneration of this community within the ACP.	<p>Decline in tree health or condition, relative to a reference site.</p> <p>Recruitment of juveniles and seed bank establishment is declining and no longer broadly comparable to a control site or pre-mining condition.</p>	<p>Investigate in accordance with the key considerations in Table 1.</p> <p>If a result of regional, seasonal or climatic conditions - no further action other than reporting in biannual reports.</p> <p>If causes determined to be site specific initiate reporting procedures. Investigate possible links with mining then develop mitigation measures and/or action plan as necessary.</p>	Environment and Community Relations Manager
Rehabilitation Monitoring	Any revegetated areas will be monitored following the methodologies outlined within the annual Rehabilitation Monitoring Program which compares the progress of the rehabilitation sites against a set of completion criteria obtained from measurement made in areas of remnant woodland and grassland communities in the local area.	To monitor the health and viability of revegetated areas over time and obtain data to assist with the long term rehabilitation of the site.	<p>Vegetation cover is insufficient to control erosion.</p> <p>If data shows that future structural and diversity goals will not be met.</p> <p>Negative trends in heterogeneity against land function metrics including: vegetation mosaics; ground cover; leaf litter and organic matter; soil depth and quality; shading; water flow paths and microhabitats.</p>	<p>Additional planting and safeguarding will be implemented in the area of impact.</p> <p>An adaptive reworking of the planting program will be undertaken to incorporate a wider range of species. The benefits of introducing additional growing material or providing additional soil ameliorants will also be investigated. Measures will be put into place, with the goal of increasing cover and diversity as compared with reference sites.</p>	Environment and Community Relations Manager

Aspect	Method /Parameters / Frequency	Purpose	Trigger	Response	Responsibility
Aquatic Ecology					
Aquatic Macro-invertebrates and fish	Biannual sampling as per AusRivAS protocols with site SIGNAL indices calculated. Fish sampling using overnight bait traps. Survey locations include both established long-term sites, and short terms sites shown in Figure 5 .	To monitor long term seasonal and climatic trends during pre and post mining. To identify any potential mining-related impact	Significant deterioration or continuing downward trend in macroinvertebrate diversity or site SIGNAL compared to pre-mining conditions, with regard to seasonal, climatic baseline variations. Trigger is individual Site Diversity or SIGNAL value below the mean Site Diversity or SIGNAL value obtained from previous sampling (refer to Table 4).	Investigate site specific changes against upstream and downstream reference sites. If changes mirrored in reference sites, investigate possible regional, climatic or seasonal basis for deterioration based in the first instance. If regional, seasonal or climatic - no further action other than reporting in biannual reports and AEMR. If site specific deterioration is not able to be linked to other site changes (i.e. not regional, seasonal, climatic), investigate links between site changes, water quality and habitat quality changes and check against groundwater monitoring trends. Reference should be made to the key considerations in Table 1 . If causes determined to be site specific initiate reporting procedures. Investigate possible links with mining then develop mitigation measures and/or action plan as necessary.	Environment and Community Relations Manager

Aspect	Method /Parameters / Frequency	Purpose	Trigger	Response	Responsibility
Site habitat condition & diversity	Biannual habitat diversity assessment using RCE & site photo referencing photos for habitat condition plus plant diversity and cover estimates for algae/aquatic plants.	To monitor long-term seasonal and site related changes/trends in aquatic habitat condition, pre- during and post mining, to aid in identifying possible physical impacts related to mining.	Any deterioration or degradation in habitat quality based on either direct observation, SIGNAL index or observed habitat/species diversity.	<p>Investigate site specific changes against upstream and downstream reference sites. If changes mirrored in reference sites, investigate possible regional, climatic or seasonal basis for deterioration based in the first instance.</p> <p>If regional, seasonal or climatic - no further action other than reporting in biannual reports and AEMR.</p> <p>If site specific deterioration is not able to be linked to other site changes (i.e. not regional, seasonal, climatic), investigate links between site changes, water quality and habitat quality changes and check against groundwater monitoring trends. Reference should be made to the key considerations in Table 1.</p> <p>If causes determined to be site specific initiate reporting procedures. Investigate possible links with mining then develop mitigation measures and/or action plan as necessary.</p> <p>Continue to monitor short-term sampling sites biannually until evidence of mining-related impact has been remediated / mitigation measures have been proven to be effective.</p>	Environment and Community Relations Manager

