

Riparian and Terrestrial Ecology Impact Assessment

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Ashton Coal Goaf Gas Drainage Project Stage 2- Riparian and terrestrial ecology

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For



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Current knowledge of the ecology of most flora and fauna species is poor. As a consequence there is often insufficient data to objectively assess the potential ramifications of any given proposal for most species. Therefore, it is typical for ecological assessments to rely to some extent on professional opinion, judgments based on the personal knowledge of the ecological consultant, investigations undertaken specifically for the proposal and/or data derived

from previous studies (i.e. literary resources). In scientific jargon, such subjective judgments are 'hypotheses': 'likely' explanations developed through a synthesis of available information and consultant experience in the discipline. These hypotheses are considered quite accurate within the profession as the experience of the consultant balances any insufficiency of data to the standards of the discipline; they nevertheless remain subjective opinions unless tested scientifically.

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Executive Summary

This riparian and terrestrial ecology report has been prepared in support of an application by Ashton Coal Operations Limited (ACOL) to modify DA 309-11-2001-I (this proposal being Mod 10) for the construction of a Central Gas Drainage Plant and associated infrastructure.

The proposed modification comprises:

- Development and operation of up to about 80 goaf gas drainage wells and a reticulated gas pipeline network over the area of underground mine workings.
- Construction and operation of a central gas drainage plant to provide continuous extraction of mine gas from the reticulated gas drainage network.
- Installation and operation of gas flaring apparatus and vent stack arrangement for gas combustion or venting.
- Interim use of portable vacuum assisted atmospheric venting apparatus.
- Development and use of associated support infrastructure.

The objectives of the Ashton Coal Project (ACP) Goaf Gas Drainage Project are to:

- Implement a system for the safe and controlled drainage of goaf gas in a cost-effective manner;
- Safely capture, reticulate and manage the goaf gas;
- Minimise impacts to both natural and man-made environments;
- Minimise greenhouse gas (GHG) emissions; and

The development was designed based on the following ecological criteria:

- Where possible mature trees and remnant vegetation have been avoided;
- Where possible ecologically sensitive areas have been avoided; and
- Where possible the length of access tracks has been minimised.

Overtime the modification will have a total footprint of approximately 13.3 hectares. The proposed footprint will impact on vegetation as shown in Table 1.

Table 1. Impact on vegetation

Vegetation Communities	Impact Area (ha)
1. Disturbed Areas /Dry Pasture	11.97
2. Riparian pasture	0.670
3. Riparian Woodland	0.162
4. Relic Ironbark trees	No impact
5. Bulloak Scrub	0.065
6. Bulloak Scrub with Emergent Box and Ironbark (Endangered Ecological Community)	0.178
7. Box Ironbark woodland (Endangered Ecological Community)	No impact
8. Planted Eucalypt and Acacia woodland	0.25
Total Impact	13.30ha
Total impact on native vegetation	0.655 ha

In total, eight (8) vegetation units were identified. One Endangered Ecological Community Central Hunter Grey Box-Ironbark Woodland (CHGBIW) - Map unit 6 and 7) was recorded, however the project has been designed to avoid this community and where pipelines are to be constructed within these areas impacts to trees will be avoided wherever possible.

Targeted surveys (January 2012) of the Local Area recorded individuals from two endangered flora populations, being the Hunter Weeping Myall population and the River red gum population in the Hunter Catchment. Individuals from the Hunter Weeping Myall and the Hunter river red gum population were recorded outside of the proposed impact areas, and will not be impacted..

Habitat for four (4) significant flora species was identified within the Proposal Area; however no individuals were recorded during surveys. Six (6) significant fauna species were recorded within and adjoining the Proposal Area:

1. Grey-crowned Babbler (*Pomatostomus temporalis*);
2. Turquoise Parrot (*Neophema pulchella*);
3. Speckled Warbler (*Pyrrholaemus sagittatus*);
4. Scarlet Robin (*Petroica boodang*);
5. Hooded Robin (*Melanodryas cucullata cucullata*); and,
6. Flame Robin (*Petroica phoenicea*).

Habitat for a further seven (7) species was also identified.

The total impact within native vegetation communities is approximately 0.66 of a hectare. The impacts within these communities is limited to the removal of grasses and in some cases shrubs in the five metre wide corridors. The proposed modification will implement the following avoidance measures:

- Trees will be avoided where possible;
- No important habitat for native fauna (i.e. nest trees) will be removed;
- No water bodies will be impacted; and,
- No hollows or rock areas will be removed.

Given the undertaking of the proposed recommendations, the development will avoid impacts on significant species, populations, communities or their habitats in the following ways:

- No significant areas of habitat will be lost or isolated;
- The development will not introduce any threats such as grazing;
- The communities within the Proposal Area will not be impacted by clearing of vegetation to the extent that the integrity of the community would be put at risk; and
- There are no long-term impacts that will put any significant species, populations, communities or their habitats at further risk.

The construction of the Central Goaf Gas Drainage Plant, Goaf Drainage Holes , pipelines and the supporting infrastructure will not significantly impact significant natural areas (i.e. modify or remove habitats) or introduce secondary impacts (i.e. downstream impacts or change competition) to any ecologically sensitive areas.

The following summarises the recommendations made in this report:

Management of Impacts on Woodland Birds

Impacts on woodland birds will be managed by the implementation of control measures during construction and the rehabilitation of habitats following construction, these measures include:

- *The selection of final locations for pipelines and drill sites when within woodland bird habitat will be assisted by a qualified ecologist*
- *The area within the woodland bird habitat will be rehabilitated with seed collected from the site.*

Management of Impacts on Frogs

The presence of potential habitat for Green and Golden Bell Frog in conjunction with the recent (2010) recording of an individual within the adjoining site requires that the following mitigation measures be implemented.

- *Areas of suitable habitat (woodland vegetation within VCA) will be walked over by a qualified ecologist immediately preceding commencement of construction.*

Management of Impacts on Endangered Ecological Community- Central Hunter Grey Box - Ironbark Woodland (CHGBIW)

The presence of this community requires that the following mitigation measures be implemented to reduce impacts:

- *The selection of final locations for pipelines and drill sites when within CHGBIW will be assisted by a qualified ecologist.*
- *Erosion protection measures will be installed within CHGBIW habitat and maintained through the construction phase.*

The implementation of the above recommendations will reduce the risk of significant impacts on any of the identified threatened species, populations, communities or their habitats known to the Local Area.

Ashton Coal Goaf Gas Drainage Project

Riparian and Terrestrial Ecology

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1.0 Introduction

This riparian and terrestrial ecology report has been prepared in support of an application by Ashton Coal Operations Limited (ACOL) to modify DA 309-11-2001-I (this proposal being Mod 10) for the construction of a Central Gas Drainage Plant and associated infrastructure.

The proposed modification comprises:

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- Construction and operation of a central gas drainage plant to provide continuous extraction of mine gas from the reticulated gas drainage network.
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- Implement a system for the safe and controlled drainage of goaf gas in a cost-effective manner;
- Safely capture, reticulate and manage the goaf gas;
- Minimise impacts to both natural and man-made environments;
- Minimise greenhouse gas (GHG) emissions; and

The development was designed based on the following ecological criteria:

- Where possible mature trees and remnant vegetation have been avoided;
- Where possible ecologically sensitive areas have been avoided; and
- Where possible the length of access tracks has been minimised.

A detailed description of the proposal is provided in Section 4 of the *Ashton Central Gas Drainage Plant and Associated Infrastructure Environmental Assessment*. The specific areas of issue for this report are presented below and diagrammatically in **Figure 1**:

1. **Local Area**- This includes all terrestrial lands from the New England Highway in the north to the Hunter River in the south and ranges from Glennies Creek in the east across Bowmans Creek and terminates on the Ravensworth mine site.
2. **Proposal Area**- also referred to as the Project or Impact Area, this includes all terrestrial lands within the footprint of the proposed disturbance, as shown in **Figure 1**.

1.1 Scope of Work

The general aim of this report is to undertake a terrestrial flora and fauna assessment of the likely impacts of the construction of a Central Gas Drainage Plant and associated infrastructure on potential and significant ecological issues.

The specific aims are to:

1. Determine the potential impacts of the proposal on terrestrial ecological matters; and,
2. Provide recommendations to minimise impacts on terrestrial ecology.

1.2 Methodology

The results of previous surveys for terrestrial ecology were incorporated into the design of new surveys for this project. This review highlighted several areas which required additional survey. These surveys undertaken in December 2011 included the following:

- Walking transects (8 hours in total) across the entire proposed pipeline routes (as shown in to Figure 1) including detailed ground searches for rare plants that are known to inhabit grasslands;
- Survey of remnants within the proposed route for significant bird habitat, in addition to the already significant woodland bird surveys conducted for the ecological monitoring program (10 days twice a year). The surveys were expanded into habitats not surveyed during the monitoring program to cover the proposed route; and,
- Nocturnal amphibian surveys undertaken in January 2012 during ideal wet weather conditions (5 nights of three hours survey). Surveys included call back of Green and Golden Bell Frog and targeted searches within depressions, dams and creeks.

2.0 Existing Environment

2.1 Vegetation Communities

In total, eight (8) vegetation units have been identified in the Proposal Area. One Endangered Ecological Community Central Hunter Grey Box-Ironbark Woodland (Map units 6 and 7) was recorded, however the project has been designed to largely avoid this community. Targeted surveys of the Local Area recorded individuals from two endangered flora populations, being the Hunter Weeping Myall population and the River red gum population in the Hunter Catchment. Individuals from the Hunter Weeping Myall and the Hunter river red gum population were recorded outside of the proposed impact areas, and will not be impacted.

These descriptions were determined from the walking surveys and the results of the quadrat data (See Appendix A). The division of these communities is based on floristic and structural differences. These communities are listed below and shown in Table 2 and Figure 2:

1. Dry pasture;
2. Riparian pasture;
3. Riparian woodland;
4. Relic Ironbark trees;
5. Bulloak Scrub;
6. Bulloak Scrub with Emergent Box and Ironbark;
7. Box ironbark woodland; and,
8. Planted Eucalypt and Acacia woodland.

Table 2. Descriptions of vegetation map units within the Proposal Area.

Unit 1	Dry Pasture
EEC:	n/a
Mapped Area:	440ha
Dominant Species:	various native and introduced grasses and herbs
General Description:	
An induced vegetation community formed by clearing of the original native woodland and ongoing grazing to maintain grassland of native grasses, such as <i>Aristida ramosa</i> , <i>Austrostipa verticillata</i> and <i>Eriochloa pseudoacrotricha</i> , introduced grasses, such as <i>Paspalum dilatatum</i> , and native and introduced herbs. Includes scattered <i>Allocasuarina luehmannii</i> , <i>Eucalyptus crebra</i> and <i>Eucalyptus moluccana</i> , mostly as regrowth.	
Unit 2	Riparian Pasture
EEC:	n/a
Mapped Area:	63.4ha

Dominant Species:	various mostly introduced grasses and herbs
General Description:	
Pasture on better quality fluvial soil dominated by introduced grasses, such as <i>Panicum maximum</i> var. <i>trichoglume</i> and <i>Paspalum dilatatum</i> , and introduced herbs, such as <i>Acetosa sagittata</i> , <i>Aster subulatus</i> , <i>Cirsium vulgare</i> and <i>Conyza bonariensis</i> .	
Unit 3 Riparian Woodland	
EEC:	n/a
Mapped Area:	58.1ha
Dominant Species:	<i>Casuarina cunninghamii</i> , <i>Salix babylonica</i> , <i>Melia azedarach</i>
General Description:	
Marginal vegetation along the creek dominated by riparian trees, but with patches of herbaceous aquatics such as <i>Persicaria decipiens</i> , <i>Phragmites australis</i> , <i>Schoenoplectus validus</i> , and <i>Typha orientalis</i> .	
Unit 4 Relic Ironbark Trees	
EEC:	n/a
Mapped Area:	n/a
Dominant Species:	<i>Eucalyptus crebra</i>
General Description:	
Not truly a separate vegetation community but worthy of separation as the only cluster of mature trees on the site. These ironbark trees were evidently retained when the remainder of the site was cleared. The understorey vegetation is dry pasture.	
Unit 5 Bulloak Scrub	
EEC:	n/a
Mapped Area:	26 ha
Dominant Species:	<i>Allocasuarina luehmannii</i>
General Description:	
Dense regrowth of <i>Allocasuarina luehmannii</i> , presumably resulting from a reduction in grazing. The understorey is very sparse and includes many weeds, such as <i>Galenia pubescens</i> and <i>Opuntia</i> spp.	
Unit 6 Bulloak Scrub with Emergent Box and Ironbark And regenerating areas of Bulloak Scrub with Emergent Box and Ironbark	
EEC:	Central Hunter Grey Box-Ironbark Woodland
Mapped Area:	51.5 ha
Dominant Species:	<i>Allocasuarina luehmannii</i> , <i>Eucalyptus moluccana</i> , <i>Eucalyptus crebra</i>
General Description:	
Similar to the previous unit but with greater regrowth of the trees which presumably dominated the original native woodland vegetation.	
Unit 7 Box ironbark woodland	
EEC:	Central Hunter Grey Box-Ironbark Woodland
Mapped Area:	25.6ha
Dominant Species:	<i>Eucalyptus crebra</i> (Narrow-leaved Ironbark) and <i>Eucalyptus moluccana</i> (Grey

	Box)
General Description:	
An induced vegetation community formed by clearing of the original native woodland and historical grazing to maintain grassland of native grasses, such as <i>Aristida ramosa</i> , <i>Austrostipa verticillata</i> and <i>Eriochloa pseudoacrotricha</i> , introduced grasses, such as <i>Paspalum dilatatum</i> , and native and introduced herbs. Includes scattered <i>Allocasuarina luehmannii</i> , <i>Eucalyptus crebra</i> and <i>Eucalyptus moluccana</i> , mostly as regrowth.	
Unit 8	Planted Eucalypt and Acacia woodland
EEC:	n/a
Mapped Area:	20.6 ha
Dominant Species:	various native and introduced grasses and herbs
General Description:	
A planted vegetation community comprising native trees, <i>Allocasuarina luehmannii</i> , <i>Eucalyptus crebra</i> and <i>Eucalyptus moluccana</i> . The planted areas in the west of the subject site vary by being dominated by <i>Acacia salicina</i> with a few individuals of <i>Acacia pendula</i> also being recorded adjacent to Brunkers Lane. Groundcover of native grasses, such as <i>Aristida ramosa</i> , <i>Austrostipa verticillata</i> and <i>Eriochloa pseudoacrotricha</i> , introduced grasses, such as <i>Paspalum dilatatum</i> , and native and introduced herbs.	

The vegetation in the Proposal Area predominantly comprises dry pasture created by historical clearing of forest, with patched of Bullock forest communities with isolated emergent eucalypt trees, relic Ironbark trees. The dominant forest type surveyed was Riparian Woodland dominated by *Casuarina cunninghamii* (River Oak); isolated paddock trees include *Eucalyptus crebra* (Narrow-leaved Ironbark) and *Eucalyptus moluccana* (Grey Box) with *Corymbia maculata* (Spotted Gum) as almost absent due largely we believe to past clearing. Low lying areas of Riparian corridors were dominated by aquatic species, Slender Knotweed (*Persicaria decipiens*), Common Reed (*Phragmites australis*), *Schoenoplectus validus*, and Broadleaf Cumbungi (*Typha orientalis*).

Ground cover in upland areas was moderately dense, and consists of forbs, grass species, and a limited number of ferns, sedges or other herbs. Common species in pasture areas include Three-awned Spear Grass (*Aristida ramosa*), Slender Bamboo Grass (*Austrostipa verticillata*), Early Spring Grass (*Eriochloa pseudoacrotricha*) and *Paspalum dilatatum*. In areas with relic trees a range of other species were present including, Windmill Grass (*Chloris truncata*), Short-hair Plume Grass (*Dichelachne micrantha*), Poison Rock Fern (*Cheilanthes sieberi* subsp. *Sieberi*), Barbed Wire Grass (*Cymbopogon refractus*), Many-flowered Mat-rush (*Lomandra multiflora* subsp. *Multiflora*), Blue Flax Lily (*Dianella revolute*), Large Tick-trefoil (*Desmodium brachypodum*), Kidney Weed (*Dichondra repens*), Winter Apple (*Eremophila debilis*), White Burr-daisy (*Calotis dentex*), Small St. John's Wort (*Hypericum gramineum*), Common Everlasting (*Chrysocephalum apiculatum*), and Tufted Bluebell (*Wahlenbergia communis*).

Appendix A shows the complete flora data recorded, the seasonality of surveys and where each quadrat, and transect, and the locality from which they were recorded.

2.2 Significant Flora

In total, twenty (20) significant flora species have previously been recorded within ten (10) kilometres of the Proposal Area. Review of local area ecological reports identified one species in particular being recorded close to the Proposal Area (within two kilometres), this being Lobbed Blue grass. It is known that this grass tolerates grazing and is often found on clay (conditions met by the site) therefore targeted in season (summer) surveys were undertaken in 2010 as part of the ecological monitoring program. No individuals were recorded during these surveys. The in-field assessment of habitats indicates that potential habitat is present for the following threatened flora species:

Grassland Flora Species

1. Lobbed Blue grass (*Bothriochloa biloba* - EPBC species);
2. Weeping Myall (*Acacia pendula*);
3. *Thesium australe*;
4. Finger Panic Grass (*Digitaria porrecta*); and,
5. *Olearia cordata*.

None of these species were recorded during surveys undertaken between January 06 and 20 2012. However as a precautionary measure each species was assessed by 7-part test (Refer to **Appendix C**).

2.6 Significant Vegetation Communities Previously Recorded in the Regional Area

Endangered Ecological Communities (EEC's) as defined under Schedule 13 of the TSC Act and protected matters under the provisions of the EPBC Act which are known to the Singleton Shire Council Local Government Area are shown in **Table 3**.

Table 3. Endangered Ecological Communities of the Singleton Shire Local Government LGA.

