Arcadia Development

Flora & Fauna Assessment

Final report regarding the proposed subdivision

Lots 1 and 2 in DP1213875
Lot 1 in DP233288
Lot 6 in DP121122
part of Lot 1 in DP1198645

Tamworth NSW

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Front photograph: Panorama of Arcadia Development area looking SW from eastern boundary (P4 on Figure 3)

Contents

1 Introduction 2

2 Background 2

3 Project Location 3

4 Project Summary 4

5 Biophysical Description of the Project Area 4

5.1 Topography and soils 4

5.2 Landscape setting 4

5.3 Landuse 4

6 Field Inspection 4

6.1 Limitations of the inspection 5

7 Results 8

7.1 Vegetation on the project area 8

7.1.1 White box grassy woodland 8

7.1.2 Blakely's red gum – yellow box grassy woodland 8

7.1.3 Derived exotic grassland 11

7.2 Rare or threatened species 11

7.3 Fauna habitat features 11

8 Impacts of the Proposal on Flora, Fauna and their Habitats 11

8.1 State Environmental Planning Policy No 44 – Koala Habitat Protection 12

9 Consideration of threatened species, endangered populations and endangered ecological communities 14

10 NSW Threatened Species Assessment 14

10.1 Section 5A Assessment - The 7 Part Test 14

10.2 7 Part Test Conclusions 24

11 Matters of National Environmental Significance 25

11.1 Consideration of EPBC matters 25

11.2 Results of database search 25

11.3 Assessment of Significance 26

11.3.1 Critically endangered or endangered species 26

11.3.2 Vulnerable species 28

11.3.3 Critically endangered and endangered ecological communities 31

11.3.4 Migratory species 33

11.4 Assessment of Significance Conclusions 34

12 Threatened Species Mitigation Recommendations 35

13 References 38

APPENDIX 1: Identification Flowchart for the Critically Endangered *White Box Yellow Box Blakely's Red Gum Grassy Woodland And Derived Native Grassland* Ecological Community **40**

APPENDIX 2: Consultant's Qualifications and Experience **42**

APPENDIX 3: Flora Species Identified on the Arcadia Development Project Area, Tamworth NSW **44**

APPENDIX 4: Photographs of the Project Area and Quadrat Sampling Sites **50**

Flora and Fauna Impact Assessment

Executive Summary

This report presents a flora and fauna impact assessment of a proposal to subdivide approximately 277 hectares (ha) that comprises Lots 1 and 2 in DP1213875, Lot 1 in DP233288, Lot 6 in DP121122 and part of Lot 1 in DP1198645 at Tamworth, NSW. It is proposed to subdivide approximately 237ha into 1,428 residential blocks and 232 larger residential blocks, ranging in size from 700m^2 to 4000m^2. Up to 5 storm water retention basins will be constructed within the ephemeral Burke's Gully where currently there is 4 farm dams. Two access roads will also be constructed across this drainage depression. It is proposed to retain approximately 23.9ha as public reserve; 23.4ha along Burke's Gully and 0.5ha adjacent to the access corridor off Bylong Road. A further 16.5ha (approximate) will be retained as a powerline easement along the northern boundary of the project area. .

*The majority of the site (approximately 272.5ha) is highly disturbed, having been extensively cleared for cropping and grazing and/or modified by pasture improvement and weed invasion. Vegetation on this area comprises derived grassland dominated by introduced species with/without isolated overstorey trees. Only 4.5ha of the project area supports remnant woodland. A field inspection of the subdivision area found two areas of grassy woodland; 0.5ha dominated by white box (*Eucalyptus albens*) and 4.0ha dominated by Blakely's red gum (*E. blakelyi*) and/or yellow box (*E. melliodora*). Both these patches and the derived grasslands constitute an endangered ecological community;* White Box Yellow Box and Blakely's Red Gum Woodland*, listed as under the NSW* Threatened Species Conservation Act 1995 *(TSC Act). They also meet the minimum condition criteria for the critically endangered ecological community;* White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland*, listed under the Commonwealth* Environment Protection and Biodiversity Conservation Act 1999 *(EPBC Act). The derived grassland fails to meet the minimum condition criteria for this critically endangered ecological community established by the Commonwealth (DEH 2006).*

These woodland patches and approximately 19.4ha of derived grassland ecological community will be retained on the project site within a public reserve described above.

Vegetation on the project area is considered to provide habitat for a further 4 threatened flora species. Although no threatened fauna were recorded during a limited fauna survey undertaken in 2013 (Mitchell Hanlon 2014) the area is considered to provide habitat for 30 threatened fauna species and 4 migratory species listed under the State and Commonwealth legislation. The conclusion of this assessment is that no significant impact will result for any New South Wales or Commonwealth listed threatened species, populations or ecological communities providing; all development is restricted to previously cleared and/or modified land (ie areas of derived grassland) and mitigation recommendations as outlined in this report are implemented. This is due to the highly degraded nature of the vegetation to be impacted, its very poor condition, proximity to existing residential development, the proposed protection and enhancement of 23.9ha that includes the remnant woodland patches as public reserve and retention of 16.9ha of existing derived grassland within a powerline easement. The mitigation recommendations outlined in this report will ensure habitat for flora and fauna species is retained on-site and that existing habitat is not adversely modified or isolated.