Aspect	Method /Parameters / Frequency	Purpose	Trigger	Response	Responsibility
Site water quality	Field water quality (both chemical and physical) monitoring during the bi-annual aquatic ecology monitoring program including depth profile monitoring of EC, Temp, pH, turbidity, DO. The monthly water quality monitoring at the existing 'whole of mine' sites will also be utilised.	To monitor long-term seasonal and site related changes/trends in specific aquatic site water quality, pre-during and post mining, to aid in identifying possible water quality impacts related to mining.	Any deterioration or significant changes in site specific water quality parameters.	Investigate site specific changes against upstream and downstream reference sites. If changes mirrored in reference sites, investigate possible regional, climatic or seasonal basis for deterioration based in the first instance. If regional, seasonal or climatic - no further action other than reporting in biannual reports and AEMR. If site specific deterioration is not able to be linked to other site changes (i.e. not regional, seasonal, climatic), investigate links between site changes, water quality and habitat quality changes and check against groundwater monitoring trends. Reference should be made to the key considerations in Table 1 . If causes determined to be site specific initiate reporting procedures. Investigate possible links with mining then develop mitigation measures and/or action plan as necessary. Continue to monitor short-term sampling sites biannually until evidence of mining-related impact has been remediated / mitigation measures have been proven to be effective.	Environment and Community Relations Manager
River Red Gum (GDE)	Visual surveys, groundwater level monitoring in adjacent piezometers, soil moisture, leaf area index (LAI), projected foliage cover, and level of recruitment. Review of rainfall and stream flow data and comparison with evapotranspiration rates and LAI changes.	To monitor the health and viability of the RRG population over time and obtain data to assist with future regeneration and rehabilitation of this population on site.	Comparative health assessments indicate that compared to a reference site, an overall decline in tree health is being observed. AND Comparative assessment of groundwater, surface water and soil moisture conditions relative to a control site indicates a relationship between these changing conditions and a reduction in RRG health.	Investigate in accordance with the key considerations in Table 1 . Develop strategy to ensure viability of local population is maintained or enhanced (may include additional seed collection and propagation and allocation of additional regeneration areas, outside of affected area.)	Environment and Community Relations Manager

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7 IMPLEMENTATION

7.1 CONTINGENCY RESPONSE

The flow chart in **Figure 6** demonstrates the implementation of this plan with respect to the performance measures / indicators identified in **Section 2.2** and general steps to be undertaken in the event that potential unplanned impact and/or exceedance of the criteria occurs.

In the event the performance measures and actions provided in **Table 1** and **Table 6** are considered to have been exceeded, or are likely to be exceeded, ACOL will undertake the following:

- ACOL will report the likely exceedance of the performance indicator as soon as practicable to the relevant agencies as required under the development consent or legislation. after becoming aware of the exceedance;
- ACOL will identify an appropriate course of action with respect to the identified impact in consultation with appropriate specialists and relevant agencies; and
- Review the effectiveness of this FFMP and performance measures to adequately manage potential impacts within the limits of the project approval.

7.2 REPORTING

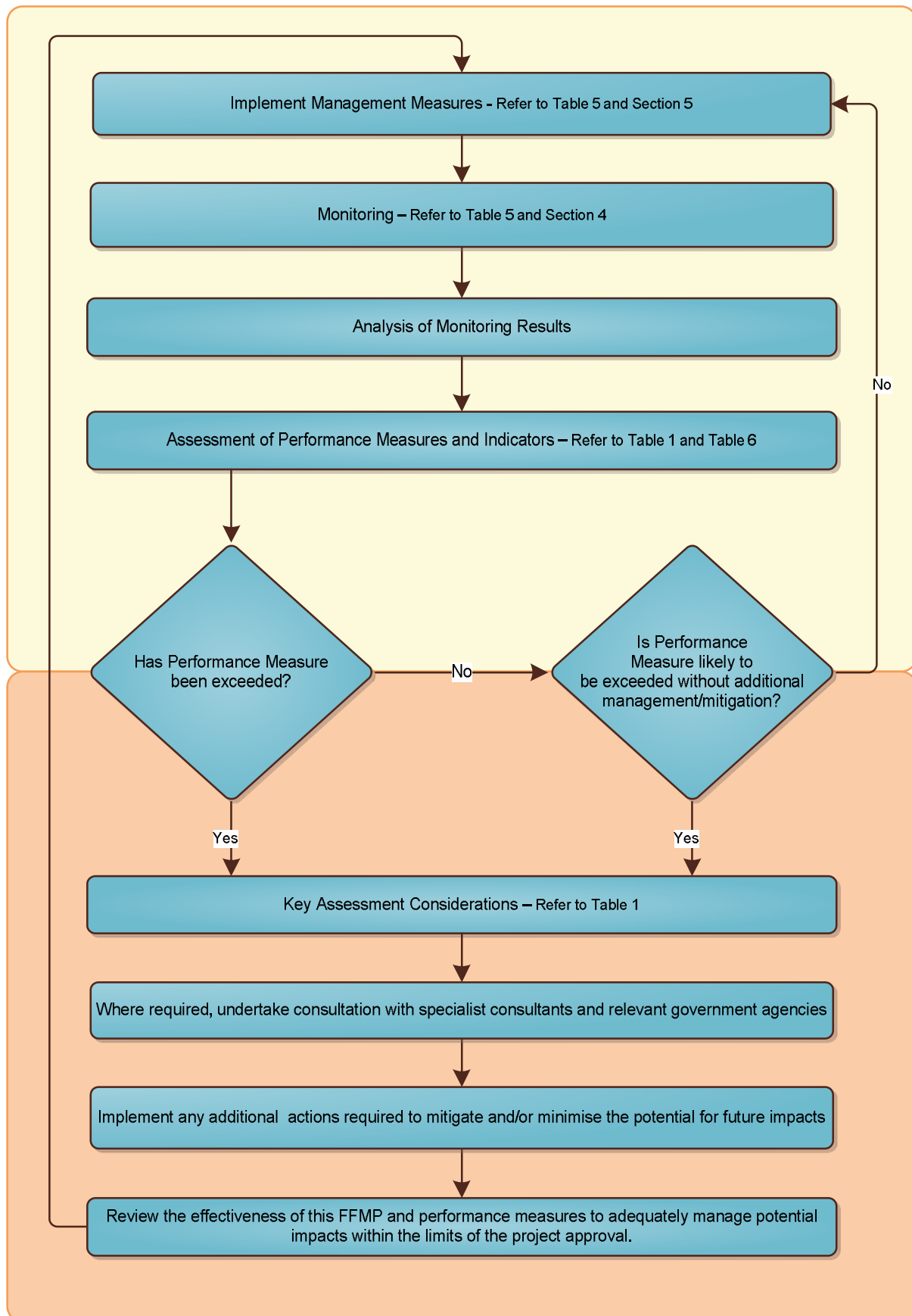
The Annual Environmental Management Report (AEMR) is the primary reporting tool for the ACP. The AEMR is required to be prepared under the ACP development consent and Mining Lease and its purpose is to review the performance of the mine against the Environmental Management Strategy and the relevant Mining Operations Plans, the conditions of this consent, and other licenses and approvals relating to the mine. The AEMR is required to include:

- An annual compliance audit of the performance of the project against conditions of the consent and statutory approvals; and
- Assess the development against the predictions made in the EIS and the terms and commitments.

In context of flora and fauna management the AEMR will report against and review the findings of monitoring conducted in relation to the items in **Table 1** and **Table 6**.

Once finalised and approved, the AEMR will be made publicly available via ACOL's website.

Figure 6: FFMP Implementation and Contingency Response



7.3 AUDITS AND REVIEWS

This FFMP may be audited (if required) under the scope of any external environmental compliance audits.

An internal review of this FFMP will be conducted in response to:

- An incident recorded as a result of the operations that potentially affects threatened species or populations;
- A significant change in operation that may affect the implementation of this management plan;
- Statutory requirements or directions/conditions of approvals requiring such action; or
- Recommendations as a result of internal or external audits.

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8 REFERENCES

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APPENDIX A APPROVAL CONDITIONS

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Table 7: Checklist of Approval Conditions (Biodiversity)

Condition number	Condition requirement (DA 309-11-2001 MOD 6)	Addressed in FFMP				
3.9	<p>The Applicant shall ensure that underground mining does not cause any exceedances of the performance measures in Table 1, to the satisfaction of the Director-General.</p> <p style="text-align: center;"><i>Table 1: Subsidence Impact Performance Measures (inter alia)</i></p> <table border="1" data-bbox="342 512 1718 598"> <thead> <tr> <th colspan="2" data-bbox="342 512 1718 539">Biodiversity</th> </tr> </thead> <tbody> <tr> <td data-bbox="342 539 871 598">Threatened species, threatened populations, or endangered ecological communities</td> <td data-bbox="871 539 1718 598">Negligible impact or environmental consequences</td> </tr> </tbody> </table> <p><i>Notes: The Applicant will be required to define more detailed performance indicators for each of these performance measures in the various management plans that are required under this consent (see condition 3.12 below).</i></p>	Biodiversity		Threatened species, threatened populations, or endangered ecological communities	Negligible impact or environmental consequences	This FFMP
Biodiversity						
Threatened species, threatened populations, or endangered ecological communities	Negligible impact or environmental consequences					
3.12	<p>The Applicant shall prepare and implement an Extraction Plan for the second workings within each seam to be mined to the satisfaction of the Director-General. Each Extraction Plan must: (<i>inter alia</i>)</p> <p>h) include a</p> <ul style="list-style-type: none"> • Biodiversity Management Plan, which has been prepared in consultation with OEH and DTIRIS, which: <ul style="list-style-type: none"> - Includes a program of works to ensure that overall terrestrial and aquatic biodiversity values are the same or better than existed in Bowmans Creek prior to longwall mining; - Provides for the management of the potential impacts and/or environmental consequences of the proposed second workings on aquatic and terrestrial flora and fauna. 	This FFMP and the Rehabilitation Management Plan				
3.39	Domestic stock and, where necessary, native fauna shall be excluded from all bushland revegetation areas.	Section 5				
3.42	If threatened species are identified on the site during construction or operation of the coal mine, the Applicant shall cease any work immediately which could adversely impact on the species pending investigation and consultation with relevant government agencies. The Applicant shall engage a suitably qualified ecologist to investigate, and identify appropriate amelioration measures.	Table 1				
3.45	<p>During the life of the mine and until the revegetated areas are established to the satisfaction of the DII, the Applicant shall maintain the revegetated areas. Maintenance shall include, where necessary, but not be limited to:</p> <ul style="list-style-type: none"> • replanting failed or unsatisfactory areas; • repairing erosion problems; • fire management, fire suppression or fire encouragement; • pest and weed control; • control of feral animal populations; • maintain and repair fencing; 	This FFMP and the Rehabilitation Management Plan				