Endangered Ecological Communities	Relevance to the activity area and surrounding vegetation
Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions TSC Act (EEC)	This forest occurs on lowland, floodplains and lower slopes on moderate fertile soils. It is dominated by <i>Eucalyptus tereticornis</i> (Forest Red Gum) and <i>E. punctata</i> (Grey Gum). Other frequently occurring canopy species are <i>Angophora costata</i> , <i>Corymbia maculata</i> , <i>E. crebra</i> and <i>E. moluccana</i> . This vegetation community was not recorded in the study area during surveys and does not require further assessment.
Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion TSC Act (EEC)	This community is dominated by Spotted Gum <i>Corymbia maculata</i> and Broad-leaved Ironbark <i>Eucalyptus fibrosa</i> , while Grey Gum <i>E. punctata</i> and Grey Ironbark <i>E. crebra</i> occur occasionally. Spotted gum Ironbark associations are known to the study area to the west and east of the activity area, however these are largely distinguishable from LHSGIBF by the co-dominance of <i>Corymbia maculata</i> , <i>E. umbra</i> and <i>E. siderophloia</i> . The floristic associations for LHSGIBF were not recorded in the study area, as such, this community does not require any further assessment.
Central Hunter Ironbark - Spotted Gum - Grey Box Forest in the NSW North Coast and Sydney Basin Bioregions TSC Act (EEC)	Central Hunter Ironbark - Spotted Gum - Grey Box Forest occurs in the central Hunter Valley mainly between Maitland and Muswellbrook. It occurs in the Muswellbrook, Singleton, Cessnock, Maitland and Dungog LGAs. open forest or woodland dominated by <i>Eucalyptus crebra</i> (Narrow-leaved Ironbark), <i>Corymbia maculata</i> (Spotted Gum) and <i>Eucalyptus moluccana</i> (Grey Box). Other tree species such as <i>Eucalyptus fibrosa</i> (Broad-leaved Ironbark) and <i>Eucalyptus tereticornis</i> (Forest Red Gum). This community and the floristic associations for this community were not recorded in the activity area, as such; this community does not require any further assessment.
Central Hunter Grey Box – Ironbark Woodland in the NSW North Coast and Sydney Basin TSC Act (EEC)	Central Hunter Grey Box - Ironbark Woodland occurs in the Central Hunter Valley between about Singleton and Muswellbrook. It is known to occur in the Cessnock, Singleton and Muswellbrook LGAs but may occur elsewhere within the Sydney Basin Bioregion. Woodland dominated by <i>Eucalyptus crebra</i> (Narrow-leaved Ironbark), <i>Brachychiton populneus</i> subsp. <i>populneus</i> (Kurrajong) and <i>Eucalyptus moluccana</i> (Grey Box). Other tree species such as <i>Angophora floribunda</i> (Rough-barked Apple) and <i>Callitris endlicheri</i> (Black Cypress Pine) may be present and occasionally dominate or co-dominate. Recorded within the subject site in vegetation communities (4, 6 and 7). Management of potential impacts area required.

Endangered Ecological Communities	Relevance to the activity area and surrounding vegetation
Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Basin Bioregions	<p>Hunter Floodplain Red Gum Woodland has been recorded from the local government areas of Maitland, Mid-Western, Muswellbrook, Singleton, and Upper Hunter but may occur elsewhere within the NSW North Coast and Sydney Basin Bioregions. Stands on major floodplains are generally dominated by <i>Eucalyptus camaldulensis</i> (River Red Gum) in combinations with <i>Eucalyptus tereticornis</i> (Forest Red Gum), <i>Eucalyptus melliodora</i> (Yellow Box) and <i>Angophora floribunda</i> (Rough-barked Apple). Within the community stands of <i>Casuarina cunninghamiana</i> subsp. <i>cunninghamiana</i> (River Oak) and <i>Casuarina glauca</i> (Swamp Oak) can form a part of this community.</p> <p>This community and the floristic associations for this community were not recorded in the activity area, as such; this community does not require any further assessment.</p>

2.3 Significant Fauna

Six (6) significant fauna species were identified in the Study Area and/or adjacent to the development site

Recorded Species:

1. Grey-crowned Babbler (*Pomatostomus temporalis*);
2. Turquoise Parrot (*Neophema pulchella*);
3. Speckled Warbler (*Pyrrholaemus sagittatus*);
4. Scarlet Robin (*Petroica boodang*);
5. Hooded Robin (*Melanodryas cucullata cucullata*); and,
6. Flame Robin (*Petroica phoenicea*).

A further seven (7) species are considered to have potential habitat within the development area. Refer to **Appendix B** for list of habitat potential for locally recorded significant species. All these thirteen (13) species are passed through the 7-Part test of significance (**Appendix C**).

Frogs which are known to forage in Grasslands near wetlands and other water bodies:

1. Green and Golden Bell Frog

Woodland Birds:

2. Diamond Firetail (*Stagonopleura guttata*);and
3. Red-backed Button-quail (*Turnix maculosa*).

Higher order Forest Birds which are known to forage in grassland:

4. Masked Owl (*Tyto novaehollandiae*);

Micro-Bats

5. Eastern Bentwing-bat (*Miniopterus schreibersii oceansis*);
6. Eastern Freetail-bat (*Mormopterus norfolkensis*); and
7. Southern or Large-footed Myotis (*Myotis macropus*).

Two of these species (Eastern Bentwing-bat and Large-footed Myotis) were recorded within the area of the proposed modification and could be potentially directly impacted by the proposal. The following section outlines the current knowledge obtained of these populations in the Study Area and how this relates to the management of the local population.

2.7.1 Grey-crowned Babbler

As part of annual reporting requirements biannual surveys of the local Grey-crowned Babbler population have been undertaken since 2009. These surveys include surveys up to 10 kilometres from the subject site where land access is not limited. Figure 3 shows the most recent population results for this species (survey period February 2012).

Locally connected troops that have been identified (as part of the local population that includes the project area) total 18 troops of approximately 94 birds inhabiting 300 hectares.

Local population of Grey-crowned Babbler in the Hunter Valley is determined by sub-populations (troops) that are linked by vegetation that permits migration and troops are not isolated by more than 1000 metres. Home ranges often overlap for this species and mingling of troops in the non-breeding season is commonly recorded (personal data).

Surveys of the impact area identified one new sub-population made up of two (2) troops or 15 individual Grey-crowned Babblers (Figure 3). Systematic foot surveys of ACOL lands (2010-2011) also identified two (2) new breeding and five (5) nesting trees within the impact area. Home ranges for the troops included 77 hectares from Bowmans Creek across open areas east to the planted corridor and 89 hectares from the central part of the impact area south towards the Hunter River (Figure 3).

During surveys individuals were recorded foraging and nest building daily within the impact area. Surveys of reserve areas within ACOL operational lands confirmed the stability of the local population with troops being recorded within every remnant. There has been a steady increase in the size of the local population from a recorded 27 individuals in 2009 to a total of 42 individuals in 2011 (55% increase). The area of occupation has risen from 38 hectares in 2009 to 94 hectares (~247% increase).

During this time underground mining has continued and mitigation measures have been implemented by ACOL to manage disturbance from impacts. This gradual expansion of the Grey-crowned Babbler population is hypothesised as being a function of improved landscape management. Over the last two years there has been a dramatic reduction in grazing intensity and improved fencing of important habitat areas. This presents several important flow on effects for the local population:

- Improved breeding success of the core habitat areas;
- Leading to increased migration into uninhabited areas;
- New areas have improved ecological resources due to removal of grazing;
- Leading to increased nest success, which is critical for this species long term viability, due to newly established troops having fewer numbers and a documented lower success rate;
- Continued occupation over a longer period leads to increase in troop size and health; which,
- Leads to a gradual radiation of the population into other adjoining areas.

Clearly the implemented management strategies are working effectively for Grey-crowned Babbler.

2.7.2 Speckled Warbler

Surveys in the local area identified two sub-populations of Speckled Warbler. Further surveys on adjoining sites located an additional sub-population (Figure 4). Since 2009, three (3) new observations have been made of Speckled Warbler foraging within the impact area; with a maximum of four (4) birds being recorded at any one time (see Figure 4). To date no evidence of breeding has been observed within newly identified foraging areas. One reasonable hypothesis for this is that individuals recorded have expanded their home-range from the core area into the outer limits of suitable habitat; an alternative hypothesis is that breeding habitat has not yet been located by surveys.

3.0 Statutory Requirements

3.1 Environment Protection & Biodiversity Conservation Act 1999

The Commonwealth Environment Protection & Biodiversity Conservation Act, 1999 (EPBC Act) provides for the need for the approval of the Commonwealth Environment Minister for all actions that will or are likely to have a significant impact on a matter of national environmental significance (MNES). The underground area was included within EPBC Act Referral 2001/524 in 2001 and was assessed and deemed not to have an impact on any MNES. Refer to **Appendix D** for assessment.

The proposed modification to the original disturbance area detailed within EPBC Act Referral 2001/524 will not result in any impacts on MNES.

3.2 Threatened Species Conservation Act 1995

The TSC Act provides a framework for the listing and declaration of threatened species, populations, endangered ecological communities, key threatening processes and critical habitat. It also provides a framework for the preparation and implementation of recovery plans and threat abatement plans and for licensing. No listed or declared threatened species, populations, endangered ecological communities, or critical habitat will be significantly impacted by this proposal.

3.3 Environmental Planning and Assessment Act 1979

The EP&A Act provides a framework for the assessment of development and activities which are likely to impact on threatened species, populations or ecological communities as listed pursuant to the TSC Act. It also requires that all relevant threat abatement plans and recovery plans are considered. Species considered to be known to the local area and which the site provides degrees of habitat for them are assessed by 7-Part tests, refer to **Appendix C** for more details.

3.4 State Environmental Planning Policies (SEPP)

3.4.1 SEPP 44 – Koala Habitat Protection

State Environmental Planning Policy No 44 – Koala Habitat Protection (SEPP 44) was introduced to protect potential and core koala habitat in NSW. Under SEPP 44, developers of land with koala habitat (as defined in the SEPP) have to consider the impact of their proposals on koalas, and in certain circumstances, prepare individual koala plans of management for their land. There is no core koala habitat in the Proposal Area and no koala recorded.

3.5 Relevant key threatening processes

The key threatening process of “clearing of native vegetation” is the only relevant process. A very small area of understorey and regenerating vegetation will be impacted and is unlikely to contribute to an increase in this risk, as such no further assessment is required.

4.0 Predicted Impacts

The development includes the Central Gas Drainage Plant, goaf drainage points, predominantly buried with some aboveground pipes (of different dimensions) and access tracks. The placement and design of the Central Gas Drainage Plant and the goaf drainage points has been based on avoiding ecological sensitive areas (through risk assessment). The goaf gas drainage network encompasses the majority of the surface above the underground mine, as it is required to access each longwall panel to provide adequate drainage in that area,

Locations for up to 80 gas bores will be selected from the potential locations shown in Figure 1. The potential locations encompass an area of approximately 13.3 ha (assuming 25m x 15m pads for each gas bore to allow the mobile gas drainage plant and an initial 5m disturbance area along the total length of pipe). There are eight (8) vegetation communities (see Figure 2) surveyed in the site area. The predicted impact on vegetation is shown in **Table 4**.

Table 4: Impact on native vegetation units

Vegetation Communities	Impact Area (ha)
1. Disturbed Areas /Dry Pasture	11.97
2. Riparian pasture	0.670
3. Riparian Woodland	0.162
4. Relic Ironbark trees	No impact
5. Bulloak Scrub	0.065
6. Bulloak Scrub with Emergent Box and Ironbark (Endangered Ecological Community)	0.178
7. Box Ironbark woodland (Endangered Ecological Community)	No impact
8. Planted Eucalypt and Acacia woodland	0.25
Total Impact	13.30ha
Total impact on native vegetation	0.655 ha

In terms of the impact on local populations the potential impact has been calculated to be small. Putting it into perspective the 0.66 ha of native vegetation to be moderately impacted by the proposal represents less than <0.5% of the Local Area habitat.

The potential impacts identified from the development come under three broad categories: 1) Direct loss of foraging habitat from excavation and pipe laying; 2) Direct impact on key habitat resources, such as nest trees; and, 3) Secondary impacts such as weeds and sedimentation from excavation and pipe laying.

These present relatively manageable impact problems that can be mitigated with the undertaking of the recommendations detailed in **Table 5** below. Given these undertakings the development **will not impact** on significant species, populations, communities or their habitats in the following ways:

- No significant areas of habitat will be lost or isolated;
- The development will not introduce any threats that may impact on the long term viability of populations;
- The communities within the Proposal Area will not be impacted (not >2% loss of habitat) to an extent that the integrity of the community would be put in doubt;

- There are no long-term impacts on communities that will put any significant species, populations, communities or their habitats at further risk.

For a full assessment of these predicted impacts on the 13 species identified at risk in this assessment refer to **Appendix C- 7 Part Tests**.

In conclusion, the proposal will not impact on ecological matters pursuant to the TSC Act and EPBC Act. Provided continuing and appropriate mitigation measures are maintained (see below) this proposal will not result in any impacts additional to those which have already been assessed for the existing ACOL underground mine.

5.0 Management Actions for Terrestrial Ecology

In total, thirteen (13) species were identified as potentially being impacted by the proposed development. The type and degree of impact varies for each species, however all potential impacts can be reduced with the application of mitigation measures. **Table 5** presents the species which could potentially be impacted in the absence of appropriate management and mitigation, the risk this poses to the long term viability of the local population and the proposed mitigation measures to reduce these impacts. If a species is still identified as being at a risk (following mitigation) of a significant impact, modifications to the development will be proposed.

Table 5: Impact and mitigation proposed to reduce impacts.

Species potentially impacted by the development	Potential of unmitigated Impacts	Mitigation Proposed to reduce impacts	Final impact on species following implementation of mitigation and management measures
Species recorded within the proposal area			
<p>Central Hunter Grey Box – Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions</p>	<ul style="list-style-type: none"> In localities where remnants of the CHGBIW have been mapped (See Figure 2) the slashing and excavation for pipe will remove habitat for this community. Erosion and sedimentation from excavated areas will introduce risks to this community (i.e. weeds) 	<ul style="list-style-type: none"> The selection of final locations for pipelines and drill sites when within CHGBIW will be assisted by a qualified ecologist. Erosion protection measures will be installed within CHGBIW habitat and maintained through the construction phase. The area within the CHGBIW habitat will be rehabilitated with seed collected from the site. Additional planting of the key species that make the CHGBIW community will be planted within the cleared areas of the Southern Woodland. 	<p>The implementation of the proposed mitigation measures will sufficiently reduce the level of impact so that no species, populations, communities or their habitats will be placed at further risk.</p>
<p>Speckled Warbler</p>	<ul style="list-style-type: none"> In localities where Speckled warbler have been mapped (See Figure 4) the slashing and excavation for pipe will remove habitat for this species. These activities may also impact on key habitat resources such as nest sites. Erosion and sedimentation from excavated areas will introduce risks to this habitat (i.e. weeds) 	<ul style="list-style-type: none"> The selection of final locations for pipelines and drill sites when within woodland bird habitat will be assisted by a qualified ecologist Erosion protection measures will be installed within Speckled warbler habitat and maintained through the construction phase. The area within the Speckled warbler habitat will be rehabilitated with seed collected from the site. Additional planting of the key species that make the CHGBIW community will be planted at a ratio of 4:1 within the cleared areas of the Southern Woodland. 	<p>The implementation of the proposed mitigation measures will sufficiently reduce the level of impact so that no species, populations, communities or their habitats will be placed at further risk.</p>
<p>Hooded Robin + (south-eastern form)</p>	<ul style="list-style-type: none"> In localities where Hooded robin have been mapped (See Figure 5) the slashing and excavation for pipe will remove habitat for this species. Loss of perch and pounce opportunities for this species. Erosion and sedimentation from excavated areas will introduce risks to this habitat (i.e. weeds) 	<ul style="list-style-type: none"> The selection of final locations for pipelines and drill sites when within woodland bird habitat will be assisted by a qualified ecologist Erosion protection measures will be installed within Hooded Robin habitat and maintained through the construction phase. The area within the Hooded Robin habitat will be rehabilitated with seed collected from the site. 	<p>The implementation of the proposed mitigation measures will sufficiently reduce the level of impact so that no species, populations, communities or their habitats will be placed at further risk.</p>

Species potentially impacted by the development	Potential of unmitigated Impacts	Mitigation Proposed to reduce impacts	Final impact on species following implementation of mitigation and management measures
Scarlet Robin	<ul style="list-style-type: none"> In localities where Scarlet robin have been mapped (See Figure 5) the slashing and excavation for pipe will remove habitat for this species. Loss of perch and pounce opportunities for this species. Erosion and sedimentation from excavated areas will introduce risks to this habitat (i.e. weeds) 	<ul style="list-style-type: none"> The selection of final locations for pipelines and drill sites when within woodland bird habitat will be assisted by a qualified ecologist Erosion protection measures will be installed within Scarlet Robin habitat and maintained through the construction phase. The area within the Scarlet Robin habitat will be rehabilitated with seed collected from the site. 	<p>The implementation of the proposed mitigation measures will sufficiently reduce the level of impact so that no species, populations, communities or their habitats will be placed at further risk.</p>
Flame Robin	<ul style="list-style-type: none"> In localities where Flame Robin have been mapped (See Figure 5) the slashing and excavation for pipe will remove habitat for this species. Loss of perch and pounce opportunities for this species. Erosion and sedimentation from excavated areas will introduce risks to this habitat (i.e. weeds) 	<ul style="list-style-type: none"> The selection of final locations for pipelines and drill sites when within woodland bird habitat will be assisted by a qualified ecologist . Erosion protection measures will be installed within Flame Robin habitat and maintained through the construction phase. The area within the Flame Robin habitat will be rehabilitated with seed collected from the site. 	<p>The implementation of the proposed mitigation measures will sufficiently reduce the level of impact so that no species, populations, communities or their habitats will be placed at further risk.</p>
Grey-crowned Babbler (eastern subspecies) (Pomatostomus temporalis)	<ul style="list-style-type: none"> In localities where Grey-crowned Babbler have been mapped (See Figure 3) the slashing and excavation for pipe will remove habitat for this species. These activities may also impact on key habitat resources such as nest sites and den trees. Erosion and sedimentation from excavated areas will introduce risks to this habitat (i.e. weeds). 	<ul style="list-style-type: none"> The selection of final locations for pipelines and drill sites when within woodland bird habitat will be assisted by a qualified ecologist Erosion protection measures will be installed within Grey-crowned Babbler habitat and maintained through the construction phase. The area within the Grey-crowned Babbler habitat will be rehabilitated with seed collected from the site. 	<p>The implementation of the proposed mitigation measures will sufficiently reduce the level of impact so that no species, populations, communities or their habitats will be placed at further risk.</p>

Species potentially impacted by the development	Potential of unmitigated Impacts	Mitigation Proposed to reduce impacts	Final impact on species following implementation of mitigation and management measures
Turquoise Parrot	<p>In localities where Turquoise Parrot have been mapped (See Figure 6) the slashing and excavation for pipe will remove habitat for this species.</p> <p>These activities may also impact on key habitat resources such as nest sites.</p> <p>Erosion and sedimentation from excavated areas will introduce risks to this habitat (i.e. weeds)</p>	<p>The selection of final locations for pipelines and drill sites when within woodland bird habitat will be assisted by a qualified ecologist</p> <p>Erosion protection measures will be installed within Turquoise Parrot habitat and maintained through the construction phase.</p> <p>The area within the Turquoise Parrot habitat will be rehabilitated with seed collected from the site.</p>	<p>The implementation of the proposed mitigation measures will sufficiently reduce the level of impact so that no species, populations, communities or their habitats will be placed at further risk.</p>
Eastern Bentwing-bat (Miniopterus schreibersii oceansis); and Southern or Large-footed Myotis (Myotis macropus).	<p>Loss of grass species that provide foraging and sheltering habitat for this species.</p> <p>Erosion and sedimentation from excavated areas will introduce risks to this habitat (i.e. weeds)</p>	<p>The selection of final locations for pipelines and drill sites when within woodland bird habitat will be assisted by a qualified ecologist</p> <p>Erosion protection measures will be installed within Masked Owl habitat and maintained through the construction phase.</p> <p>The area within the Masked Owl habitat will be rehabilitated with seed collected from the site.</p>	<p>The implementation of the proposed mitigation measures will sufficiently reduce the level of impact so that no species, populations, communities or their habitats will be placed at further risk.</p>
Weeping Myall (Acacia pendula)	<p>Slashing and excavation for pipe laying may remove individuals.</p> <p>Disturbance from informal tracks.</p> <p>Changes in competition levels due to changes in grazing regime.</p>	<p>Pre-slashing and excavation surveys of the wells proposed in the vicinity of Brunkers Lane were individuals have been previously recorded.</p> <p>If individuals are recorded relocate tracks and excavation routes and a seed collection, propagation and planting programme will be undertaken.</p>	<p>The implementation of the proposed mitigation measures will sufficiently reduce the level of impact so that no species, populations, communities or their habitats will be placed at further risk.</p>
Species potentially having habitat within the proposal area			
Lobbed Blue grass (Bothriochloa biloba)	<p>Slashing and excavation for pipe laying may remove individuals.</p>	<p>Pre-slashing and excavation surveys.</p> <p>If individuals are recorded relocate tracks and excavation</p>	<p>The implementation of the proposed mitigation measures</p>