Condition number	Condition requirement (DA 309-11-2001 MOD 6)	Addressed in FFMP
	<ul style="list-style-type: none"> • fertiliser application; and • application of lime or gypsum to control pH and improve soil structure. 	
3.46	<p>The Applicant shall prepare and implement a Flora and Fauna Management Plan (FFMP) for the DA area. The Plan is specifically required to outline procedures for clearing or disturbing vegetation and other habitat types, along with measures for habitat reinstatement and management. The Plan shall be prepared in consultation with OEH and SSC, and to the satisfaction of the Director-General. The Plan shall be prepared by an appropriately qualified and experienced ecologist. The ecologist shall be responsible for providing advice to minimise potential impacts upon threatened and protected fauna species that may utilise the site and to provide expert advice on the regeneration and reconstruction of flora and fauna habitat on mined areas. The Plan shall include but not be limited to:</p> <p>a) demonstration of consistency with commitments made in documents listed in condition 1.2 and compliance with the conditions of this consent;</p> <p>b) details of strategic vegetation management, outlining timeframes for clearing and re-vegetation activities and a map illustrating the Plan. The Plan should aim to maximise scope for new vegetation to establish and restore ecological integrity;</p> <p>c) details of the creation, landscaping and management of on-site vegetation to provide habitat for the Grey-crowned Babbler and other threatened species likely to occur on the site;</p> <p>d) details of the creation, landscaping and management of ponds along Bowmans Creek, where practical, to provide for Green and Golden Bell Frog habitat; the creation of new habitat must be based on current findings related to nearby populations and must be integrated with existing habitat for this species on the site at Bowmans Creek and Bettys Creek, and with habitat which is proposed to be created on Bettys Creek by Glendell Mine;</p> <p>e) details of the schedule for clearing activities incorporating seasonal habitat requirements for species such as bats and other mammals, with the objective of avoiding incidents during sensitive hibernation and breeding periods;</p> <p>f) details of pre-clearance inspections, including the identification and inspection of trees containing tree hollows, including stags, prior to clearing of any vegetation;</p> <p>g) details of how micro habitats including dead trees, stags, stumps and hollow branches will, where practical, be salvaged and relocated to areas depauperate of tree hollow habitat and in the recreation of habitat areas;</p> <p>h) details of the establishment of roost and denning boxes appropriate for bat and avifauna species and methods for their regular maintenance. The details on the specific height, aspect, design, location and timing for the placement of the roosts and nest boxes shall consider any publicly available results and recommendations following the ongoing fauna habitat monitoring program occurring at the Mt Owen mine;</p> <p>i) details of the methods for strategically placing felled trees between cleared and remnant bushland to provide runways of ground cover for dispersion of animals;</p>	<p>This FFMP</p> <p>Ecologists Joanne Woodhouse (AECOM) and John-Paul King (PEA).</p> <p>Refer to Table 5</p> <p>Appendix C and Figure 2</p> <p>Section 5</p> <p>Section 4</p> <p>Appendix C</p> <p>Appendix C</p> <p>Appendix C</p> <p>Appendix C</p> <p>Appendix C</p>

Condition number	Condition requirement (DA 309-11-2001 MOD 6)	Addressed in FFMP
	j) details of measures to care for any animals injured or found during clearing activities, including the use of WIRES to attend to fauna as necessary, and the methods for their relocation if appropriate. This shall include measures for harbouring and releasing nocturnal animals at night;	Appendix C
	k) strategies for the establishment of long-term post-mining land use objectives over the site;	Refer to Rehabilitation Management Plan
	l) measures to re-instate vegetation communities and to use local endemic species for revegetation as soon as possible;	Refer to Rehabilitation Management Plan
	m) methods to actively manage existing areas of remnant vegetation (habitat management zones) through fencing (using animal friendly materials) to exclude grazing animals and control of feral animals where practical, revegetate where appropriate, and maintain weed and fire controls;	Section 5
	n) strategies for the establishment of wildlife corridor links to adjoining habitat areas and integration of rehabilitation works with nearby mines;	Section 5
	o) details of strategies for the exclusion of grazing stock on areas of native bushland reconstruction;	Section 5
	p) measures to monitor the success of revegetated areas and plant additional species where necessary;	Section 4. Refer to Rehabilitation Management Plan for detail.
	q) methods of revegetation;	Refer to Rehabilitation Management Plan
	r) consideration of Aboriginal heritage management to ensure that activities under the Plan do not impact on Aboriginal heritage values;	Table 1
	s) development of a protocol for identifying and managing significant impacts on any threatened flora and fauna species not identified in the EIS, during construction or operation of the mine; and	Section 5
	t) details of the habitat monitoring required under this consent.	Section 4
	The FFMP shall be submitted for the approval of the Director-General, in consultation with OEHL, no later than one month prior to the commencement of construction of the development, or within such period otherwise agreed by the Director-General. Construction shall not commence until written approval has been received from the Director-General. Upon receipt of the Director-General's approval, the Applicant shall supply a copy of the FFMP to Council, NoW, DTIRIS, and OEHL, within 14 days. The Applicant shall make the FFMP available for public inspection on request.	Appendix B The approved FFMP will be posted on the ACOL website

Condition number	Condition requirement (DA 309-11-2001 MOD 6)	Addressed in FFMP
3.47	<p>The regeneration works shall be monitored by an appropriately qualified and experienced ecologist. The results of the monitoring and the effectiveness of the revegetation and the FFMP shall be reported annually as part of the Annual Environmental Management Report in accordance with the Department of Mineral Resource's Guidelines to the Mining, Rehabilitation and Environmental Management Process (March 1998) or its latest version.</p>	<p>Findings will be reported in AEMR.</p>
3.48	<p>The Applicant shall prepare a detailed monitoring program of habitat areas on the site, including any wetlands and aquatic habitats, during the development and for a period after the completion of the development to be determined by the Director-General in consultation with OEH. The monitoring program shall be included in the FFMP and a summary of the results shall be provided in the AEMR. The program shall:</p> <ul style="list-style-type: none"> a) monitor impacts attributable to the development and include monitoring of the success of any restoration or reconstruction works. The Applicant shall carry out any further works required by the Director-General and DTIRIS as a result of the monitoring; b) establish an ongoing monitoring program of the existing and proposed revegetated areas to assess their floristics and structure and to propose contingency measures for improvements to revegetation if required; and c) establish an ongoing monitoring program of fauna species diversity and abundance and the effectiveness of reconstructed ecosystems in providing fauna habitat and contingency measures should impacts be identified as occurring. <p>Note: Emphasis should be given to the need for monitoring of the effectiveness of rehabilitation to learn from the process. It should be noted that both positive and negative outcomes need to be reported, to maximise the opportunity to incorporate best practice principles into future mining proposals. The information obtained from the monitoring shall be used to guide future revegetation efforts on the mine site.</p>	<p>This FFMP. Refer to Rehabilitation Management Plan for detail on monitoring of revegetation.</p>