Species potentially impacted by the development	Potential of unmitigated Impacts	Mitigation Proposed to reduce impacts	Final impact on species following implementation of mitigation and management measures
Finger Panic Grass (Digitaria porrecta) Thesium australe Olearia cordata	<p>Disturbance from informal tracks.</p> <p>Changes in competition levels due to changes in grazing regime.</p>	<p>routes and a seed collection, propagation and planting programme will be undertaken.</p>	<p>will sufficiently reduce the level of impact so that no species, populations, communities or their habitats will be placed at further risk.</p>
Green and Golden Bell Frog	<p>In localities where slashing and excavation is to commence there is a risk of harming individuals migrating across the landscape, especially during the spring and summer months.</p>	<p>Areas of suitable habitat will be walked over by a suitably qualified ecologist immediately preceding commencement of construction.</p>	<p>The implementation of the proposed mitigation measures will sufficiently reduce the level of impact so that no species, populations, communities or their habitats will be placed at further risk.</p>
Diamond Firetail	<p>Loss of grass species that provide foraging habitat for this species.</p> <p>Disturbance to the regime i.e. fire and grazing regime that may impact of food resources.</p> <p>Erosion and sedimentation from excavated areas will introduce risks to this habitat (i.e. weeds)</p>	<p>The selection of final locations for pipelines and drill sites when within woodland bird habitat will be assisted by a qualified ecologist</p> <p>Erosion protection measures will be installed within Diamond Firetail habitat and maintained through the construction phase.</p> <p>The area within the Diamond Firetail habitat will be rehabilitated with seed collected from the site.</p>	<p>The implementation of the proposed mitigation measures will sufficiently reduce the level of impact so that no species, populations, communities or their habitats will be placed at further risk.</p>
Red-backed Button-quail	<p>Loss of grass species that provide foraging and sheltering habitat for this species.</p> <p>Erosion and sedimentation from excavated areas will introduce risks to this habitat (i.e. weeds)</p>	<p>The selection of final locations for pipelines and drill sites when within woodland bird habitat will be assisted by a qualified ecologist</p> <p>Erosion protection measures will be installed within Red-backed Button-quail habitat and maintained through the construction phase.</p> <p>The area within the Red-backed Button-quail habitat will be rehabilitated with seed collected from the site.</p>	<p>The implementation of the proposed mitigation measures will sufficiently reduce the level of impact so that no species, populations, communities or their habitats will be placed at further risk.</p>

Species potentially impacted by the development	Potential of unmitigated Impacts	Mitigation Proposed to reduce impacts	Final impact on species following implementation of mitigation and management measures
<p>Masked Owl</p>	<p>Loss of grass species that provide foraging and sheltering habitat for this species.</p> <p>Erosion and sedimentation from excavated areas will introduce risks to this habitat (i.e. weeds)</p>	<p>The selection of final locations for pipelines and drill sites when within woodland bird habitat will be assisted by a qualified ecologist</p> <p>Erosion protection measures will be installed within Masked Owl habitat and maintained through the construction phase.</p> <p>The area within the Masked Owl habitat will be rehabilitated with seed collected from the site.</p>	<p>The implementation of the proposed mitigation measures will sufficiently reduce the level of impact so that no species, populations, communities or their habitats will be placed at further risk.</p>
<p>Eastern Freetail-bat (Mormopterus norfolkensis); and</p>	<p>Loss of grass species that provide foraging and sheltering habitat for this species.</p> <p>Erosion and sedimentation from excavated areas will introduce risks to this habitat (i.e. weeds)</p>	<p>The selection of final locations for pipelines and drill sites when within woodland bird habitat will be assisted by a qualified ecologist</p> <p>Erosion protection measures will be installed within Masked Owl habitat and maintained through the construction phase.</p> <p>The area within the Masked Owl habitat will be rehabilitated with seed collected from the site.</p>	<p>The implementation of the proposed mitigation measures will sufficiently reduce the level of impact so that no species, populations, communities or their habitats will be placed at further risk.</p>

6.0 Conclusions

This riparian and terrestrial ecology report has been prepared in support of an application by Ashton Coal Operations Limited (ACOL) to modify DA 309-11-2001-I (this proposal being Mod 10) for the construction of a Central Gas Drainage Plant and associated infrastructure.

The proposed modification comprises:

- Development and operation of up to about 80 goaf gas drainage wells and a reticulated gas pipeline network over the area of underground mine workings.
- Construction and operation of a central gas drainage plant to provide continuous extraction of mine gas from the reticulated gas drainage network.
- Installation and operation of gas flaring apparatus and vent stack arrangement for gas combustion or venting.
- Interim use of portable vacuum assisted atmospheric venting apparatus.
- Development and use of associated support infrastructure.

The proposed Central Gas Drainage Plant and associated infrastructure will have a range of impacts on local ecological issues, which require considered management and mitigation to reduce the risks of impacts to an acceptable level, including:

Footprint of the Impact

A total disturbance area of **13.3 hectares** was assessed for the project. There are 8 vegetation communities on site of which only **0.66 of a hectare** of native vegetation will be impacted by the proposal.

These present relatively manageable impacts that can be mitigated with the appropriate allocation of resources. The development avoids impacts on significant species, populations, communities or their habitats in the following ways:

- *No significant areas of habitat will be lost or isolated;*
- *The development will not introduce any threats such as grazing;*
- *The communities within the Proposal Area will not be impacted (not >0.5% loss of habitat) to an extent that the integrity of the community would be put in doubt;*
- *There are no long-term impacts on communities that will put any significant species, populations, communities or their habitats at further risk.*

Management of Impacts on Woodland Birds

Impacts on woodland birds will be managed by the implementation of control measures during construction, the rehabilitation of habitats following construction, and a proposed increase in habitat within the Southern Woodland VCA area, these measures include:

- *The selection of final locations for pipelines and drill sites when within woodland bird habitat will be assisted by a qualified ecologist*
- *The area within the woodland bird habitat will be rehabilitated with seed collected from the site.*

Management of Impacts on Frogs

The presence of potential habitat for Green and Golden Bell Frog in conjunction with the recent (2010) recording of an individual within the adjoining site requires that the following mitigation measures be implemented.

- *Areas of suitable habitat (woodland vegetation within VCA) will be walked over by a suitably qualified ecologist immediately preceding commencement of construction.*

Management of Impacts on Communities

The presence of the CHGBIW community requires that the following mitigation measures be implemented to reduce impacts:

- *The selection of final locations for pipelines and drill sites when within CHGBIW will be assisted by a qualified ecologist.*
- *Erosion protection measures will be installed within CHGBIW habitat and maintained through the construction phase.*

The implementation of the above recommendations will reduce the risk of significant impacts on any of the identified threatened species, populations, communities or their habitats known to the Local Area.

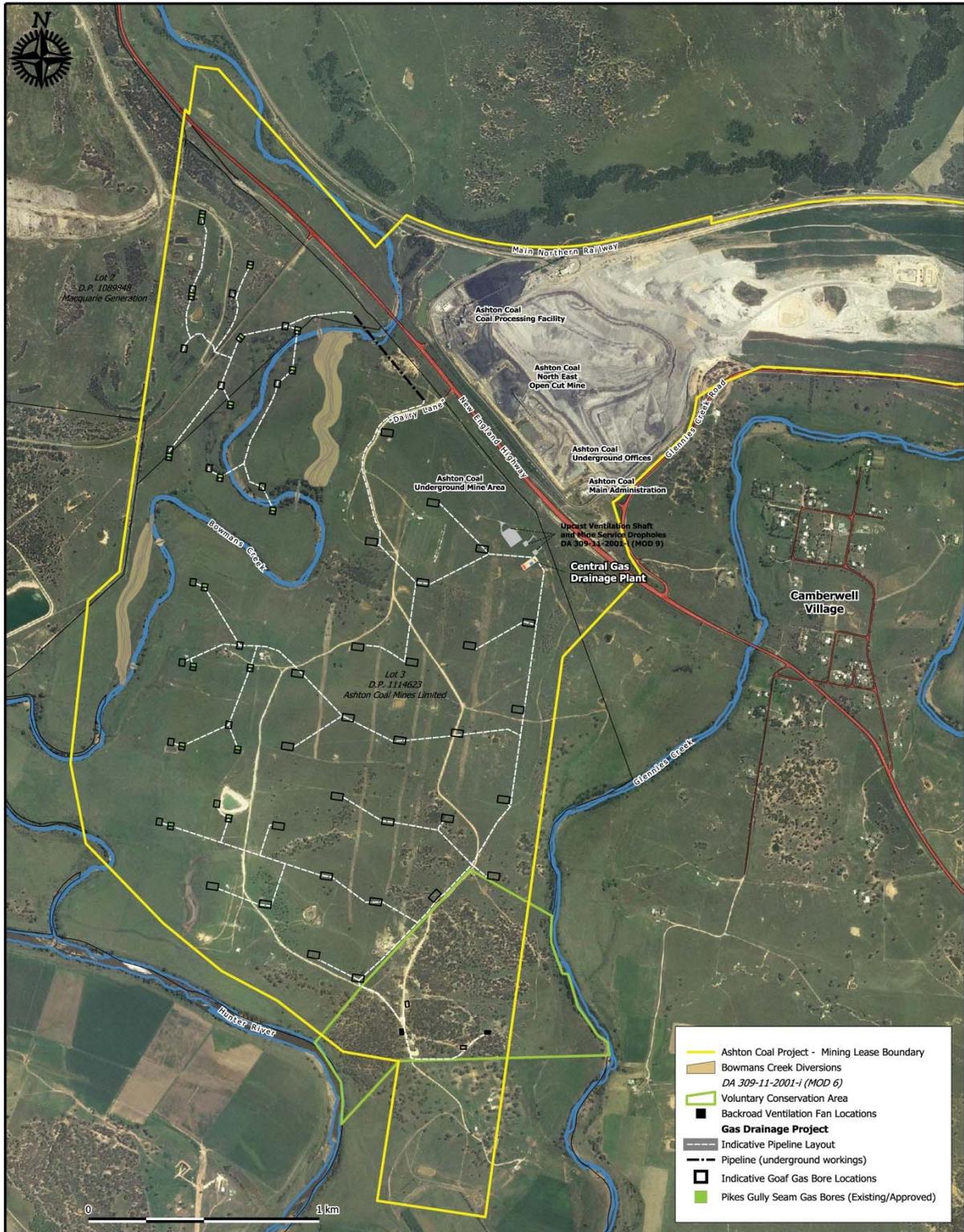
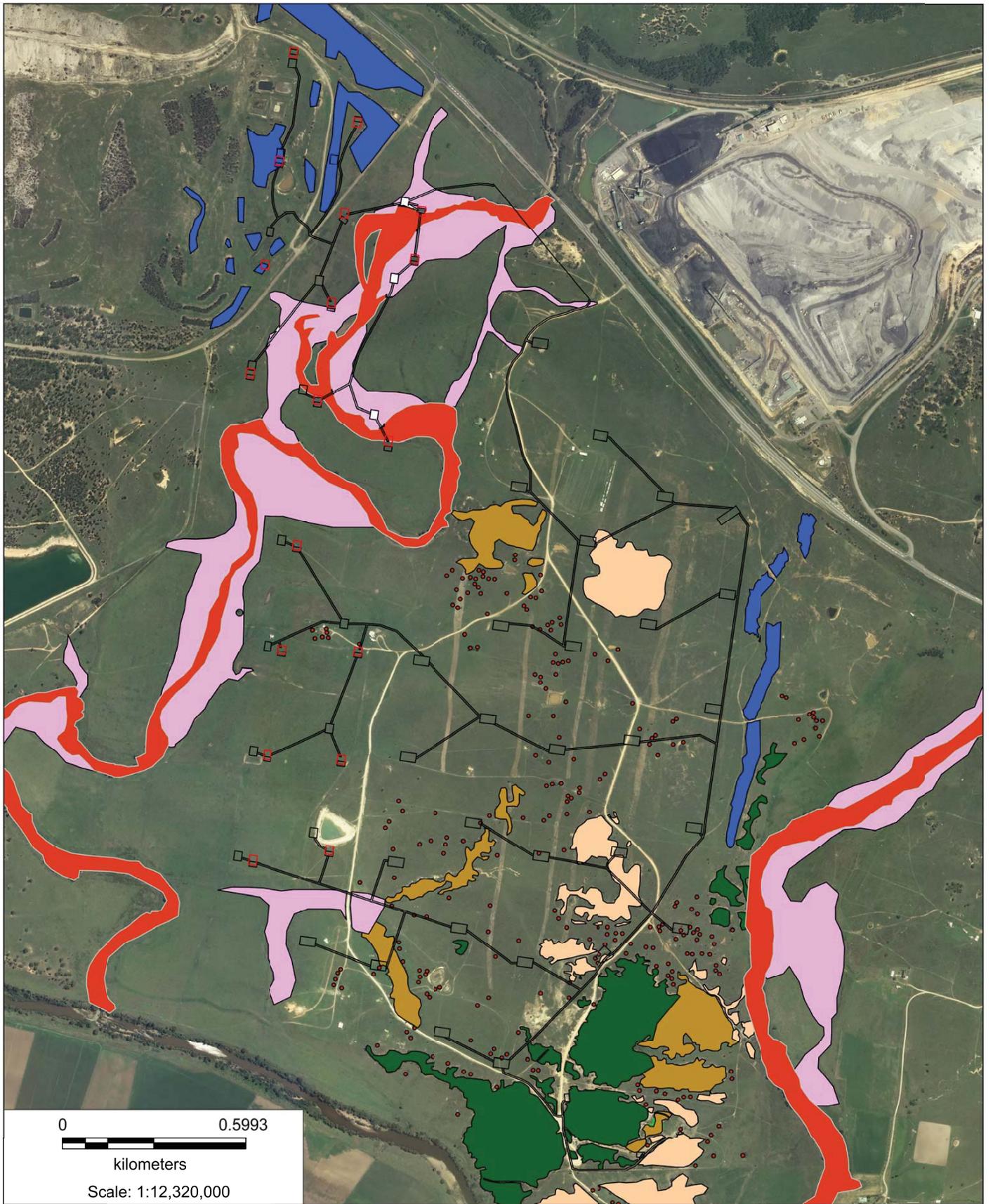
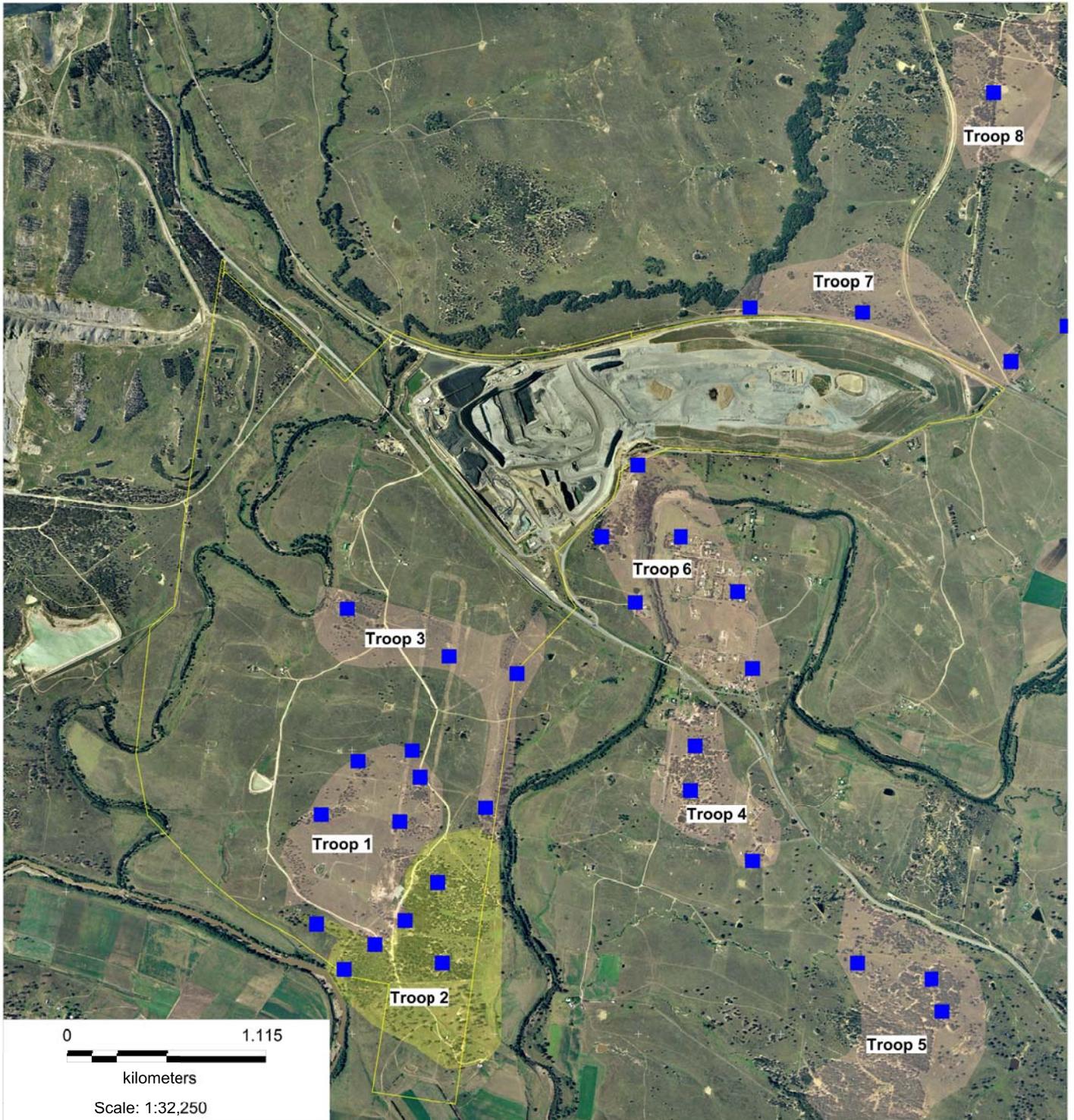


Figure 1- Proposal Area



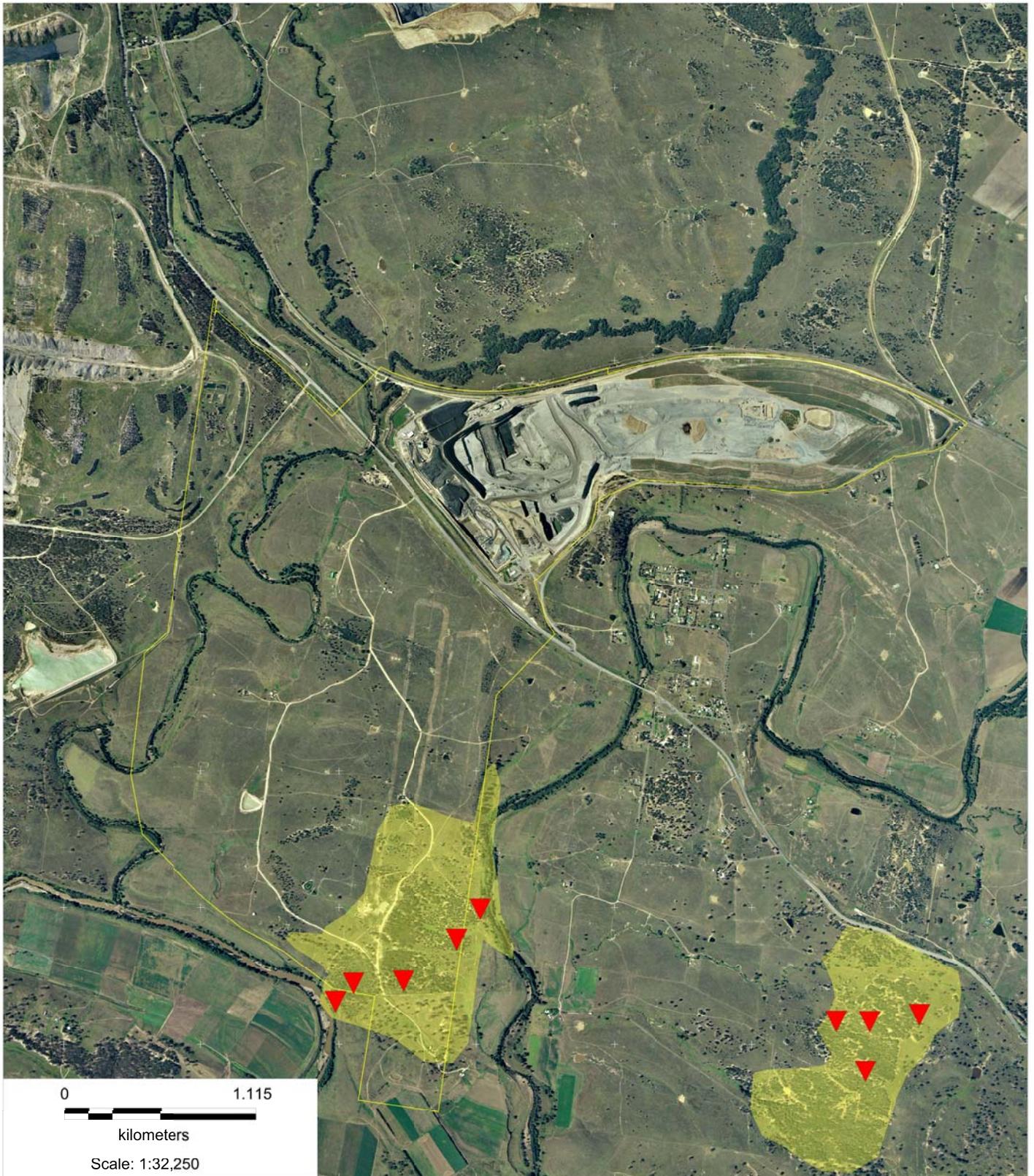
Vegetation Communities

Figure 2.



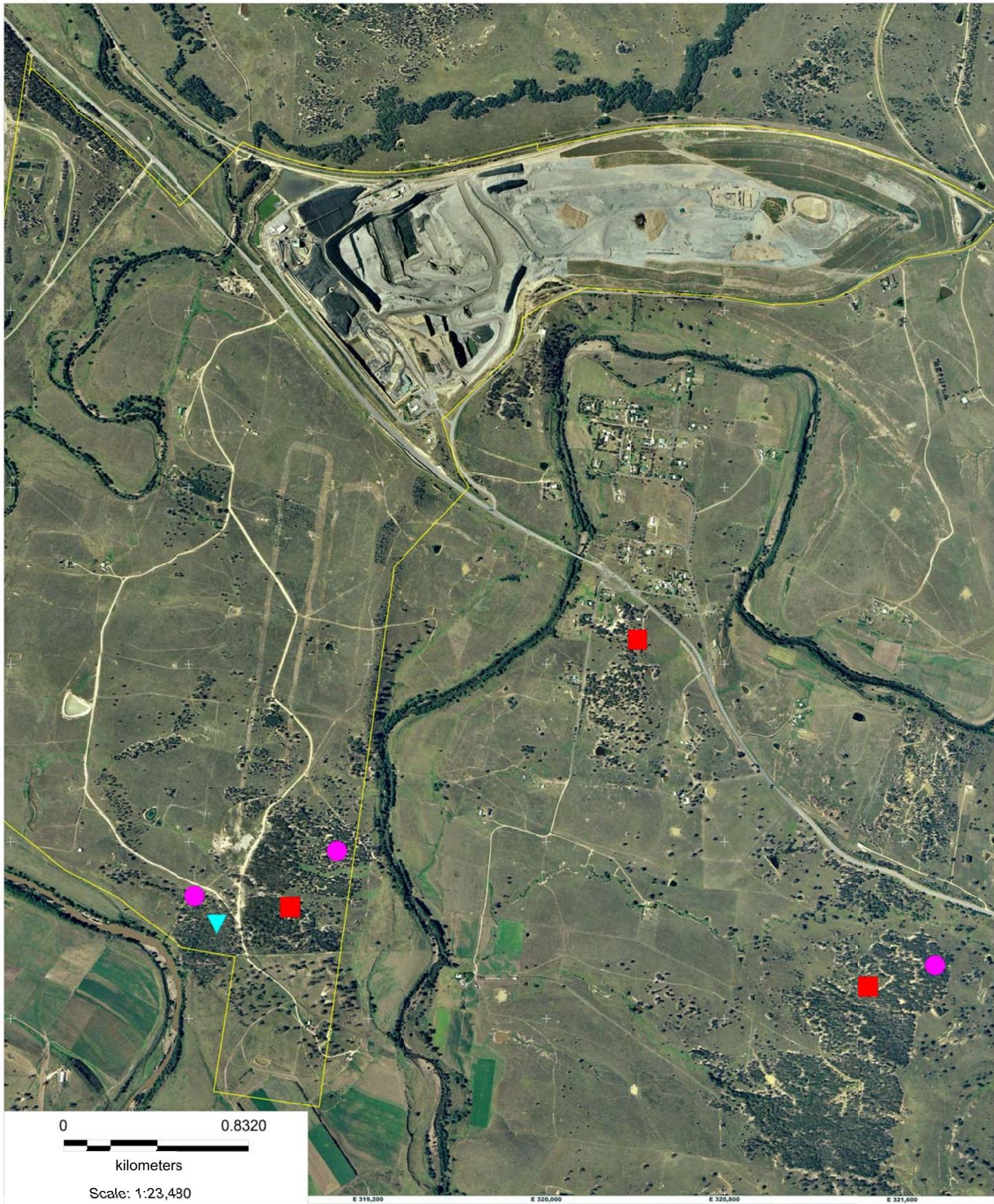
Grey-crowned Babbler Records and Home Ranges

Figure 3.



**Speckled Warbler Records
and Home Ranges**

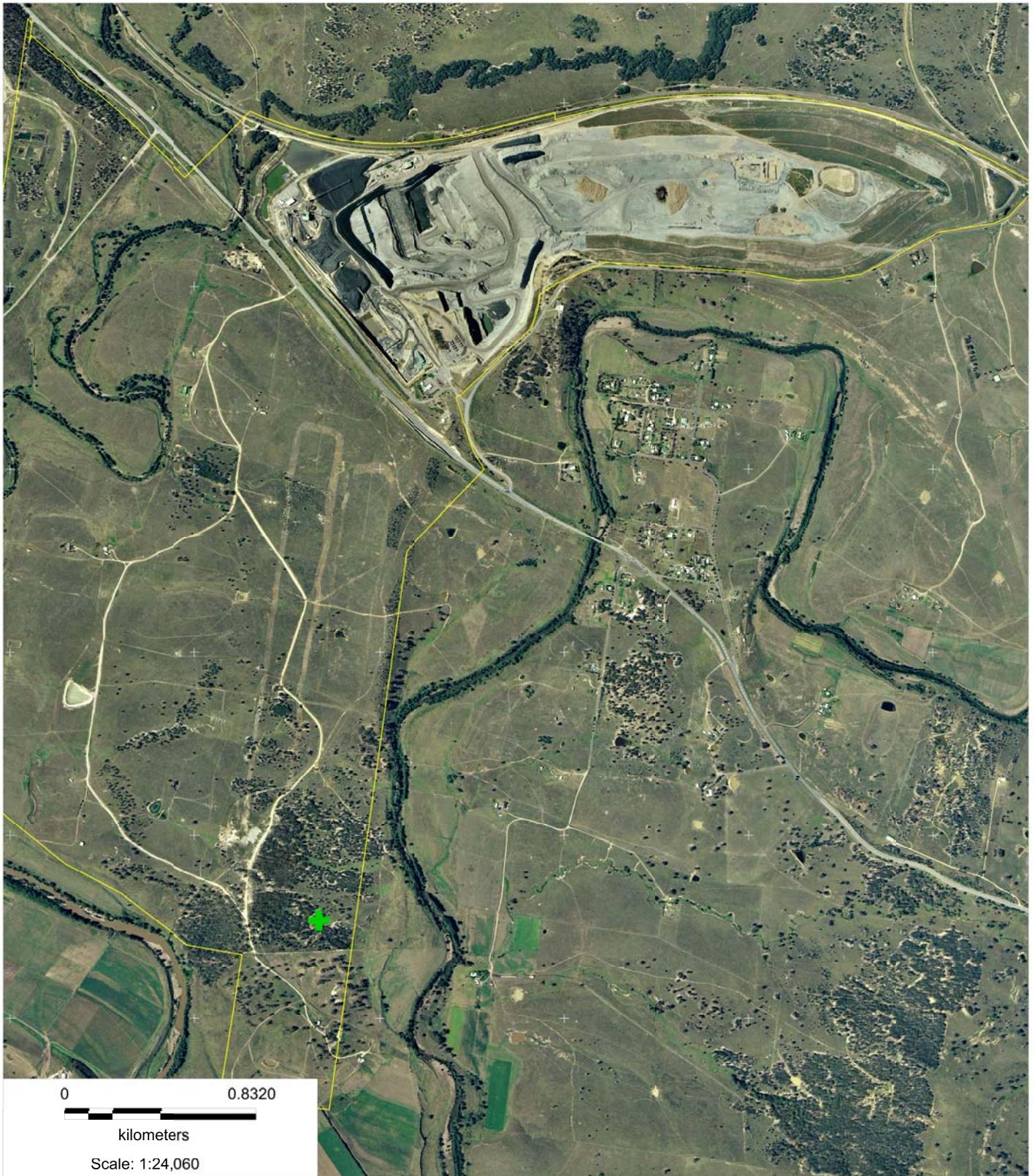
Figure 4.



- Hooded Robin
- ▲ Flame Robin
- Scarlet Robin

Significant Robin Records

Figure 5.



Turquoise Parrot Records

Figure 6.

Appendix A – Flora of the Local Area

Table A1. Flora transect data

Classification/ Scientific name	Recent Synonyms	Common Name	Exotic species
Transect data information:			
Transect data recorded from walking transects in Bowmans creek locality.			
SUBKINGDOM TRACHEOBIONTA		Vascular Plants	
SUPERDIVISION PTERIDOPHYTANAE		Seedless Vascular Plants	
DIVISION POLYPODIOPHYTA		Ferns	
CLASS POLYPODIOPSIDA			
Order Pteridales			
ADIANTACEAE			
<i>Cheilanthes sieberi</i>		Slender Cloak-fern	
SUPERDIVISION SPERMATOPHYTANAE		Seed Plants	
DIVISION MAGNOLIOPHYTA		Flowering Plants	
CLASS ROSOPSIDA		Eudicotyledons	
SUBCLASS CARYOPHYLLIDAE			
Order Caryophyllales			
AIZOACEAE			
<i>Galenia pubescens</i>		Galenia	i
AMARANTHACEAE			
<i>Alternanthera denticulata</i>		Lesser Joyweed	
<i>Amaranthus viridus</i>		Green Amaranth	i
<i>Gomphrena celosioides</i>		Gomphrena Weed	i
BASELLACEAE			
<i>Anredera cordifolia</i>		Madeira Vine	i
CACTACEAE			
<i>Opuntia aurantiaca</i>		Tiger Pear	i
<i>Opuntia stricta</i> var. <i>stricta</i>		Common Prickly Pear	i
CARYOPHYLLACEAE			
<i>Spergularia marina</i>		Saltspurry	
CHENOPODIACEAE			
<i>Chenopodium ambrosioides</i>		Mexican Tea	i
<i>Einadia hastata</i>		Shrubby Berry-saltbush	
<i>Enchylaena tomentosa</i>		Ruby Saltbush	
POLYGONACEAE			
<i>Persicaria decipiens</i>	<i>Polygonum decipiens</i>	Slender Knotweed	
<i>Persicaria lapathifolia</i>	<i>Polygonum lapathifolia</i>	Pale Knotweed	
<i>Polygonum arenastrum</i>		Common Wireweed	

Classification/ Scientific name	Recent Synonyms	Common Name	Exotic species
<i>Rumex brownii</i>		Swamp Dock	
<i>Rumex crispus</i>		Curled Dock	i
PORTULACACEAE			
<i>Portulaca olearacea</i>		Pigweed	
SUBCLASS ROSIDAE			
Order Saxifragales			
CRASSULACEAE			
<i>Bryophyllum X houghtonii</i>		Mother-of-millions	i
HALORAGACEAE			
<i>Myriophyllum verrucosum</i>		Red Water-milfoil	
Order Myrtales			
MYRTACEAE			
<i>Eucalyptus crebra</i>		Narrow-leaf Ironbark	
ONAGRACEAE			
<i>Epilobium billardierianum</i>		Smooth Willow-herb	i
<i>Ludwigia peploides</i> subsp. <i>montevidensis</i>		Water Primrose	
<i>Oenothera stricta</i> subsp. <i>stricta</i>		Common Evening Primrose	i
Order Malpighales			
PHYTOLACCACEAE			
<i>Phytolacca octandra</i>		Inkweed	i
SALICACEAE			
<i>Salix babylonica</i>		Weeping Willow	i
Order Fabales			
FABACEAE			
FABOIDEAE			
<i>Glycine tabacina</i> agg.			
Order Fagales			
CASUARINACEAE			
<i>Alloocasuarina luehmanii</i>	<i>Casuarina luehmanii</i>	Bulloak	
<i>Casuarina cunninghamiana</i>		River Oak	
Order Brassicales			
BRASSICACEAE			
<i>Hirschfeldia incana</i>		Buchan Weed	i
<i>Rorippa laciniata</i>		Watercress	i
Order Malvales			
EUPHORBIACEAE			
<i>Chamaesyce dallachyana</i>		Caustic Weed	i
<i>Ricinus communis</i>		Castor Oil Plant	i
MALVACEAE			

Classification/ Scientific name	Recent Synonyms	Common Name	Exotic species
<i>Modiola caroliniana</i>		Red-flowered Mallow	i
<i>Sida corrugata</i>		Corrugated Sida	i
<i>Sida rhombifolia</i>		Paddys Lucerene	i
Order Sapindales			
ANACARDIACEAE			
<i>Schinus areira</i>	<i>Schinus molle</i> var. <i>areira</i>	Pepper tree	i
SUBCLASS ASTERIDAE			
Order Gentianales			
APOCYNACEAE			
<i>Araujia sericifera</i>	<i>Araujia hortorum</i>	Moth Vine	i
Order Lamiales			
MYOPORACEAE			
<i>Eremophila debilis</i>	<i>Myoporum debile</i>	Amulla	
PLANTAGINACEAE			
<i>Plantago lanceolata</i>		Plantain	i
<i>Plantago major</i>		Large Plantain	i
VERBENACEAE			
<i>Verbena bonariensis</i>		Purple Top	i
BORAGINACEAE			
<i>Heliotropium amplexicaule</i>		Blue Heliotrope	
Order Solanales			
SOLANACEAE			
<i>Cestrum parqui</i>		Green Cestrum	i
<i>Datura stramonium</i>		Common Thornapple	i
<i>Lycium ferocissimum</i>		African Boxthorn	i
<i>Solanum nigrum</i>		Black Nightshade	i
Order Apiales			
APIACEAE			
<i>Centella asiatica</i>		Swamp Pennywort	
<i>Foeniculum vulgare</i>		Fennel	i
Order Asterales			
ASTERACEAE			
<i>Aster subulatus</i>	<i>Symphotrichum subulatum</i>	Wild Aster	i
<i>Bidens pilosa</i>		Cobblers Peg	
<i>Carthamus lanatus</i>		Saffron Thistle	i
<i>Centipida minima</i> subsp. <i>minima</i>	<i>Centipida minima</i> var. <i>minima</i>	Spreading Sneezeweed	
<i>Chrysocephalum apiculatum</i>	<i>Helichrysum apiculatum</i>	Yellow Buttons	
<i>Cirsium vulgare</i>		Scotch Thistle	i

Classification/ Scientific name	Recent Synonyms	Common Name	Exotic species
<i>Conyza bonariensis</i>		Fleabane	i
<i>Dittrichia graveolens</i>		Stinkwort	i
<i>Schkuhria pinnata</i> var. <i>abrotanoides</i>		Dwarf Marigold	
<i>Senecio madagascariensis</i>		Fireweed	i
<i>Senecio quadridentatus</i>		Cotton Fireweed	
<i>Sonchus oleraceus</i>		Common Sow-thistle	i
<i>Tagetes minuta</i>		Stinking Roger	i
<i>Xanthium occidentale</i>	<i>Xanthium strumarium</i> pp	Noogoora Burr	i
CAMPANULACEAE			
<i>Wahlenbergia stricta</i>		Tall Bluebell	
CLASS LILIOPSIDA		Monocotyledons	
SUBCLASS COMMELINIDAE			
Order Poales			
CYPERACEAE			
<i>Cyperus eragrostis</i>		Umbrella Sedge	i
<i>Cyperus polystachyos</i>		Bunchy Flat-sedge	
<i>Fimbristylis dichotoma</i>		Common Fringe-rush	
<i>Isolepis cernua</i>	<i>Scirpus cernuus</i>	Nodding Club-rush	
<i>Schoenoplectus validus</i>	<i>Scirpus validus</i>	River Club-rush	
JUNACEAE			
<i>Juncus acutus</i>		Spiny Rush	i
<i>Juncus usitatus</i>		Common Rush	
POACEAE			
<i>Aristida ramosa</i>		Three-awned Spear Grass	
<i>Austrostipa verticillata</i>	<i>Stipa verticillata</i>	Slender Bamboo Spear Grass	
<i>Avena barbata</i>		Beared Oat	i
<i>Chloris truncata</i>		Windmill Grass	
<i>Chloris virgata</i>		Feathertop Rhodes Grass	
<i>Cortaderia selloana</i>		Pampas Grass	i
<i>Cynodon dactylon</i>		Common Couch	n
<i>Digitaria brownii</i>		Cotton Panic Grass	
<i>Digitaria parviflora</i>		Small-flower Finger Grass	
<i>Digitaria sanguinalis</i>		Crab Grass	i
<i>Ehrharta erecta</i>		Panic Veldtgrass	i
<i>Eragrostis curvula</i>		African Lovegrass	i
<i>Lachnagrostis filiformis</i>	<i>Agrostis avenacea</i>	Blown Grass	
<i>Panicum effusum</i>		Hairy Panic	
<i>Paspalum dilatatum</i>		Paspalum	i
<i>Phragmites australis</i>		Common Reed	