APPENDIX B CORRESPONDENCE

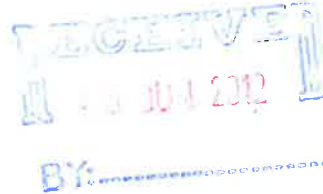
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**Office of
Environment
& Heritage**

Your reference: DA 309-11-2001-i
Our reference: Doc12/21940;
Lic06/533-08
Contact: Robert Gibson
(02) 4908 6851

Mr Phil Fletcher
Ashton Coal Operations Pty Limited
PO Box 699
SINGLETON NSW 2330



Dear Mr Fletcher

RE: ASHTON COAL MINE – FLORA & FAUNA (BIODIVERSITY) MANAGEMENT PLAN AND ABORIGINAL CULTURAL HERITAGE

Thank you for your letter of 10 April 2012 to the Office of Environment and Heritage (OEH) in which Ashton Coal sought comments from OEH on the three updated site-wide management plans for Flora & Fauna (Biodiversity), Heritage and Water for the Ashton Coal Project (DA 309-11-2001-i). My apologies for the delay in responding.

Water Management Plan

Comments will be forwarded separately from the NSW Office of Water, as this is the appropriate agency to review the Water Management Plan.

Flora and Fauna Management Plan

OEH encourages the development of biodiversity management plans to ensure that proponents have determined how they will meet their statutory obligations and designated environmental objectives. However, OEH does not approve or endorse these documents as our role is to set environmental objectives for environmental/conservation management, not to be directly involved in the development of strategies to achieve those objectives.

Aboriginal Cultural Heritage

OEH has reviewed the proposed amended Aboriginal Cultural Heritage Management Plan (ACHMP). OEH notes the existence of two Aboriginal Heritage Impact Permits (AHIPs) issued under Section 90 of the National Parks & Wildlife Act 1974 (AHIP#1130976 & AHIP#1131017) which regulate the extent of allowable impact to Aboriginal archaeological sites and objects within the area of long walls 1 through to 8. OEH takes this opportunity to remind Ashton Coal Operations (ACOL) of its legislative obligation to comply with all conditions and requirements of those AHIPs.

In addition OEH has the following comments with regard to the draft ACHMP dated 02/03/2012 which forms Appendix J to the main document (Ashton Coal Project Upper Liddell Seam Extraction Plan, Version A, March 2012):

1. Section 4.1 (p7): The statement that "there are three sites of particularly high scientific and cultural significance" should read "there are three identified sites of particularly high scientific and cultural significance"
2. Section 4.1 (p14) Table 2: OEH notes that a number of registered AHIMS sites (#37-3-1016 & #37-3-1017) have been subject to collection by multiple parties (Insite Heritage & Umwelt). OEH requires that

assemblages of Aboriginal objects recovered are curated in such a manner that the components are held together at one location unless alternative arrangements are expressly authorised. OEH requires that if the Aboriginal objects recovered from those locations are held in separate locations that they are immediately transported so as to be curated together in accordance with AHIP #1130976. In order to ensure data consistency any analysis of Aboriginal objects from a site or deposit should be done in such a manner that all objects from any one assemblage be analysed as a group by the same analyst and according to the same criteria.

3. Section 4.1 (p14) Table 2: OEH notes in the "Management #" column of Table 2, with reference to AHIMS#37-3-1016 reference is made to AHIP#11309761. This should read AHIP#1130976.
4. Section 5 (p21): OEH notes reference to historical consultation with the Aboriginal community with regard to the development of the existing ACHMP. No evidence has been provided regarding consultation with the Aboriginal community over the development of the document under review.
5. Section 5 (p23) Table 3 Item 1.03: OEH notes that no provision for the Aboriginal community to assess the state of Aboriginal sites prior to long wall mining is provided in this item. OEH recommends that the monitoring of sites by the Aboriginal community is conducted in such a manner that Aboriginal representatives are afforded an opportunity to observe as outlined in Item 1.01 of Table 3.
6. Section 5 (p25) Table 3 Item 3.02: OEH considers that the determination of significance of a site or object should be made in consultation with representatives of the Aboriginal community through dialogue with the archaeologist.
7. Appendix B (p40): OEH notes that Stage 4, Item 6 notes a preference for dry sieving. In order to minimise possible contamination or removal of residues that may be present on objects recovered through the salvage process OEH would consider that dry sieving was preferential and should be used where possible.
8. Appendix B (p43): OEH notes reference to 'archaeological significance' in the discussion of "Unrecorded Aboriginal Heritage Sites". This should be amended to reflect possible cultural as opposed to purely scientific, significance.
9. Appendix B (p44): OEH notes the use of the word 'Aboriginal' in Item B of the procedure for assessment of remains as a way of differentiating between forensic and non forensic sites as well as in point 2 of the following process. OEH notes that Aboriginality alone is not a criterion by which the identification of remains as non-forensic can be made. Human remains of an Aboriginal nature can clearly fall within the criteria for which a crime scene must be declared and associated protocols followed. OEH requires that the wording of this section be amended to address this issue.
10. Appendix B (p44) Final point 4: OEH notes that native faunal remains can represent scientifically and/or culturally significant sites. In the event that faunal remains are discovered they should be subjected to assessment and if identified as of native origin an archaeologist and representatives of the Aboriginal community must be consulted in order to determine any significance. NOTE: Notification of ANY remains to Aboriginal community members must be done in such a manner as to allow the Aboriginal people the ability to decline any contact or knowledge of the remains if they wish.
11. Appendix C (p45) "Monitoring": OEH notes the reference to monitoring of "mine related impacts on Aboriginal sites within LW1-8 during and at completion of each longwall panel". OEH notes that this should be amended to read "prior to, during and at completion of each longwall panel."