Classification/ Scientific name	Recent Synonyms	Common Name	Exotic species
<i>Setaria parviflora</i>	<i>Setaria gracilis</i>	Slender Pigeon Grass	i
<i>Sporobolus creber</i>	<i>Sporobolus indicus</i> var. <i>creber</i>	Slender Rats Tail Grass	
<i>Vulpia bromoides</i>		Foxtail Grass	i
TYPHACEAE			
<i>Typha orientalis</i>		Broad-leaf Cumbungi	
Order Commelinales			
COMMELINACEAE			
<i>Commelina cyanea</i>		Scurvy Weed	
<p>ABBREVIATIONS:</p> <p>i = introduced (i.e. not indigenous to Australia)</p> <p>n = native Australian species not considered to be indigenous to the site</p> <p>c = cultivated (i.e. planted on the site)</p> <p>t = threatened</p> <p>spp. = several species of the one genus (sometimes occurring as a hybrid swarm)</p> <p>sp. = unidentified species⁴</p> <p>var. = variety</p> <p>subsp. = subspecies</p> <p>agg. = an aggregate of several yet to be defined species</p>			
<p>SCIENTIFIC NAMES & AUTHORITIES:</p> <p>Scientific names & families are those used in the <i>Flora of New South Wales</i> as maintained by the Royal Botanic Gardens (http://plantnet.rbgsyd.gov.au).</p> <p>The classification scheme used for orders and higher taxa is detailed at http://www.hunterwetlands.com.au</p> <p>For sake of simplicity, scientific names in this list do not include authorities. These can be found in the <i>Flora of New South Wales</i>.</p>			

Appendix B – Habitat assessment

Table B1: Analysis of the Proposal Areas habitat potential for significant species recorded in the Local Area and the identification of impacts.

Scientific name	Local information	Habitat present?	Will this habitat be impacted?	7-part test?
Plants				
Lobbed Blue grass <i>(Bothriochloa biloba)</i>	Lobbed blue grass is a tall (1.0m) perennial that flowers in summer. It was recorded on the Ravenswroth site in 2009. This species is often found in woodland and derived grassland communities. It is believed that grazing may have a positive effect on the species, due to it being less palatable than its completion and reduces the competitive advantage of its main competitor.	No	No	No
Finger Panic Grass (<i>Digitaria porrecta</i>)	This species is found in native grassland, woodlands or open forest with a grassy understory, on richer soils in the North West Slopes and North West Plains botanical divisions of NSW. In NSW, the most frequently recorded associated tree species are <i>Eucalyptus albens</i> and <i>Acacia pendula</i> .	No	No	No
White-flowered Wax Plant <i>(Cynanchum elegans)</i>	Rainforest gullies and thick scrub in wet sheltered areas.	No	No	No
<i>Olearia cordata</i>	Dry forest species that is known from Wisemens Ferry to Wollombi	No	No	No
<i>Ozothamnus tessellatus</i>	A rare woodland species that has a very small known distribution in the Rylstone area	No	No	No
<i>Dillwynia tenuifolia</i>	A rare woodland species known to sandstone, shale and laterite.	No	No	No
<i>Acacia pendula</i> <i>(Acacia pendula population in the Hunter catchment)</i>	Individuals recorded in the Local Area within 100 meters of the proposal area in the north western sector (gas wells 13,14,16,17,18). Extensive surveys located a mixture of <i>Acacia pendula</i> and a superficially similar species <i>Acacia salicina</i>	No	No. Well removed from activity.	No
Singleton Mint Bush <i>(Prostanthera cineolifera)</i>	Little is known of about this species. One record known to the Wollimi region.	No	No	No
Charmhaven Apple <i>(Angophora inopina)</i>	Known to the Lake Macquarie, Central Coast and Bulahdelah areas. Only found in four vegetation types of which one: <i>Eucalyptus haemastoma</i> – <i>Corymbia gummifera</i> – <i>Angophora inopina</i> woodland/forest was recorded onsite. No individuals were recorded onsite.	No	No	No

Scientific name	Local information	Habitat present?	Will this habitat be impacted?	7-part test?
Netted Bottle Brush <i>(Callistemon linearifolius)</i>	A dry sclerophyll forest on the coast and adjacent ranges, nearest records north in the Lake Macquarie Cessnock boarder. No individuals were recorded onsite.	No	No	No
Darwinia biflora	Often found on the edges of weathered shale-capped ridges, where these intergrade with Hawkesbury Sandstone.	No. No such habitat onsite.	No	No
Darwinia peduncularis	Usually grows on or near rocky outcrops on sandy, well drained, low nutrient soil over sandstone. No such habitat onsite.	No. No such habitat onsite.	No	No
Eucalyptus camaldulensis <i>(population in the Hunter catchment Eucalyptus camaldulensis)</i>	Creek River and floodplain species of the interior river system of the East coast of Australia. Scattered remnants in the Local Area and recorded on the lower reaches of Bowmans Ck and Glennies Ck	No	No. Well removed from activity and no downstream effects predicted.	No
Broken Back Ironbark <i>(Eucalyptus fracta)</i>	Found on Sandstone escarpments in the ranges.	No	No	No
Slaty Red Gum <i>(Eucalyptus glaucina)</i>	Grows in grassy woodland and dry eucalypt forest, in moderately fertile and well-watered soils.	No	No	No
Grove's Paperbark <i>(Melaleuca groveana)</i>	Grove's Paperbark grows in heath and shrubland, often in exposed sites, at high elevations, on rocky outcrops and cliffs.	No	No	No
Cymbidium canaliculatum <i>(Cymbidium canaliculatum population in the Hunter Catchment)</i>	Grows in the hollows of trees in dry sclerophyll forest or woodland.	No	No	No
Illawarra Greenhood <i>(Pterostylis gibbosa)</i>	All known populations grow in open forest or woodland.	No	No	No
Evans Grevillea <i>(Grevillea evansiana)</i>	Restricted to a small area east of Rylstone on the Central Tablelands. Grows in dry sclerophyll forest or woodland, occasionally in swampy heath, in sandy soils, usually over Hawkesbury sandstone.	No	No	No
Hairy Geebung <i>(Persoonia hirsute)</i>	The Hairy Geebung is found in sandy soils in dry sclerophyll open forest, woodland and heath on sandstone.	No	No	No

Scientific name	Local information	Habitat present?	Will this habitat be impacted?	7-part test?
<i>Leionema lamprophyllum</i> subsp. <i>obovatum</i> <i>(Leionema lamprophyllum</i> subsp. <i>obovatum</i> population in the Hunter Catchment)	<i>Leionema lamprophyllum</i> subsp. <i>obovatum</i> occurs in dry eucalypt forest on exposed rocky terrain.	No	No	No
Frogs				
Green and Golden Bell Frog <i>(Litoria aurea)</i> E1	Recorded approximately 1 kilometre to the north west in 2009. Past records on the Ravensworth Hunter Valley project area show a range of records that are likely dispersing individuals from the core population in the Liddell main population. Bowmans Creek provides some habitat for individuals but not for breeding populations. No individuals recorded onsite.	No	No	No
Davies' Tree Frog <i>(Litoria daviesae)</i> V	Davies Tree Frog occurs in permanently flowing streams above 400 m elevation.	No	No	No
Littlejohn's Tree Frog <i>(Litoria littlejohni)</i> V	Plateaus and eastern slopes of the Great Dividing Range. Records are isolated and tend to be at high altitude.	No	No	No
Glandular Frog <i>(Litoria subglandulosa)</i> V	Glandular Frogs may be found along streams in rainforest, moist and dry eucalypt forest or in subalpine swamps.	No	No	No
Giant Burrowing Frog <i>(Heleioporus australiacus)</i> V	Breeding habitat of this species is generally soaks or pools within first or second order streams.	No	No	No
Stuttering Frog <i>(Mixophyes balbus)</i> E1	Found in rainforest and wet, tall open forest in the foothills and escarpment on the eastern side of the Great Dividing Range.	No	No	No
Sphagnum Frog <i>(Phyllorhina sphagnicolus)</i> V	Rainforests, including Antarctic Beech forest, moist eucalypt forest and sphagnum moss beds, usually at higher elevations.	No	No	No
Red-crowned Toadlet <i>(Pseudophryne australis)</i>	Occurs in open forests, mostly on Hawkesbury and Narrabeen Sandstones. Inhabits periodically wet drainage lines below sandstone ridges that often have shale lenses or cappings.	No	No	No
Birds				

Scientific name	Local information	Habitat present?	Will this habitat be impacted?	7-part test?
Speckled Warbler <i>(Pyrrholaemus sagittatus)</i> V	Recorded onsite and in the Local Area. Inhabits woodland and forest where it forages on the ground at the edges and within the interior of remnants. Can fly into open areas and use road verges. Requires large remnants for stable populations.	Known to the local area and the Ashton Lease area, but requires forest or woodland for habitat.	No	No
Spotted Harrier <i>(Circus assimilis)</i>	Occurs in grassy open woodland including acacia and Mallee remnants, inland riparian woodland, grassland and shrub lands. It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands.	No	No.	No
Red Goshawk <i>(Erythroriarchis radiates)</i> E4A	Red Goshawk appear to move from nesting sites in the ranges to coastal plains, where they are associated with permanent wetlands.	No	No	No
Black-breasted Buzzard <i>(Hamirostra melanosternon)</i>	Black-breasted Buzzard prefers timbered watercourses as breeding habitat. It also hunts over grasslands and sparsely timbered woodlands.	No	No	No
Little Eagle <i>(Hieraaetus morphnoides)</i> V	Recorded in Glennies Creek 2010. Occupies open eucalypt forest, woodland or open woodland. She oak or acacia woodlands and riparian woodlands of interior NSW are also used	No	No	No
Blue-billed Duck <i>(Oxyura australis)</i> V	Wetlands, ponds and sewerage works.	No	No	No
Black Bittern <i>(Ixobrychus flavicollis)</i> V	Inhabits both terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation. Where permanent water is present, the species may occur in flooded grassland, forest, woodland, rainforest and mangroves.	No	No	No
Gang-gang Cockatoo <i>(Callocephalon fimbriatum)</i> V	In summer, generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In winter, may occur at lower altitudes in drier more open eucalypt forests and woodlands, and often found in urban areas.	No	No	No
Glossy Black-Cockatoo <i>(Calyptorhynchus lathami)</i> V	Inhabits open forest and woodlands of the coast and the Great Dividing Range up to 1000 m in which stands of she-oak species, particularly Black She-oak (<i>Allocasuarina littoralis</i>), Forest She-oak (<i>A. torulosa</i>) or Drooping She-oak (<i>A. verticillata</i>) occur.	No	No	No

Scientific name	Local information	Habitat present?	Will this habitat be impacted?	7-part test?
Black-necked Stork <i>(Ephippiorhynchus asiaticus)</i> E1	Black-necked Storks are mainly found on shallow, permanent, freshwater terrestrial wetlands, and surrounding marginal vegetation, including swamps, floodplains, watercourses and billabongs, freshwater meadows, wet heathland, farm dams and shallow floodwaters, as well as extending into adjacent grasslands, paddocks and open savannah woodlands. They also forage within or around estuaries and along intertidal shorelines, such as saltmarshes, mudflats and sandflats, and mangrove vegetation.	No	No	No
Brown Treecreeper <i>(Climacteris picumnus)</i> V	Found in eucalypt woodlands (including Box-Gum Woodland) and dry open forest of the inland slopes and plains inland of the Great Dividing Range; mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species; also found in mallee and River Red Gum (<i>Eucalyptus camaldulensis</i>) Forest bordering wetlands with an open understorey of acacias, saltbush, lignum, cumbungi and grasses; usually not found in woodlands with a dense shrub layer; fallen timber is an important habitat component for foraging; also recorded, though less commonly, in similar woodland habitats on the coastal ranges and plains.	No	No	No
Brown Treecreeper (eastern subspecies) <i>(Climacteris picumnus victoriae)</i> v	Local record two kilometres to the north of the site. Could be a transient in the Local Area.	No	No	No
Diamond Firetail <i>(Stagonopleura guttata)</i> V	This species is often found in the Local Area in grassy eucalypt woodlands, including Box-Gum Woodlands. Also occurs in open forest, mallee, Natural Temperate Grassland, and in secondary grassland derived from other communities. Often found in riparian areas (rivers and creeks), and sometimes in lightly wooded farmland. Feeds exclusively on the ground, on ripe and partly-ripe grass and herb seeds and green leaves, and on insects (especially in the breeding season). Recorded two kilometres north of the site.	Does forage on exotic and native grassland in Autumn in the local area.	No. This very minor removal of a common potential foraging habitat in the regional area does not constitute an impact.	No
Painted Honeyeater <i>(Grantiella picta)</i> v	Inhabits Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests. A specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias	No	No	No
Black-chinned Honeyeater (eastern subspecies) <i>(Melithreptus gularis gularis)</i> v	Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark (<i>Eucalyptus sideroxylon</i>), White Box (<i>E. albens</i>), Inland Grey Box (<i>E. microcarpa</i>), Yellow Box (<i>E. melliodora</i>) and Forest Red Gum (<i>E. tereticornis</i>).	No	No	No

Scientific name	Local information	Habitat present?	Will this habitat be impacted?	7-part test?
Regent Honeyeater <i>(Anthochaera Phrygia)</i> E1	The species inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak. Regent Honeyeaters inhabit woodlands that support a significantly high abundance and species richness of bird species.	No	No	No
Varied Sittella <i>(Daphoenositta chrysoptera)</i> V	Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, Mallee and Acacia woodland. Recorded in the ranges to the south of the site.	No	No	No
Olive Whistler <i>(Pachycephala olivacea)</i> v	Mostly inhabit wet forests above about 500m. During the winter months they may move to lower altitudes.	No	No	No
Hooded Robin <i>(Melanodryas cucullata)</i> v	Prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and Mallee, often in or near clearings or open areas.	No.	No	No
Hooded Robin (south-eastern form) <i>(Melanodryas cucullata cucullata)</i> v	Prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and Mallee, often in or near clearings or open areas.	Known to the Ashton Lease area and can sometimes be recorded in pasture near to woodland edge or scattered trees.	No. This very minor removal of a common potential marginal foraging habitat in the regional area does not constitute an impact.	No
Scarlet Robin <i>(Petroica boodang)</i> v	The Scarlet Robin lives in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs.	No	No	No
Flame Robin <i>(Petroica phoenicea)</i> v	Breeds in upland tall moist eucalypt forests and woodlands, often on ridges and slopes. Prefers clearings or areas with open understoreys. The groundlayer of the breeding habitat is dominated by native grasses and the shrub layer may be either sparse or dense.	No	No	No
Grey-crowned Babbler (eastern subspecies) <i>(Pomatostomus temporalis temporalis)</i>	Recorded onsite and in the Proposal Area. Inhabits woodland and mallee and in the lower Hunter will be recorded on the edges of forests and gardens of rural lots and recreational gardens, such as golf courses. Forages on-ground and on the branches and trunks of trees.	No	No.	No
Little Lorikeet <i>(Glossopsitta pusilla)</i> V	Forages primarily in the canopy of open Eucalyptus forest and woodland, yet also finds food in Angophoras, Melaleucas and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity.	No	No	No

Scientific name	Local information	Habitat present?	Will this habitat be impacted?	7-part test?
Swift Parrot <i>(Lathamus discolor)</i> e1	On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations.	No	No	No
Turquoise Parrot <i>(Neophema pulchella)</i> v	Recorded in the southern woodland in 2010. Lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland. Usually seen in pairs or small, possibly family, groups and have also been reported in flocks of up to thirty individuals. Prefers to feed in the shade of a tree and spends most of the day on the ground searching for the seeds or grasses and herbaceous plants, or browsing on vegetable matter.	Can be recorded foraging on grass under the shade of paddock trees or in woodlands.	The isolation of these grasses and the high presence of similar marginal habitats in the local area results in this no being an impact on this species.	No
Barking Owl <i>(Ninox connivens)</i> V	Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. Is flexible in its habitat use and hunting can extend in to closed forest and more open areas. Sometimes able to successfully breed along timbered watercourses in heavily cleared habitats (e.g. western NSW) due to the higher density of prey on these fertile soils.	No	No	No
Powerful Owl <i>(Ninox strenua)</i> V	The Powerful Owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. The Powerful Owl requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well.	No	No	No
Red-backed Button-quail <i>(Turnix maculosa)</i> V	In NSW, said to occur in grasslands, heath and crops. Said to prefer sites close to water, especially when breeding. The species has been observed associated with the following grasses (in various vegetation formations): speargrass <i>Heteropogon</i> , Blady Grass <i>Imperata cylindrica</i> , <i>Triodia</i> , <i>Sorghum</i> , and Buffel Grass <i>Cenchrus ciliaris</i> . One record 10 kilometres north at Greenland.	Known to be recorded in pasture near to woodland edge or scattered trees.	No. This very minor removal of a common potential marginal foraging habitat in the regional area does not constitute an impact.	No
Masked Owl <i>(Tyto novaehollandiae)</i> v	Lives in dry eucalypt forests and woodlands from sea level to 1100 metres.	No	No	No
Sooty Owl <i>(Tyto tenebricosa)</i> v	Occurs in rainforest, including dry rainforest, subtropical and warm temperate rainforest, as well as moist eucalypt forests	No	No	No
Mammals				
Eastern Pygmy-possum <i>(Cercartetus nanus)</i> v	Found in a broad range of habitats from rainforest through sclerophyll (including Box-Ironbark) forest and woodland to heath, but in most areas woodlands and heath appear to be preferred, except in north-eastern NSW where they are most frequently encountered in rainforest.	No	No	No