Should you have any questions please phone Mr Robert Gibson on (02) 4908 6851 for any questions relating to the advice on biodiversity or Mr Roger Mehr on (02) 6773 7005 on issues relating to Aboriginal cultural heritage.

Yours sincerely

DL Crosdale

14/6/12

DIANE CROSDALE
Manager Planning and Aboriginal Heritage
Office of Environment and Heritage

APPENDIX C VEGETATION CLEARANCE PROTOCOL

VEGETATION CLEARANCE PROTOCOL

1. Delineation of area to be cleared

The boundary between the area to be cleared and adjoining vegetation will be clearly marked or fenced. Habitat trees in close proximity to construction activities will be clearly marked and protected. Marked boundaries will be cross-referenced to the approved impact area.

2. Pre-clearance inspections

A desktop review of previous studies/surveys of the area and the likelihood of threatened species occurring within the area will be undertaken prior to carrying out field surveys. The review will identify the potential for breeding or hibernating native fauna or populations of the threatened species listed in **Table 2** of this FFMP. This process will assist in formulating the scope and design of field surveys.

Pre-clearance inspections will be undertaken within two weeks prior to the commencement of vegetation clearing, and where possible will be scheduled to avoid disturbance during hibernation and breeding periods. The pre-clearance inspections will include identification and inspection of trees containing hollows, including stags. Any isolated trees that have been identified as providing hollows, and which are located close to the construction and stockpile areas, will be protected with orange barrier netting during construction.

Should any threatened species be identified within the area to be cleared, ACOL will notify National Parks and Wildlife Services. Where necessary, fauna management strategies such as capture and release programs would be developed prior to the commencement of clearing activities.

3. Vegetation clearance

Where possible, vegetation clearance will be scheduled to incorporate seasonal habitat requirements of bats and other mammals (refer to **Table 2** of this FFMP), by avoiding hibernation and breeding periods.

Habitat trees will be inspected for fauna immediately before and after felling. Animals found prior to or during clearing activities will be released to surrounding suitable habitat. Injured animals found prior to or during clearing activities will be cared for in accordance with the Animal Ethics and Care Committee permit. If necessary, the Wildlife Information and Rescue Service (WIRES) will be contacted for first aid advice or assistance.

In the event of the detection of the masked owl or other threatened species including grey crowned babbler, hooded robin and speckled warbler within the woodlands to be cleared, all clearing work will cease and further investigations will take place to determine if nesting is occurring. If nesting is recorded, a buffer of 200m around the nest site will be established. Clearing may occur outside of this exclusion zone until any young have left the nest.

In the case of arboreal or flying mammals attempts will be made to relocate the den or roost to the southern woodland voluntary conservation area. After capture, the animal(s) will be held by a trained wildlife carer for a period of no longer than two weeks until the roost or den can be relocated, either as an entire tree or part thereof, in a similar location to the south of the New England Highway with regard to vegetation, aspect and height above ground. Artificial roosts or den sites will also be placed around the relocated roost or den. If relocation of the roost or den

is not possible, at least five suitable artificial boxes will be provided within the most suitable habitat. Work may recommence once the animal(s) have been captured and removed from the area.

Felled trees will be placed between cleared and remnant bushland where possible to provide runways of ground cover for dispersal of animals. Tree trunks will be placed along the bunds adjacent to cleared woodland to facilitate terrestrial species movement and to provide refuge and foraging opportunities. Woody debris from smaller trees will be placed along the bunds or in small piles or strips within the woodland to the south of Glennies Creek Road where grey-crowned babbler foraging habitat is to be established to encourage the relocation of the northern woodland population. Excess material may be mulched and used on site.

Small piles of timber will also be placed within the southern woodland voluntary conservation area and to the south of Glennies Creek Road to provide habitats for relocated animals and to increase shelter and foraging opportunities for animals already within the woodlands. Micro habitats, including dead trees, stags, stumps and hollow branches will be salvaged and relocated to areas lacking tree hollow habitat and/or to revegetation areas.

Some timber will be used within dams to provide perches for wetland species and refuge for amphibians. Large woody debris will be used to restore aquatic habitat within the Bowmans Creek diversions.