Scientific name	Local information	Habitat present?	Will this habitat be impacted?	7-part test?
Spotted-tailed Quoll <i>(Dasyurus maculatus) v</i>	Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline.	No	No	No
Brush-tailed Phascogale <i>(Phascogale tapoatafa) v</i>	Prefer dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter.	No	No	No
Yellow-bellied Sheath-tail-bat <i>(Saccolaimus flaviventris) V</i>	Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. When foraging for insects, flies high and fast over the forest canopy, but lower in more open country.	No	No	No
Parma Wallaby <i>(Macropus parma) v</i>	Preferred habitat is moist eucalypt forest with thick, shrubby understorey, often with nearby grassy areas, rainforest margins and occasionally drier eucalypt forest.	No	No	No
Brush-tailed Rock-wallaby <i>(Petrogale penicillata) E1</i>	Occupy rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges, often facing north.	No	No	No
Red-legged Pademelon <i>(Thylogale stigmatica) V</i>	Inhabits forest with a dense understorey and ground cover, including rainforest, moist eucalypt forest and vine scrub.	No	No	No
Eastern Freetail-bat <i>(Mormopterus norfolkensis) v</i>	Occur in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. Roost mainly in tree hollows but will also roost under bark or in man-made structures.	No	No	No
Hastings River Mouse <i>(Pseudomys oralis) E1</i>	A variety of dry open forest types with dense, low ground cover and a diverse mixture of ferns, grass, sedges and herbs	No	No	No
Yellow-bellied Glider <i>(Petaurus australis) v</i>	Occur in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils.	No	No	No
Squirrel Glider <i>(Petaurus norfolcensis) v</i>	Inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. Prefers mixed species stands with a shrub or Acacia midstorey.	No	No	No
Koala <i>(Phascolarctos cinereus)</i>	Inhabit eucalypt woodlands and forests.	No	No	No

Scientific name	Local information	Habitat present?	Will this habitat be impacted?	7-part test?
Rufous Bettong <i>(Aepyprymnus rufescens) v</i>	Rufous Bettongs inhabit a variety of forests from tall, moist eucalypt forest to open woodland, with a tussock grass understorey. A dense cover of tall native grasses is the preferred shelter.	No	No	No
Long-nosed Potoroo <i>(Potorous tridactylus) v</i>	Inhabits coastal heaths and dry and wet sclerophyll forests. Dense understorey with occasional open areas is an essential part of habitat, and may consist of grass-trees, sedges, ferns or heath, or of low shrubs of tea-trees or melaleucas. A sandy loam soil is also a common feature.	No	No	No
Grey-headed Flying-fox <i>(Pteropus poliocephalus) v</i>	Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops.	No	No	No
Large-eared Pied Bat <i>(Chalinolobus dwyeri) v</i>	Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (<i>Hirundo ariel</i>), frequenting low to mid-elevation dry open forest and woodland close to these features. Females have been recorded raising young in maternity roosts (c. 20-40 females) from November through to January in roof domes in sandstone caves. They remain loyal to the same cave over many years. Found in well-timbered areas containing gullies.	No	No	No
Eastern False Pipistrelle <i>(Falsistrellus tasmaniensis) v</i>	Prefers moist habitats, with trees taller than 20 metres.	No	No	No
Golden-tipped Bat <i>(Kerivoula papuensis) v</i>	Found in rainforest and adjacent wet and dry sclerophyll forest up to 1000m. Also recorded in tall open forest, <i>Casuarina-dominated riparian forest and coastal Melaleuca forests.</i>	No	No	No
Little Bentwing-bat <i>(Miniopterus australis) v</i>	Moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. Generally found in well-timbered areas.	No	No	No
Eastern Bentwing-bat <i>(Miniopterus schreibersii oceanensis) v</i>	Hunt in forested areas, catching moths and other flying insects above the tree tops.	No	No	No
Southern Myotis <i>(Myotis macropus) v</i>	Recorded onsite and in the vicinity of the Proposal Area. Generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. Forage over streams and pools catching insects and small fish by raking their feet across the water surface.	No	No.	No

Scientific name	Local information	Habitat present?	Will this habitat be impacted?	7-part test?
Greater Long-eared Bat <i>(Nyctophilus timoriensis)</i> (South-eastern form)	Inhabits a variety of vegetation types, including mallee, bulloke <i>Allocasuarina leuhmanni</i> and box eucalypt dominated communities, but it is distinctly more common in box/ironbark/cypress-pine vegetation that occurs in a north-south belt along the western slopes and plains of NSW.	No	No	No
Greater Broad-nosed Bat <i>(Scoteanax rueppellii)</i>	Utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest.	No	No	No
Eastern Cave Bat <i>(Vespadelus troughtoni)</i>	A cave-roosting species that is usually found in dry open forest and woodland, near cliffs or rocky overhangs; has been recorded roosting in disused mine workings, occasionally in colonies of up to 500 individuals.	No	No	No
Reptiles				
Broad-headed Snake <i>(Hoplocephalus bungaroides)</i>	Shelters in rock crevices and under flat sandstone rocks on exposed cliff edges during autumn, winter and spring.	No	No	No
Rosenberg's Goanna <i>(Varanus rosenbergi)</i>	Found in heath, open forest and woodland.	No	No	No

Appendix C – 7-Part Tests

Section 5A EP&A Act – 7 Part Test

Based on the assessment several significant species/ communities require further assessment under the provisions of the EP&A Act 1995 (7 -part tests). These potentially impacted species are assessed and recommendations are made to mitigate impacts and sustain populations in the Local Areas. Potentially impacted species include:

Grass land Flora Species

1. Lobbed Blue grass (EPBC species);
2. *Acacia pendula*;
3. *Thesium australe*
4. Finger Panic Grass (*Digitaria porrecta*);and,
5. *Olearia cordata*.

Communities

1. Central Hunter Grey Box – Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions

Frogs which are known to forage in nearby Grasslands

1. Green and Golden Bell Frog

Woodland Birds

2. *Stagonopleura guttata* (Diamond Firetail);
3. *Neophema pulchella* (Turquoise Parrot);
4. *Pomatostomus temporalis* (Grey-crowned Babbler);
5. *Pyrrholaemus sagittatus* (Speckled Warbler);
6. *Turnix maculosa* (Red-backed Button-quail);
7. Scarlet Robin
8. Hooded Robin
9. Flame Robin

Higher order Forest Birds which are known to forage in grassland

10. Masked Owl

Micro-Bats

11. Eastern Bentwing-bat (*Miniopterus schreibersii oceansis*)
12. Eastern Freetail-bat (*Mormopterus norfolkensis*),
13. Southern or Large-footed Myotis (*Myotis macropus*)

7-Part test - Threatened Flora which is known to grow in grassland

(a) in the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction

Acacia pendula

See part (b) below for population impacts.

Digitaria porrecta

This species is found in native grassland, woodlands or open forest with a grassy understorey, on richer soils in the North West Slopes and North West Plains, botanical divisions of NSW. In NSW, the most frequently recorded associated tree species are *Eucalyptus albens* and *Acacia pendula*. Common associated grasses and forbs in NSW sites include *Austrostipa aristiglumis*, *Enteropogon acicularis*, *Cyperus bifax*, *Hibiscus trionum* and *Neptunia gracilis*. (DECC threatened species profile; PlanNet). The absence of previous records for this species within the region and the lack of suitable habitat within the Study Area (i.e. native grasslands and woodlands) suggest that this species is unlikely to occur in the Study Area and were not recorded during the various surveys. No clearing of habitat or shrubs in general is proposed as part of the proposal. The life cycle of the species is **not** likely to be disrupted such that a viable local population of the species is placed at risk of extinction

Thesium australe

This species occurs in grassland or grassy woodland, and is often found in damp sites in association with Kangaroo Grass (*Themeda australis*). It has previously been recorded from the Singleton area (25km radius). (DECC threatened species profile; PlanNet). It was not found within the Study Area during the various surveys, and much of the area has been highly modified for pasture, further reducing the likelihood of this species. No clearing of habitat or shrubs in general is proposed as part of the proposal. The life cycle of the species is **not** likely to be disrupted such that a viable local population of the species is placed at risk of extinction

Olearia cordata

The species' habitat is woodland on exposed Hawkesbury Sandstone ridges. Soils are shallow or skeletal and are usually neutral to slightly acidic. Records are 150–500m above sea level on steep to gentle slopes (Maryott-Brown and Wilks 1993). Associated flora includes *Angophora costata*, *A. bakeri*, *Eucalyptus punctata* and *Corymbia eximia* with understorey species including *Allocasuarina torulosa*, *Acacia linifolia*, *Persoonia linearis* and *Leucopogon muticus* along with various Grasses.

It was not found within the Study Area during the various surveys, and much of the area has been highly modified for pasture, further reducing the likelihood of this species. No clearing of habitat or shrubs in general is proposed as part of the proposal. The life cycle of the species is **not** likely to be disrupted such that a viable local population of the species is placed at risk of extinction

(b) in the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

This factor applies a similar test as in factor (a) to endangered populations.

Acacia pendula Hunter Valley endangered Population

This species is found in native grassland, woodlands or open forest with a grassy understorey, on richer soils in the North West Slopes and North West Plains, botanical divisions of NSW. In NSW, the

most frequently recorded associated tree species is Eucalyptus albens. Several populations' area known to the Hunter Valley. No clearing of habitat or shrubs in general is proposed as part of the proposal. The life cycle of the population is **not** likely to be disrupted such that a viable local population is placed at risk of extinction

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

- i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be removed or modified as a result of the action.**

No impacts on endangered ecological communities.

- ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.**

No impacts on endangered ecological communities.

(d) in relation to the habitat of a threatened species, population, or ecological community:

- i. the extent to which habitat is likely to be removed or modified as a result of the action proposed, and**

The proposed action **would** result in the loss of a very small area of potential marginal habitat, which will be fully regenerated upon completion. In terms of percentage impacts the cumulative effect of all actions will result in short term modification of **less than 0.1%** of marginal habitat for these species in the regional area.

- i. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and**

The proposal will not contribute to the cumulative loss of habitat and the increased fragmentation or isolation of habitat.

- ii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.**

No habitat that is identified as being used by these species or habitats that represent suitable habitat will be impacted and the proposed actions will not modify or fragment habitats.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

The proposal would not have any adverse effect on critical habitat. There is a capacity for critical habitats to be gazetted under the Threatened Species Conservation Act 1995. No such habitats have yet been gazetted for the Diamond Firetail, Turquoise parrot, Grey-crowned Babbler, Speckled Warbler, Hooded Robin, Scarlet robin, Flame robin and Red-backed Button-quail.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery or threat abatement plan.

The proposed action is consistent with the objectives of management for these species. In short the proposal will not:

- Introduce any action that removes or modifies habitat;
- Introduce any threat that may impact on viability; or
- Remove any critical elements or fragment habitats.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The action does not constitute any of the key threatening processes.

Woodland Birds 7 -part test

(a) in the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction

Diamond Firetail, Turquoise parrot (*Neophema pulchella*)

The Diamond Firetail is a locally rare species, with only one record in the Local Area. Although considered sedentary, regional seasonal movements in the Lower Hunter are likely, and given the infrequent records of the species a rare visitor to the area. The Diamond Firetail occupies eucalypt woodlands, forests and mallee where there is a grassy understorey. Firetails build bottle-shaped nests in trees and bushes, and forage on the ground, largely for grass seeds and other plant material, but also for insects (Blakers et al. 1984, Read 1994).

Turquoise parrot *in* the Local Area are usually recorded in open forests with a native grass understorey or mixed forests/ woodlands that include *Callitris* or *Casuarinas* and Eucalypts. Can be found foraging under a single tree within a cleared area; however this is always close to established forest areas that provide good habitat potential. One individual was recorded in the Southern Woodland in 2010 foraging within the Bulloak woodland on native grasses.

Grey-crowned Babbler, Speckled Warbler, Hooded Robin, Scarlet Robin, Flame Robin

There is a strong population of Grey-crowned Babbler in the Local Area that is connected and viable. In total surveys conducted on site and in the Local Area recorded over 50 individuals. Given the tendency of the species to relocate in close proximity to previous breeding sites and to expand their home ranges at different times of the year, individuals would be expected to use the proposal area.

Surveys in the Local Area identified two sub-populations of Speckled Warbler. Further surveys on adjoining sites located another additional sub-population. Local records for the species are extensive with over 60 sightings on the Atlas database for the LGA. Unlike the Babbler this ground foraging bird requires larger remnants for survival. The background local knowledge on this species suggests that in large (>50ha) forests/ woodlands either in gullies or ridgelines where there is a mixture of grasses and an open structure in the understorey Speckled warbler is likely to be present.

Many species which rely on the woodland such as the Hooded Robin still forage well out into paddocks, thus the effective area of a remnant from the perspective of a bird is often greater than the area that humans perceive and researchers typically measure. Individuals were recorded in the Southern Woodland in 2011. With this in mind the potential range of the Hooded Robin in the Local Area could include the Southern Woodland, Riparian corridors and enhancement of this habitat is recommended to provide additional resources to the local population.

A pair of Flame robins were recorded in the southern woodland in 2011, they are likely to be infrequent visitors to the local area and have significant overlap in terms of habitat requirements with the other robins recorded onsite (Hooded robin and red-capped robin). The provisions made for conservation of the hooded robin will sufficiently conserve habitat for all robins.

Scarlet robin has not been recorded onsite or in the local area. Again it should also be covered by the conservation and mitigation measures proposed for Hooded robin.

Red-backed Button-quail (*Turnix maculosa*)

Surveys in the Local Area identified one record for this species 10 kilometres north of the Local Area. Further surveys on subject site and Local Area failed to any additional sub-populations. The background local knowledge on this species suggests that it occupies grasslands with scattered trees and cleared lands. We consider that this proposal will not reduce the viability of woodland birds in the Local Area, to a degree that could put the local population at risk of extinction.

(b) in the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

This factor applies a similar test as in factor (a) to endangered populations.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

iii. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be removed or modified as a result of the action.

Not applicable to Grey-crowned Babbler, Speckled Warbler, Hooded Robin, Scarlet Robin, Flame Robin, Diamond Firetail, Turquoise parrot, Red-backed Button-quail.

iv. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable to Grey-crowned Babbler, Speckled Warbler, Hooded Robin, Scarlet Robin, Flame Robin, Diamond Firetail, Turquoise parrot, Red-backed Button-quail.

(d) in relation to the habitat of a threatened species, population, or ecological community:

ii. the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

The proposed action **would** result in the loss of 3,375 m² of potential marginal habitat from the activity area.

iii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

The proposal will not contribute to the cumulative loss of habitat and the increased fragmentation or isolation of habitat.

iv. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

Diamond Firetail, Turquoise parrot

It is currently difficult to quantify the importance of the habitat, the Diamond Firetail is rarely recorded in the Local Area however Turquoise parrot is often recorded in the Local Area in similar habitats, but only in larger remnants. Given that the proposal will remove only a small area of the potential marginal habitat, it is predicted that this would not constitute a loss of significant habitat.

Grey-crowned Babbler, Speckled Warbler, Hooded Robin, Scarlet Robin, Flame Robin.

It is currently difficult to quantify the importance of the habitat to Grey-crowned Babbler and Speckled Warbler, however the Grey-crowned Babbler is often recorded in the Local Area in similar habitats, as is the Speckled Warbler, but only in larger remnants. Given that the proposal will remove only a small area of the potential marginal habitat, it is predicted that this would not constitute a loss of significant habitat.

Several Hooded and Flame Robins including juveniles have been recorded in the Local Area within the ACP Southern Woodland Conservation Area. The habitats provided by Bowmans Creek are suitable to the requirements of Hooded Robin. Given the limited distribution of the species in the sub-regional area (based on NPWS records) and the breeding records made on this site, we consider the individuals to be part of isolated and disjunct population that is significant. Notwithstanding the importance of the habitat in the Local Area, the proposal will only result in the short term loss of a small area of habitat and result in the long term increase in potential habitat for the species.

Red-backed Button-quail (*Turnix maculosa*)

It is currently difficult to quantify the importance of the habitat, however the Red-backed Button-quail is often recorded in the Local Area in similar habitats, but only in larger remnants. Given that the proposal will remove only a small area of the potential marginal habitat, it is predicted that this would not constitute a loss of significant habitat.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

The proposal would not have any adverse effect on critical habitat. There is a capacity for critical habitats to be gazetted under the Threatened Species Conservation Act 1995. No such habitats have yet been gazetted for the Diamond Firetail, Turquoise parrot, Grey-crowned Babbler, Speckled Warbler, Hooded Robin, Scarlet robin, Flame robin and Red-backed Button-quail.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery or threat abatement plan.

Diamond Firetail, Turquoise parrot (*Neophema pulchella*)

At this point in time no recovery plan has been prepared for Diamond Firetail by DECCW.

Key recovery priorities for Turquoise parrot are:

- Undertake fox and feral cat control programs in key habitat areas.
- Retain areas of open woodland with grassy under-storey and adjoining grassland.
- Protect hollow-bearing trees for nest sites. Younger mature trees should also be retained to provide replacements for the older trees when they eventually die and fall over.

- Protect sites where Turquoise Parrots forage and nest from heavy, prolonged grazing.
- Report suspected illegal bird trapping, egg collection or sales to NPWS.

The proposal will assist in the recovery of this species by providing resources for the local population. A major priority of the mitigation for the Local Area is to restore and increase the Riparian corridor and Floodplain area of Bowmans Creek.

Grey-crowned Babbler, Speckled Warbler, Hooded Robin, Scarlet Robin, Flame Robin.

At this point in time no recovery plan has been prepared for the Grey-crowned Babbler and the Robins by DECCW.

Key recovery priorities for the Speckled Warbler are:

1. Keep domestic dogs and cats indoors at night. Desex domestic dogs and cats. Assess the appropriateness of dog and cat ownership in new subdivisions.
2. Undertake fox and feral cat control programs.
3. NPWS should be consulted when planning development to minimise impact on populations.
4. Retain dead timber on the ground in open woodland areas.
5. Limit firewood collection.
6. Retain existing vegetation along roadsides, in paddocks and remnant stands of native trees.
7. Encourage regeneration of habitat by fencing remnant stands to protect from long-term, intense grazing.
8. Fence suitable woodland habitats, particularly those with unimproved pasture and an intact native ground plant layer.
9. Increase the size of existing remnants, planting trees and establishing buffer zones of unimproved uncultivated pasture around woodland remnants.
10. Assess the importance of the site to the species' survival. Include the linkages the site provides for the species between ecological resources across the broader landscape.
11. Report any new sightings of the speckled warbler or Hooded Robin to the DECCW.

The proposal will assist in the recovery of this species by providing resources to 1,2,3,4,5,7,8, and 9. As stated a key requirement is remanent size. A major priority of the mitigation for the proposal is to restore and increase the Riparian corridor and Floodplain area of Bowmans Creek.

Red-backed Button-quail (*Turnix maculosa*)

Key recovery priorities for the Red-backed Button-quail are:

1. Protect and restore habitats, especially preventing drainage or destruction of key wetlands and habitats, as the species shows some preference for nesting near water. Also promote conservation incentives and agreements to improve management and protection of unreserved populations.
2. Raise awareness in the general community on the habitat requirements and threats, and foster community based programs to manage and restore wetlands and other habitats. Also raise awareness of the threats of habitat alteration and trampling of nestlings by livestock and feral Pigs, and ways to reduce threat.
3. Develop sustainable burning regimes, specifically reviewing the hazard reduction conditions on the NSW Threatened Species Hazard Reduction List; and providing maps of known occurrence to the NSW Rural Fire Service.
4. Reduce habitat destruction pressures from agriculture and urban development.
5. Develop appropriate agricultural management practices to protect habitat, by excluding stock or reducing grazing pressure, and controlling weeds. Exclude livestock from areas used for nesting.
6. Control introduced predators, especially Red Foxes.

The Proposal will not have a major influence on management of this species in the Local Area. A major priority of the mitigation for the proposal is to restore and increase the Riparian corridor and Floodplain area of Bowmans Creek, which will assist in the restoration of habitats for this species.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Diamond Firetail, Turquoise parrot (*Neophema pulchella*)

The NSW DECCW have identified that the following threatening processes are acting upon these species:

- Clearing and fragmentation of woodland, grassy woodland, open forest, grassland and mallee habitat for agriculture, residential development, and firewood collection.
- Loss of hollow-bearing trees.
- Poor regeneration of open forest and woodland habitats.
- Invasion of weeds, resulting in the loss of important food plants.
- Modification and destruction of ground- and shrub layers within habitat through: removal of native plants, litter and fallen timber; introduction of exotic pasture grasses; heavy grazing and compaction by stock; and frequent fire.
- Predation of eggs and nestlings by increased populations of native and introduced predators such as the Pied Currawong *Strepera graculina*, foxes and cats.
- Risk of local extinction due to small, isolated populations.
- Illegal trapping of birds and collection of eggs which also often results in the destruction of hollows.

Key recommendations proposed as part of the Local Area management plans to reduce the impact of these threats on the local populations include:

1. Increasing the size of the riparian corridor and creating floodplain woodland habitat;
2. Undertaking long term feral animal control;
3. Controlling grazing;
4. Controlling fire; and,
5. Connecting larger potential habitat sites by creating stepping stones between home ranges.

Grey-crowned Babbler, Speckled Warbler, Hooded Robin, Flame Robin and Scarlet Robin

The NSW DECCW have identified that the following threatening processes are acting upon these three species:

- Clearing of woodland remnants resulting in fragmentation of habitats.
- Heavy grazing, removal of coarse, woody debris within woodland remnants and the introduction of exotic pasture grasses.
- Nest predation by species such as ravens and butcherbirds may be an issue in some regions where populations are small and fragmented

The proposed action constitutes a key threatening process, and it is considered to contribute to the increased impact of a threatening process.

The NSW DECCW have identified that the following threatening processes are acting upon Speckled Warbler:

- Due to the fragmented nature of the populations and their small size the species is susceptible to catastrophic events and localised extinction.
- Poor regeneration of grassy woodland habitats.
- Habitat is lost and further fragmented as land is being cleared for residential and agricultural developments. In particular, nest predation increases significantly, to nest failure rates of over 80%, in isolated fragments.
- Nest failure due to predation by native and non-native birds, cats, dogs and foxes particularly in fragmented and degraded habitats.

Key recommendations proposed as part of the Local Area management plans to reduce the impact of these threats on the local population include:

1. Increasing the size of the riparian corridor and creating floodplain woodland habitat;
2. Undertaking long term feral animal control;
3. Controlling grazing;
4. Controlling fire; and,
5. Connecting larger potential habitat sites by creating stepping stones between home ranges.

Red-backed Button-quail (*Turnix maculosa*)

The NSW DECCW have identified that the following threatening processes are acting upon Red-backed Button-quail:

- The ground-dwelling nature of the Red-backed Button-quail and its defensive habit of freezing when disturbed render the species susceptible to predation by introduced, and native, predators, offset to an unknown extent by its cryptic plumage and habits. Further, clearing and alteration of habitat increases the number of feral and domestic predators such as the Red Fox (*Vulpes vulpes*) and feral Pigs and Cats (*Felis catus*). Possible reasons for the apparent decline of this species include:
 - Red-backed Button-quail may be threatened by inappropriate burning and grazing regimes.
 - Further, drainage of coastal wetlands and riparian grasslands for agriculture, particularly sugar cane farming, and urban development, reduces available breeding habitat.
 - Trampling and disturbance by livestock and feral herbivores, such as Pigs (*Sus scrofa*), may alter the quality of habitat of this species and could directly affect nesting birds.

Key recommendations proposed as part of the Local Area management plans to reduce the impact of these threats on the local population include:

1. Increasing the size of the riparian corridor and creating floodplain woodland habitat;
2. Undertaking long term feral animal control;
3. Controlling grazing;
4. Controlling fire; and,
5. Connecting larger potential habitat sites by creating stepping stones between home ranges.

Masked Owl *Tyto novaehollandiae* 7-Part Test

(a) in the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction

Masked Owl inhabit a diverse range of wooded habitats that provide tall or dense mature trees with hollows suitable for nesting and roosting. Within NSW most records are from open dry sclerophyll forest, tall open forests as well as in ecotones between forests and farmlands. Roosts in forested areas, in dry forests they are often located in moist or sheltered microhabitats in gullies and drainage lines. Roost in large eucalypt trees in large vertical hollows with average dimensions of 1.5 metres deep and 50cm wide.

Nest trees are generally an isolated or emergent live eucalypt tree within remnant woodland or forest. Nest hollows usually in trunks and near-vertical spouts. Nest locations are often cited near abundant food resources.

Forage predominantly on terrestrial prey but are also known to take arboreal and scansorial prey in dense vegetation. Prefers foraging in mosaically arrayed vegetation, but can also utilise in open country adjoining

forests and woodlands. Prey taken are normally small to medium sized terrestrial mammals which are generally found in forested or woodland communities. Travel long distances from roost locations to forage for prey.

A small area of marginal foraging habitat was recorded within the subject site. Given the small area of limited habitat potential of the site, the removal of these resources **will not** reduce the viability of Masked Owl in the local area, to a degree that could put the local population at risk of extinction.

(b) in the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

This factor applies a similar test as in factor (a) to endangered populations.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be removed or modified as a result of the action.

Not applicable to Masked Owl.

ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable to Masked Owl.

(d) in relation to the habitat of a threatened species, population, or ecological community:

i. the extent to which habitat is likely to be removed or modified as a result of the action proposed.

The proposed action **would** result in the loss of 5.5 hectares of potential marginal habitat from the subject site.

ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action.

The proposal will not contribute to the cumulative loss of habitat and the increased fragmentation or isolation of habitat.

iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

It is currently difficult to quantify the importance of the habitat, however the foraging records made nightly during these surveys indicate that the species utilizes the site occasionally. Given the small scale of removal it is predicted that this would not constitute a loss of significant habitat.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

The proposal would not have any adverse effect on critical habitat. There is a capacity for critical habitats to be gazetted under the Threatened Species Conservation Act 1995. No such habitats have yet been gazetted for Masked Owl.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery or threat abatement plan.

NSW DEH has identified 31 PAS actions to help with the recovery and amelioration of threats on this species. These include:

1. Seek scholarship funds for an identified aboriginal student to investigate the cultural and historic significance of the Masked Owl;
2. Encourage CMAs to invest in actions that actively manage and/or conserve large forest owl habitat as part of their Catchment Action Plans;
3. Current information on owl and habitat identification must be maintained on the threatened species website;
4. Prepare guidelines addressing issues associated with habitat protection and management and survey and assessment on private lands;
5. Promote awareness of the research needs of the Masked owl among the scientific and academic community;
6. Seek an ARC Linkage Grant or other joint funding opportunity to initiate research into identified key areas of the biology and ecology of the three large forest owls;
7. Convene a threatened owl workshop with relevant experts and stakeholders to reassess the state conservation status of the Masked Owl;
8. Prepare environmental impact assessment guidelines to assist consent and determining authorities and environmental consultants to assess impacts of developments on the Masked Owl;
9. Provide up to date and accurate large forest owl and habitat information in the PVP Developer - Threatened Species Tool';
10. Provide up to date information and data for the Biobanking assessment methodology;
11. Use records of concurrence and licence conditions to develop a set of prescriptive guidelines that may be used to mitigate the impacts of developments on the Masked Owl outside conservation reserves and State forests;
12. Investigate the implementation of the forestry threatened species licence owl prescriptions by carrying out proactive audits targeting these prescriptions and through IFOA monitoring and reporting;
13. Make an assessment of the implementation and effectiveness of forestry owl prescriptions and if necessary refine the prescriptions and negotiate changes to the forestry threatened species licences;
14. Encourage private landholders to undertake management options to conserve and/or actively manage forest owl habitat;
15. Develop a sampling methodology stratified across different land tenures and disturbance histories, as well as a set of standardised regional monitoring protocols;
16. Implement a regional monitoring program. This will be undertaken once owl habitat models have been refined, validated and sampling strategy developed.
17. Investigate and pursue the cooperative involvement of other agencies, researchers and the community in the implementation of the regional monitoring program;
18. Monitor and report on effectiveness of concurrence and licence conditions previously applied to reduce impacts of development on Masked Owls and their habitats, by recording conditions, picking case studies and checking owl presence post development;
19. Finalise the large forest owl Multi species plan for Sooty, Masked and Powerful Owl by 2006;
20. Encourage student radio tracking projects examining the use of logged and unlogged forest by the Masked Owl species;
21. Update and refine existing Masked Owl habitat models using the best available information and map the amount of modelled habitat across forested land in NSW;
22. Carry out post harvest surveys in locations where Masked Owls were detected prior to logging to determine if they are continuing to occupy the habitat;

23. Design a sampling strategy to test the modelled habitat for the presence of Masked Owls and undertake field validation; and
24. Estimate amount of mapped modelled habitat for Masked Owls that is occupied (based on proportion of sample sites with owls in them). Use this to further estimate number of owl territories within different land tenures (based on home range data).

PAS actions require individuals to where possible identify actions to which they can contribute. In terms of this project, the actions this document will contribute are points 4, 11, 12 and 15.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The proposed action will only constitute minor vegetation modification within disturbed road corridors through slashing of vegetation where required. While minor, these actions are likely to contribute, albeit not in a significant manner to the following key threatening processes.

- Native vegetation clearing; and
- Anthropogenic climate change.

The NSW DEH have identified that the following threatening processes are acting upon this species:

- Loss of mature hollow-bearing trees and changes to forest and woodland structure, which leads to fewer such trees in the future.
- Clearing of habitat for grazing, agriculture, forestry or other development.
- A combination of grazing and regular burning is a threat, through the effects on the quality of ground cover for mammal prey, particularly in open, grassy forests.
- Secondary poisoning from rodenticides.
- Being hit by vehicles.

The proposed action will not impact upon any of the threatening process identified by DEH. The modification of already disturbed road corridors is unlikely to impact on any habitat utilised by this species.

Green and Golden Bell frog *Litoria aurea* 7-Part Test

(a) in the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction

The Green and Golden Bell Frog inhabits marshes, dams and stream sides, particularly those containing bullrushes *Typha* spp. or spikerushes *Eleocharis* spp. Optimum habitat includes water bodies which are unshaded, free of predatory fish *Gambusia holbrooki*, have a grassy area nearby and diurnal sheltering sites available such as vegetation and/or rocks (White & Pyke 1996). Some sites, are in highly disturbed areas such as disused industrial sites, brick pits, landfill areas and even cleared land. Adults forage on insects and are preyed upon by wading birds and snakes. The species has persisted where multiple waterbodies, including those that are fish-free, occur within 1-2 km of each other (Goldingay 2008).

Dispersal patterns between populations vary (DEC 2005) but individuals are capable of moving long distances in a single day/night of up to 1–5 kilometres (Pyke & White 2001; White & Pyke 2008). The green and golden bell frog feeds on a variety of items that include invertebrates such as insect larvae, crickets, cockroaches, dragonflies, earthworms, flies, grasshoppers, mosquito wrigglers, isopods, freshwater crayfish and slugs (DEC 2005). The suggested dietary preference of tadpoles is the algal or bacterial scum growing on submerged rocks and other substrata (Pyke & White 2001). They are naturally preyed upon by various wading bird species and snakes and are also presumably fed on as larvae by tortoises, eels and other fish.

Active by day and usually breeds in summer when conditions are warm and wet (Cogger 1992). Tadpoles development with temperature and other conditions (Pyke & White 1996). Bell frogs may have greater

breeding success in ephemeral ponds forming away from the lagoon (Goldingay and Newell 2005). All breeding sites are characterised by stationary water and dense emergent vegetation (Gillespie 1996). Hamer et al. (2002) suggested that increased fertiliser use in the 1960s and 1970s has affected tadpole development. Christy and Dickman (2002) recognised saltwater intrusion in coastal wetlands as a consequence of landscape changes as a potential threat to bell frog breeding sites.

A small area of marginal foraging habitat was recorded within the subject site. Given the small area of limited habitat potential of the site, the removal of these resources **will not** reduce the viability of Green and Golden Bell Frog in the local area, to a degree that could put the local population at risk of extinction.

(b) in the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

This factor applies a similar test as in factor (a) to endangered populations.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be removed or modified as a result of the action.

Not applicable to Green and Golden Bellfrog.

ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable to Green and Golden Bellfrog.

(d) in relation to the habitat of a threatened species, population, or ecological community:

i. the extent to which habitat is likely to be removed or modified as a result of the action proposed.

The proposed action **would** result in the loss of <1 hectares of potential marginal habitat from the subject site.

ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action.

The proposal will not contribute to the cumulative loss of habitat and the increased fragmentation or isolation of habitat.

iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

It is currently difficult to quantify the importance of the habitat, however the foraging records made nightly during these surveys indicate that the species utilizes the site occasionally. Given the small scale of removal it is predicted that this would not constitute a loss of significant habitat.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

The proposal would not have any adverse effect on critical habitat. There is a capacity for critical habitats to be gazetted under the Threatened Species Conservation Act 1995. No such habitats have yet been gazetted for Green and Golden Bellfrog.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery or threat abatement plan.

NSW DEH has identified 7 PAS actions to help with the recovery and amelioration of threats on this species. These include:

1. Identify & assess, where possible, threats on key sites.;
2. Develop & implement control/management strategies re: ferals where necessary & if possible in concert with existing control/management programs (e.g., Reserve PoMs, Red Fox TAP & Cane Toad RoundUp);
3. Implement DEC actions according to 'NSW NPWS Frog Hygiene Protocol'. Protocol to be distributed to public authorities, researchers, consultants & individuals implementing rec plan actions. s132 licences to be conditioned in accordance with the Protocol;
4. Encourage, where possible, Taronga Park Zoo in its continued maintenance of currently held captive colonies of GGBF;
5. Prepare a captive husbandry manual;
6. Promote estabmnt. of further colonies @ Tar. Zoo &/or additional institutions. Provenance of future captive colonies should, where poss, be prioritised on basis of individuals sourced from Sth Tablelds Upp Hunter Sth Coast Far Nth Coast Illawarra Wes Syd;
7. Encourage activities of GGBF groups to continue. Establish community 'Friends of the GGBF' groups in key regional areas.
8. Liaise with public authorities to increase protection of areas of GGBF habitat occurring on public lands and with private landholders whose properties contain key populations of GGBF to increase protection of these areas;
9. Prepare and disseminate annual newsletter to participating groups, an annual update/newsletter summarising the key actions undertaken as part of the GGBF recovery program;
10. Prepare and disseminate information pamphlets in regional areas of the species distribution;
11. Revise & disseminate Species Profile to affected agencies & organisations. Disseminate Environmental Impact G'lines to consent & determining authorities. These will be available to consultants & other interested parties;
12. Undertake community survey & monitoring across its statewide distribution in an effort to detect new populations & add to knowledge of spp. historical distribution. Develop systematic community based monitoring & reporting program;
13. Undertake community training workshops on frog identification, handling, hygiene protocols and monitoring techniques;
14. Use GGBF as flagship sp. for public awareness raising program re: pest status of Gambusia & its impact on GGBF & other frog & fish spp. Program to address the mosquito control issue, alternatives to Gambusia & allay concerns re: mosquitoes & GGBF habitat;
15. Recovery Team/Plan coordination. Team to meet annually to review progress of the recovery program;
16. Develop conservation assessment protocol & endeavour to have protocol applied to all known populations;
17. Develop strategies for the control &/or eradication of Gambusia from specific GGBF sites, where appropriate, in accordance with the Gambusia TAP;
18. Initiate installation of supplementary breeding habitat when other Gambusia control methods are not feasible/failed in accordance with Gambusia TAP;
19. Relevant land managers/authorities to consider this rec. plan when preparing land use planning instruments. Consent/determining authorities to consider this plan & DEC GGBF g'lines when assessing the impact of development & activity proposals;
20. Prepare & implement management plans for identified key sites on DEC land. Encourage the preparation & implementation for key sites on public lands;

21. Prepare habitat enhancement guidelines for the construction, enhancement and maintenance of supplementary or compensatory GGBF habitat;
22. Encourage relevant public authorities & land holders to undertake habitat enhancement or creation in strategic locations with the involvement of the local community, local councils and other land managers where appropriate;
23. Develop & maintain a database of records across the spp. range which will serve as a permanent record of GGBF population trends & current habitat management activities that are underway;
24. Establish a systematic monitoring program at key sites on DEC lands across the species range;
25. Encourage low key monitoring as opportunity permits at other sites in collaboration with the local interest groups, private landholders and/or public authorities;
26. Monitor possible interactions between the GGBF & the Cane Toad at sites in the vicinity of their current distributional contact zone (Yamba/Yuragir NP & at Port Macquarie/Lake Innes NR);
27. Finalise priority state and national recovery plan in accordance with previous commitments by June 2007;
28. Promote & co-ordinate a program of investigations into aspects of the biology & ecology of the GGBF, in-situ & ex-situ, as well as investigations into the impacts of specific threatening processes;
29. Liaise with agencies/groups currently involved with translocation trials & promote the preparation of a GGBF Translocation Guide summarising the state of current knowledge & where further information is required;
30. Prepare a translocation guide;
31. Review by the GGBF Rec Team of the success or otherwise of existing translocation/supplementation trials. Recommendations to be made regarding the future direction of such trials & inform the preparation of a translocation guide for this species;
32. Approach ACT Parks & Conservation Service to give consideration to participation in future translocation trials with the view to re-establishing the species in the ACT using appropriately provenanced material; and
33. GGBF Rec Team to consider future proposals for reintroduction Prioritise such proposals on basis of current knowledge of regional conservation status, distribution & genetics as well as to the overall objective of this recovery plan.

PAS actions require individuals to where possible identify actions to which they can contribute. In terms of this project, the actions this document will contribute are points 4, 11, 12 and 15.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The proposed action will only constitute minor vegetation modification within disturbed road corridors through slashing of vegetation where required. While minor, these actions are likely to contribute, albeit not in a significant manner to the following key threatening processes.

- Native vegetation clearing; and
- Anthropogenic climate change.

The NSW DEH have identified that the following threatening processes are acting upon this species:

- Destruction of wetlands
- Alteration of drainage patterns and stormwater runoff
- Fungal pathogen, frog Chytrid fungus
- Predation by feral animals (e.g. foxes)
- Herbicides and other weed-control measures
- Predation by exotic fish (e.g. Plague Minnow)
- Loss of suitable breeding habitat through alteration by infilling and destruction of wetlands
- Road mortality (especially on small populations).