Where practicable, tree hollows in large branches will be removed during tree clearing operations and relocated to the southern woodland voluntary conservation area. These will be blocked at one end and then attached to a living tree at approximately 4m above the ground to provide a supplementary habitat resource. Replacement hollows or nesting boxes will be provided within the riparian corridor at a ratio of 3:1 to offset the loss of habitat trees removed during vegetation clearing. The design of replacement habitat boxes, including the height, aspect, location and timing for placement, will depend on the species to be targeted, and will be determined in consultation with an experienced ecologist. The design will also consider publicly available results of fauna monitoring programs undertaken within the local area (particularly at the Mt Owen Mine).

APPENDIX D MANAGEMENT OF CONSERVATION AREA

As defined within Item F of the Conservation Agreement:

The Owner and the Minister recognise that the development consent issued by the NSW Department of Planning for Development Application No. 309-11-2011-i on the 11 October 2002 permits the mining of coal by longwall methods in four seams beneath the conservation area, which will impact on the surface of the conservation area.

Annexure C of the Conservation Agreement provides principles and activities for the management of the conservation area, and these are outlined below.

ITEM 1:

The landholders shall not undertake, consent to or permit the following activities unless they are undertaken in the manner specified as follows:

Weed control

- a) Carrying out weed control using the appropriate control methods to ensure that they do not compromise the integrity of the conservation values identified. Control and monitoring of weed growth will be as determined by the Ashton Coal Land Management Plan subject to the conditions of this Agreement, and the guidelines below.
- Ensure methods of weed control do not damage cultural heritage values.
 - Glyphosate based herbicide may be used by direct application to cut surfaces (cut and paint or scrape and paint methods).
 - Spraying of a glyphosate based herbicide can be used. This should be limited to according to the directions on the label and ensuring that there is no off-target damage.
 - Weeds can be removed by hand, ensuring that all plant parts that can reproduce are removed and that soils do not become prone to erosion.
 - Other weed control methods may be use with prior written permission of the Director-General.
 - Ensure control programs are commenced when timing and extent of weed removal will minimise adverse effects on wildlife (weeds may provide protection or habitat for native fauna). Removal of African boxthorn should not be undertaken during nesting periods for small birds which may nest in the plants.
 - Continue to check for weed invasion and regrowth and treat any outbreaks.
 - Check adjacent areas for invasive plant species and remove, or control their spread.

Feral animals

- b) Monitoring impacts to the conservation area by feral animals and undertaking of on-going control programs for feral animals is appropriate.
- Methods for control can include shooting, trapping and use of poisonous baits with advice from OEH and the Livestock Health and Pest Authority.
 - Participate in community feral animal control programs, and encourage neighbours to implement pest animal control programs. Contact your local National Parks office to find out if community control programs are occurring in your area.

Native Fauna

- c) Kangaroo culling when part of a population control program for the Land and only with approval by way of a Section 121 licence issued under the *National Parks and Wildlife Act 1974*. Planning for this operation should be done in consultation with the OEH.

Domestic animals and livestock

- d) Mustering of livestock with the use of working dogs and horses.
- e) Controlled grazing may be used as a hazard reduction tool to reduce fuel loads in the conservation area as deemed necessary, and with the following guidelines.
 - Grazing should be initially excluded from the conservation area to encourage the natural regeneration of indigenous plants and to encourage the growth of a shrub layer.
 - Grazing must be excluded from areas of revegetation.
 - Grazing may be desirable to reduce seeding of particular weed species.
 - Where native grasses and ground covers are present, rotational grazing should be used. Graze with high numbers for short periods and allow long rest periods to ensure flowering and reseedling to occur of native groundlayer species.
 - Stock should be removed during peak flowering times, that is in Spring or early Summer, being September through to the end of January.
 - Groundcover should be maintained above 80%.
 - Should stock be identified as introducing weeds into the conservation area, stock should be put in a holding yard or weed free paddock for 2 full days (48 hours) prior to entering conservation area. This will reduce the spread of weeds from dung.
 - Stock to be removed from Conservation Area if unacceptable levels of erosion or damage are apparent.
 - Guidelines to be outlined in the Ashton Coal Conservation Area Plan of Management based on the recommendations coming from the Flora and Fauna Management Plan and associated regular Flora and Fauna monitoring.

Fire

- f) Suppression where practicable of all wildfires occurring in the conservation area as quickly as possible with the aim of keeping fires to a small area.
- g) Undertaking of fire hazard reduction to protect the natural assets of the conservation area, in appropriate locations, with any required approvals and/or permits using:
 - raking and hand clearing
 - pile burning
 - fuel reduction burns
 - controlled grazing.
- h) Using fire hazard reduction burns and controlled burning which take into account the following fire interval guidelines for broad vegetation types and any guidelines given in the Ashton Coal Bushfire Management Plan:
 - In Sclerophyll Grassy Woodland vegetation, fire should not occur within five years of a previous fire, and should be burnt within forty years of any previous fire.

Vehicle access

- i) Vehicle access to formed trails for access to private property, management purposes as outlined, approved by OEH, fire fighting and/or any emergency requirements.

Threatened species

- j) Implementing any reasonable measures included in recovery plans or other management guidelines for any threatened species or communities which or may be found in the conservation area. At the time of signing this agreement, there is no recovery plan in place for the Grey-crowned Babbler.
- k) Implementing any reasonable measures to mitigate any alteration of habitat following subsidence due to longwall mining to minimise negative effects on the conservation area and in accordance with the Ashton Coal Subsidence Environmental Management Plan and the development consent issued by the Minister for Planning for Development Application No. 309-I1-2001-i on the 11 October 2002.