The proposed action will not impact upon any of the threatening process identified by DEH. The modification of already disturbed road corridors is unlikely to impact on any habitat utilised by this species.

1.2 **Micro-Bats 7 part tests**

(a) in the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction

Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*)

M. schreibersii oceanensis colonise in large numbers mainly in caves but also within man made structures such as bridge culverts, drains and buildings (DEH 2004; Hoyer and Spence 2004). They are known to travel large distances between different roosts according to changing seasonal needs with winter roosting sites being located in cooler caves to aid in hibernation (Strahan 2000). As a result of migratory habits of this species, defining a local population is nearly impossible. Nursery caves are large but must contain specific conditions of high temperature and humidity to be suitable. They are often large, dome-shaped chambers which allow them to house large numbers of juvenile bats and to retain warmed air created from bat activities. *M. schreibersii oceanensis* is essentially a coastal species with foraging associated with major drainage systems (DEH 2004). They are insectivorous and show a preference for foraging in well timbered valleys above the tree canopy (Dwyer 1995).

Eastern Freetail-bat (*Mormopterus norfolkensis*), Southern or Large-footed Myotis (*Myotis macropus*)

Myotis macropus generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. They forage over streams and pools catching insects and small fish by raking their feet across the water surface. Roosting sites is also an important factor for this species. Roost selection by *M. macropus* appears to be proximity of suitable waterways for foraging (Campbell 2009). Retention and maintenance of extensive riparian habitat, as well as the preservation of other structures used for roosting, are the most important conservation strategies for management of the day-roosting habitat of *M. macropus*. (Campbell 2009).

Mormopterus norfolkensis is a tree-dwelling insectivorous bat which is often found in dry eucalypt forest and coastal woodlands. They have also been captured within riparian zones, wet sclerophyll forest and rainforest (Allison and Hoyer 1995). They forage above the canopy or in unobstructed corridors in open areas (Allison and Hoyer 1995) on either winged or wingless ants (Allison 1989). The habitat requirements of *M. norfolkensis* are not very well known or understood. They are tree dwelling bats (Allison and Hoyer 1995) which roost together in small colonies in hollows or under loose bark (Australian Museum 2004b). The Eastern Freetail-bat was recorded foraging within the vegetation remnants contained on the subject site. Potential roosting habitat occurred in the Local Area, and the early detection of calls (just after dusk) suggests that this species may be resident onsite. Tree hollow surveys did not identify any habitat trees within the proposal area.

We consider that this proposal will not reduce the viability of micro-bats in the Local Area, to a degree that could put the local population at risk of extinction.

(b) in the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

This factor applies a similar test as in factor (a) to endangered populations.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be removed or modified as a result of the action.

Not applicable to Eastern Bentwing-bat, Southern Myotis or Eastern Freetail-bat.

ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable to Eastern Bentwing-bat, Southern Myotis or Eastern Freetail-bat.

(d) in relation to the habitat of a threatened species, population, or ecological community:

- i. the extent to which habitat is likely to be removed or modified as a result of the action proposed, and**

The proposed action **would** result in the loss of 0.66ha of potential marginal habitat from the activity area.

- ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and**

The proposal will not contribute to the cumulative loss of habitat and the increased fragmentation or isolation of habitat.

- iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.**

It is currently difficult to quantify the importance of the habitat, the Eastern Bentwing-bat and Southern Myotis are rarely recorded in the local area however the Eastern Freetail-bat is often recorded in the Local Area in similar habitats. Recent research has highlighted the importance of continuous riparian corridors and water permanency (Barclay *et al* 2009) to the Southern Myotis. Given that the proposal will remove only a small area of the potential marginal habitat, it is predicted that this would not constitute a loss of significant habitat.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

The proposal would not have any adverse effect on critical habitat. There is a capacity for critical habitats to be gazetted under the Threatened Species Conservation Act 1995. No such habitats have yet been gazetted for the Eastern Bentwing-bat, Southern Myotis or Eastern Freetail-bat.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery or threat abatement plan.

Eastern Freetail-bat (*Mormopterus norfolkensis*), Southern or Large-footed Myotis (*Myotis macropus*)

At this point in time no recovery plan has been prepared for this species by DECCW. DECCW (2006) have identified that the following actions need to be followed in order to recover this species:

- Retain hollow-bearing trees and provide for hollow tree recruitment.
- Retain foraging habitat and protect roosting sites from damage or disturbance.
- Minimise the use of pesticides in foraging areas.
- Control foxes and feral cats around roosting sites, particularly maternity caves.

The proposal is consistent with all the recovery objectives for these species.

Eastern Bentwing-bat (*Miniopterus schreibersii oceanis*)

DECCW (2006) have identified that the following actions need to be followed in order to recover this species:

- Control foxes and feral cats around roosting sites, particularly maternity caves.

- Retain native vegetation around roost sites, particularly within 300 m of maternity caves.
- Minimise the use of pesticides in foraging areas.
- Protect roosting sites from damage or disturbance.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Eastern Freetail-bat (*Mormopterus norfolkensis*), Southern or Large-footed Myotis (*Myotis macropus*)

The NSW DECCW have identified that the following threatening processes are acting upon this species:

- Reduction in stream water quality affecting food resources;
- Loss or disturbance of roosting sites;
- Clearing adjacent to foraging areas; and
- Application of pesticides in or adjacent to foraging areas.

The proposed action constitutes a key threatening process, and it is considered to contribute to the increased impact of a threatening process.

Eastern Bentwing-bat (*Miniopterus schreibersii oceanis*)

The NSW DECCW have identified that the following threatening processes are acting upon this species:

- Damage to or disturbance of roosting caves, particularly during winter or breeding.
- Loss of foraging habitat.
- Application of pesticides in or adjacent to foraging areas.
- Predation by feral cats and foxes.

References

- Allison F.R. (1989). Chapter 43. Molossidae. In D.W.Walton and B.J. Richardson (Eds). Fauna of Australia Volume 1B Mammalia. Australian Government Publishing Service, Canberra.
- Allison, F.R. and Hoye, G.A. (1995) "Eastern Freetail-bat *Mormopterus norfolkensis*." in Strahan, R. (Ed.) The Mammals of Australia. Reed Books, Chatswood, NSW.
- Augee, M.L. and Ford, D. 1999. Radio-tracking studies of Grey-headed Flying-foxes, *Pteropus poliocephalus*, from the Gordon colony, Sydney. Proceedings of the Linnean Society of New South Wales 121, 61-70.
- Barclay, R. M., Chruszcz B. J., Rhodes M. (2009). Foraging behaviour of the large-footed myotis, *Myotis moluccarum* (Chiroptera : Vespertilionidae) in south-eastern Queensland *Australian Journal of Zoology*, 2000, **48**, 385–392
- Campbell, S. (2009). So long as it's near water: variable roosting behaviour of the large-footed myotis (*Myotis macropus*) *Australian Journal of Zoology*, **57**, 89–98
- Campbell, B. (2001) Aspects of roost selection by microchiropteran bats in Bundjalong National park, North-eastern NSW. *The Australian Bat Society Newsletter*, N 17, 2001.
- DEH (2003) EPBC ACT Administrative Guidelines on Significance - Supplement for the Grey-headed Flying-Fox.
- Eamus D, Hatton T, Cook P, Colvin C. 2006. *Ecohydrology: Vegetation Function, Water and Resource management*. CSIRO Publishing: Australia.

- Eby, P. 2000b. A case for listing Grey-headed Flying-fox *Pteropus poliocephalus* as threatened in NSW under IUCN criterion A2. In Proceedings of a Workshop to Assess the Status of the Grey-headed Flying-fox in New South Wales.
- Eby, P., Collins, L., Richards, G. and Parry-Jones, K. 1999. The distribution, abundance and vulnerability to population reduction of a nomadic nectarivore, *Pteropus poliocephalus* during a period of resource concentration. *Australian Zoologist* 31, 240-253
- Kunz, T.H. (1982) Roosting ecology of bats. Pp 1-56 in: *Ecology of Bats* (T.H. Kunz, ed.). Plenum Press, New York
- Mensforth L.J., Thorburn P.J., Tyerman, S.D., Walker G.R., (1994). Sources of Water Used by Riparian *Eucalyptus camaldulensis* Overlying Highly Saline Groundwater *Oecologia*, Vol. **100**, No. 1/2, pp. 21-28
- Roberts J, Marston F. 2000. *Water Regime of Wetland and Floodplain Plants in the Murray-Darling Basin*. CSIRO, Land and Water: Canberra, ACT.
- Rundel PW, Nobel PS (1991) Structure and function in desert root systems. In: Atkinson D (ed) *Plant root growth, an ecological perspective*. Blackwell Scientific, Oxford, pp 349-378
- Sinclair, S.J. (2006). The influence of Dwarf Cherry (*Exocarpus stricta*) on the health of River Red Gum (*Eucalyptus camaldulensis*) *Australiana Forestry* V **69** No2. p 134-141.
- Thorburn, P.J., and Walker G.R., (1994). Variations in Stream Water Uptake by *Eucalyptus camaldulensis* with Differing Access to Stream Water. *Oecologia*, Vol. **100**, No. 3 pp. 293-301
- Tidemann, C.R., Eby, P., Parry-Jones, K.A. and Vardon, M. 1999. Grey-headed Flying-fox. In *The Action Plan for Australian Bats*. Duncan, A., Baker, G.B. and Montgomery, N. (eds). Environment Australia, Canberra.
- Wen, L., Ling, J., Saintilan, N., and Rogers, K. (2009). An investigation of the hydrological requirements of River Red Gum (*Eucalyptus camaldulensis*) Forest, using Classification and Regression Tree modelling. *Ecohydrol.* **2**, 143–155 (2009)

Appendix D – EPBC Assessment

The EPBC Protected Matters search (refer to section 6.4 of this report) identified Fifty two (52) nationally listed threatened species as being known to the regional area (20 kilometres radius from the site). Of these 52 species 12 have habitat in the local area and six (5) have habitat in the Proposal area, these being;

- Regent Honeyeater;
- Swift Parrot;
- Grey-headed Flying-fox;
- Black-eyed Susan; and
- Black Apple.

An assessment of the potential impact of the activity on these species pursuant to the EPBC Act (1999) is presented in **Table D1** and **Table D2**.

Table D1 - EPBC assessments for listed species at risk from the proposal.

<i>Factor</i>	<i>Response</i>
Assessment for Regent Honeyeater	
1. Whether the action will lead to a long-term decrease in the size of a population.	No, the action is unlikely to result in a long-term decrease in the size of a population.
2. Whether the action will reduce the area of occupancy of the species.	No, the removal of vegetation from the site will not remove winter flowering resources that are used by the species. It is unlikely to result in a reduction to the area of occupancy.
3. Whether the action will fragment an existing population into two or more populations.	No, the action will not result in the fragmenting of an existing population.
4. Whether the action will adversely affect habitat critical to the survival of a species.	No, the action will not adversely affect critical habitat.
5. Whether the action will disrupt the breeding cycle of a population.	No, the action will not disrupt the breeding cycle of a population. Regent Honeyeater breed in Box-Ironbark woodlands, riparian forest and gallery forests (Oliver 1999). Breed from mid-August to mid-Jan. The activity will not occur within suitable breeding habitat and as such the breeding cycle will not be disrupted.
6. Whether the action will modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	The habitat is not identified as important habitat for the species. Regent Honeyeater utilises dry eucalypt woodlands and forests dominated by Box and Ironbark eucalypts. The action will not modify the availability or

Factor	Response
	quality of habitat to the extent that a species is likely to decline.
7. Whether the action will result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat*.	The action is unlikely to result in invasive species becoming established in 'endangered' species habitats.
8. Whether the action will interfere with the recovery of the species.	The action is unlikely to interfere with the recovery of the species.
Assessment for Swift Parrot	
1. Whether the action will lead to a long-term decrease in the size of a population.	No, the action is unlikely to result in a long-term decrease in the size of a population.
2. Whether the action will reduce the area of occupancy of the species.	<p>Swift parrot occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany (<i>Eucalyptus robusta</i>), Spotted Gum (<i>Corymbia maculata</i>), Red Bloodwood (<i>C. gummifera</i>), Mugga Ironbark (<i>E. sideroxylon</i>), and White Box (<i>E. albens</i>). Commonly used lerp infested trees include Grey Box (<i>E. microcarpa</i>), Grey Box (<i>E. moluccana</i>) and Blackbutt (<i>E. pilularis</i>).</p> <p>The proposal will not remove any areas identified as favoured habitat and is unlikely to result in a reduction to the area of occupancy.</p>
3. Whether the action will fragment an existing population into two or more populations.	No, the action will not result in the fragmenting of an existing population.
4. Whether the action will adversely affect habitat critical to the survival of a species.	No, the action will not adversely affect critical habitat.
5. Whether the action will disrupt the breeding cycle of a population.	No, the action will not disrupt the breeding cycle of a population. Swift Parrot breed only breed in Tasmania. The activity will not occur within suitable breeding habitat and as such the breeding cycle will not be disrupted.
6. Whether the action will modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	The proposal will not remove any areas identified as favoured habitat. The action will not modify the availability or quality of habitat to the extent that a species is likely to decline.

Factor	Response
7. Whether the action will result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat*.	The action is unlikely to result in invasive species becoming established in 'endangered' species habitats.
8. Whether the action will interfere with the recovery of the species.	The action is unlikely to interfere with the recovery of the species.
Factor	Response
Assessment for Grey-headed Flying-fox	
1. Whether the action will lead to a long-term decrease in the size of a population.	No, it is unlikely that the proposal will result in the long-term decrease in the population size of the Grey-headed Flying-fox.
2. Whether the action will reduce the area of occupancy of the species.	No, it is unlikely that the proposal will not result in the reduction in the area of occupancy of the Grey-headed Flying-fox as their occupancy area would be considered to be their roosting and breeding camp to which they belong. The nearest known camp for this species is in Blackbutt Nature Reserve, Newcastle. Therefore any activity occurring within the study area is likely to be for foraging only. No rainforest elements, which would contain foraging resources, e.g. fruit, occurred within the vegetation units along the proposed activity, therefore foraging would be limited to foraging upon eucalypt blossom.
3. Whether the action will fragment an existing population into two or more populations.	The proposal will not fragment the existing population. Grey-headed Flying-foxes are extremely mobile species often foraging kilometres from their known camp. Known camps are at Blackbutt Reserve, Newcastle and at Wambina Nature Reserve, Matcham.
4. Whether the action will adversely affect habitat critical to the survival of a species.	No areas of critical habitat will be affected by this proposal and as such the proposal is unlikely to affect the survival of this species. The proposal does not affect camp habitat for this species, nor does it affect any important foraging habitat, such as rainforests which provide fruit for this species. Therefore any foraging activity occurring within the vegetation is likely to be for eucalypt blossom which would not be modified significantly by the proposal.
5. Whether the action will disrupt the breeding cycle of a population.	No, the action will not disrupt the breeding cycle of a population.
6. Whether the action will modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	No, the action will not modify the availability or quality of habitat to the extent that a species is likely to decline. No habitat will be modified or removed within the activity area.

Factor	Response
7. Whether the action will result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat*.	The action is unlikely to result in invasive species becoming established in 'endangered' species habitats.
8. Whether the action will interfere with the recovery of the species.	The action is unlikely to interfere with the recovery of the species.
Factor	Response
Assessment for Black-eyed Susan (<i>Tetradlea juncea</i>)	
1. Whether the action will lead to a long-term decrease in the size of a population.	No, the action will not result in the long-term decrease in the size of the population. Habitat for the species is restricted to Eucalyptus forests and heaths on low nutrient soils. The majority of populations occur on low nutrient soils associated with the Awaba Soil Landscape. The action will not result in the loss of potential Black-eyed Susan habitat.
2. Whether the action will reduce the area of occupancy of the species.	Black-eyed Susan was recorded in the study area and in total 126 clumps were recorded on the subject site. However, all but two of these clumps will be conserved. The potential area of occupancy will not be reduced as part of the activity.
3. Whether the action will fragment an existing population into two or more populations.	The subpopulation will not be fragmented by the action.
4. Whether the action will adversely affect habitat critical to the survival of a species.	No area of potential habitat will be affected by the proposal. The activity will not effect habitat critical to its survival as a species.
5. Whether the action will disrupt the breeding cycle of a population.	The action is unlikely to disrupt the breeding cycle
6. Whether the action will modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	The action will not modify, destroy, remove, isolate or decrease the availability or quality of habitat and cause any decline to plant clumps.
7. Whether the action will result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat*.	The action will not result in the introduction of invasive species. The action will not create favourable conditions for invasive species, such as the addition of nutrients etc.

Factor	Response
8. Whether the action will interfere with the recovery of the species.	The action will not interfere with the recovery of the species as it will leave all potential <i>Tetratheca juncea</i> habitat in its existing condition.
Assessment for Black Apple (<i>Angophora inopina</i>)	
1. Whether the action will lead to a long-term decrease in the size of a population.	<p>Occurs most frequently in four main vegetation communities: (i) <i>Eucalyptus haemastoma</i>–<i>Corymbia gummifera</i>–<i>Angophora inopina</i> woodland/forest; (ii) <i>Hakea teretifolia</i>–<i>Banksia oblongifolia</i> wet heath; (iii) <i>Eucalyptus resinifera</i>–<i>Melaleuca sieberi</i>–<i>Angophora inopina</i> sedge woodland; (iv) <i>Eucalyptus capitellata</i>–<i>Corymbia gummifera</i>–<i>Angophora inopina</i> woodland/forest.</p> <p>Specimens of <i>Angophora inopina</i>/A. floribunda x were recorded onsite and are considered within report as having equal conservation status as pure <i>A.inopina</i>. In total, 21 individuals were recorded within the proposal area, almost all within lot 15 and lot 11 (See Figure 5). The potential loss of 21 individuals is not considered to constitute a significant decrease in population size as the local area is considered core habitat for the species.</p> <p>No action will result in the long-term decrease in the size of the population.</p>
2. Whether the action will reduce the area of occupancy of the species.	The loss of these individuals will remove some individuals from the population but not reduce the overall area of occupation of the species in the regional area. The area of occupancy will not be reduced by the activity.
3. Whether the action will fragment an existing population into two or more populations.	The population will not be fragmented by the action.
4. Whether the action will adversely affect habitat critical to the survival of a species.	No habitat will be affected by the activity.
5. Whether the action will disrupt the breeding cycle of a population.	The action is unlikely to disrupt the breeding cycle
6. Whether the action will modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	The action will not modify, destroy, remove, isolate or decrease the availability or quality of habitat and cause any decline to <i>Angophora inopina</i> population.
7. Whether the action will result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat*.	The action will not result in the introduction of invasive species however mitigation measures such as thorough cleaning of machinery, equipment, shoes, and clothing etc. will ensure no invasive seed species enter the disturbed area. The action will not create favourable conditions for invasive species, such as the addition of

Factor	Response
	nutrients etc.
8. Whether the action will interfere with the recovery of the species.	The action is unlikely to interfere with the recovery of the species.