Restoration of indigenous vegetation

- l) Restoration of native vegetation using natural regeneration as the preferred method.
- m) Revegetation to establish indigenous plants, using species produced from material sourced locally and without fertilisers, where

- the ability to regenerate naturally within a reasonable time frame has been lost, or
- to prevent soil erosion;
- to aid in the establishment of species diversity and height diversity in areas dominated by single species and with depleted natural seed resources.

Revegetation must not compromise cultural heritage and the soil surface. Prior to any proposed revegetation an archaeological assessment must be carried out. The Owner should be aware that any works which impact on cultural heritage will require a Section 90 consent under the *National Parks and Wildlife Act 1974*.

Seed collection

- n) Collection of seed collection in keeping with *Guidelines/or Collection of Seed, and other Plant Propagation material* (available from OEH), and the following limitations and permissions:
- Collect seed in the conservation area only if seed of the particular species and genotype is not available elsewhere, or if the seed collected is intended for seedlings that will be planted within the conservation area or adjacent to the conservation area.
 - Licences are required for collection of material of protected plants listed under Section 131 (Schedule 13) of the National Parks and Wildlife Act 1974.
 - Where seed collection involves species listed on Schedule 1 or 2 of the *Threatened Species Conservation Act 1995*, the relevant licence or prior written permission from the Director-General should be obtained.

Thinning of indigenous vegetation

- o) Thinning of regenerating indigenous species, which are altering the structure of the vegetation and/or reducing conservation values. The benefits to conservation should be greater than the disturbance associated with thinning.

Provision of habitat

- p) Installation of habitat boxes for native fauna in strategic locations where suitable hollows for native fauna are limited or absent. Locations and number to be determined as per the Ashton Coal Flora and Fauna Management Plan and recommendations made in regular Fauna monitoring programs in consultation with OEH.

Cultural heritage

- q) Recording and management of any newly identified Aboriginal objects, as per the Ashton Coal Archaeology and Cultural Heritage Plan.

Visitation and research

- r) Visitation, research and community use at a level that does not adversely impact on the conservation or Aboriginal heritage values of the area. Research projects should be discussed with OEH.
- s) Visitation, research and community use by the Aboriginal Community as outlined in the Ashton Coal Archaeology and Cultural Heritage Plan.

Developments

- t) Carrying out developments as described in Clause 2.3 of the Agreement, and maintaining developments (including existing management and access roads) with the following conditions:
- As a priority the developments should not impact on cultural heritage. The Owner should be aware that any developments which impact on cultural heritage will require a Section 90 consent under the *National Parks and Wildlife Act 1974*.
 - The width of roads and trails will be a maximum of 4 metres wide roadway with 2 metres width for vegetation clearance on each side.
 - Clear a corridor not greater than 3 metres wide during construction or for maintenance for the installation of fences or other agreed rural structures.

- Construct and maintain fences where required to ensure they are stock proof but will not impede the movement of, or be a danger to, native fauna.
- Construct replacement access roads using recommendations for construction and maintenance to be determined by the Owner in consultation with the OEH.
- Remove fallen timber and any other obstructions to maintain access.
- Where clearing is necessary, undertake all works in a manner that minimises disturbance to soil and hydrological characteristics and is in accordance with any recommendations made in the Ashton Coal Archaeology and Cultural Heritage Plan or any other relevant Ashton Coal Environmental Management Plan as listed in 1 E.
- Remove old internal fences and close unwanted tracks within the conservation area and facilitate restoration of native vegetation by allowing natural regeneration.

Monitoring

- u) Annexure B contains dated aerial photographs/maps showing the location of the conservation area, the conservation values and photo-points. Photographs have been taken at these photopoints at the time of entering the agreement. This provides baseline information and data for ongoing monitoring and adaptive management of the conservation area.
- v) Photographs at the identified photo-points should be taken from time to time for the purposes of ongoing monitoring of the conservation values. This should be carried out in consultation with OEH. The process can include the specific monitoring as described in the Ashton Coal Flora and Fauna Management Plan (White Mining Limited 2003a).
- w) The Owner will as part of the approval issued by the NSW Department of Planning for Development Application No. 309-11-2001-i on the 11 October 2002 conduct regular environmental monitoring and complete Annual Environmental Monitoring Reports for the mine site. Monitoring of the cultural heritage and biodiversity values of the conservation area will be included in but not limited to these reports. This will form the basis for decisions about ongoing management actions. A copy of relevant monitoring reports should be forwarded to OEH.

ITEM 2:

The landholders shall not undertake, consent to or permit (unless specified in Item 1 of Annexure C or with prior written consent of the Director-General)

- a) the sowing or planting of trees, grasses or other plants in the conservation area;
- b) the introduction of any non-indigenous plants or non-indigenous fauna into the conservation area;
- c) the entry of domestic animals including pets and domestic livestock in the conservation area;
- d) the use or application of fertiliser or pesticides in the conservation area;
- e) the use of trail bikes, four wheel drive vehicles or any other vehicle in the conservation area off any formed road;
- f) any works in the conservation area, especially any revegetation work and developments, which have the potential to impact on any cultural features;
- g) the removal of any biological or inorganic component of the conservation area; and
- h) any works which will adversely affect the natural flows and bodies of water apart from those works outlined in Item 1 clause 2.3.5 or approved mining operations.