1 Introduction

This report has been prepared at the request of Mr Roger Garment on behalf of Mr John Smyth, as a requirement of the statutory matters that must be included as part of;

- Section 5A of the NSW *Environmental Planning and Assessment Act 1979 (*EP&A Act), and
- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The aim of this report is to provide an assessment of potential impacts of the development proposal on flora and fauna, especially in regards to critical habitats; threatened species, populations and ecological communities, or their habitats. A particular requirement of the brief was the determination of whether the white box grassy woodland previously identified on the site constitutes the *White Box Yellow Box Blakely's Red Gum grassy woodland and derived native grassland* critically endangered ecological community (CEEC) listed under the Commonwealth *EPBC Act*.

The following assessment has been conducted, in accordance with s5A of the *Environment Planning and Assessment Act 1997 (EP&A Act)* and the *Significant Impact Guidelines (EPBC Act)*, for the proposed residential subdivision on Lots 1 and 2 in DP1213875, Lot 1 in DP233288, Lot 6 in DP121122 and part of Lot 1 in DP1198645 (Arcadia Development) subsequently referred to in this assessment as the "project area" (refer Figure 1).

2 Background

In 2013, Tamworth Regional Council commissioned Mitchell Hanlon Consulting, Tamworth to undertake a Flora and Fauna assessment of existing *RU4- Primary Production Small Lots* as identified in the *Tamworth Regional Council Local Environmental Plan* (2010) for re-zoning (Mitchell Hanlon 2014). The land being that identified in Tamworth Regional Council's *South Tamworth Rural Lands Master Plan (Stage 2)* as potentially suitable for commercial and residential land uses (Mitchell Hanlon 2014). The area assessed under this report includes the current project area.

The report identified the presence of white box yellow box orange gum grassy woodland within the project area which was classified as;

- the endangered ecological community (EEC) *White Box Yellow Box Blakely's Red Gum Woodland* listed under the NSW *TSC Act*, and
- critically endangered ecological community (CEEC) *White Box Yellow Box Blakely's Red Gum grassy woodland and derived native grasslands*, listed under the Commonwealth *EPBC Act*.

It was the conclusion of this assessment that re-zoning of the project area was unlikely to have any significant impact on any *EPBC* or *TSC Act* listed threatened flora or fauna or communities (Mitchell Hanlon 2014).

In May 2015, The Envirofactor was engaged by John Smyth to provide as second opinion as to the likely occurrence of CEEC on the project area. A review of Mitchell Halon report was inconclusive due to the use of a 0.04 ha (20m x 20m) area for the collection of flora data rather than the 0.1ha (20m x 50m) required by the Commonwealth guideline for the identification of the CEEC (DEH 2006 refer Appendix 1). A field inspection of the area undertaken in May 2015 was also inconclusive due to seasonality (ie late autumn is outside the period of growth flowering and seed set of most native ground layer species).

In August 2015, Eco Logical Australia was engaged by Mitchell Hanlon Consulting to validate field data collected in 4 quadrats within the areas identified as CEEC in the 2014 survey (Eco Logical Australia 2015). Given the dynamic nature of the ground layer in these ecosystems and its susceptibility to changes in grazing regime, rainfall, temperature and seasonality it is difficult to understand how it was considered a survey 2 years after the original survey in 2013, and conducted in a different season, would provide any validation of the original survey data. This notwithstanding, the conclusion of this survey confirmed the presence of the CEEC. It is however this author's opinion, that results from this 2015 survey were yet again inconclusive regarding the presence of the CEEC. As this determination was again based on 0.04ha sampling sites rather than 0.1ha required by the Commonwealth guideline (DEH 2006) and being undertaken in winter, outside the period of growth, flowering and seed set of most native ground layer species in northern NSW.

This current survey and assessment commissioned by John Smyth is consistent with the Commonwealth guideline for the identification of the CEEC, as it uses a 0.1ha sampling site for data collection and was conducted in mid-spring within the growth, flowering and seed set of many ground layer species in northern NSW.

3 Project Location

The project area lies on the North West Slopes of NSW within the Tamworth LGA. It is located approximately 6 kilometres (km) south west of the Tamworth CBD (refer Figure 1). The area under consideration comprises approximately 277ha bounded to the west by Duri/Werris Creek Road to the south by Burgmann's Lane, while the northern boundary abuts existing residential/rural residential development. The eastern boundary adjoins the Long Yard Golf Course and an area currently being sold as residential/rural residential development blocks.

FIGURE 1: Location of the Project Area

4 Project Summary

The proposal under consideration is the subdivision of the area described above for residential and rural residential housing comprising 1,428 residential blocks and 232 larger residential blocks (refer Figure 2). The proposed subdivision will involve the construction of houses and their associated infrastructure (roads, utilities, fences, sheds and gardens). It will also involve the construction of up to 5 storm water retention basins.

5 Biophysical Description of the Project Area

5.1 Topography and soils

The project area lies towards the southern edge of the Nandewar Bioregion (Thackway and Cresswell 1995) within the Peel sub-region of the Naomi River catchment area. The topography is undulating, dissected northwest to southeast by an ephemeral drainage depression known as Burke's Gully. Geology of the area generally comprises tertiary basalts with red-brown loamy clay soils (Morgan and Terrey 1992).

5.2 Landscape setting

The project area lies within a region that has been extensively cleared (66%) for grazing and cropping (Morgan and Terrey 1992). As a consequence, native vegetation remnants are generally confined to; steeper hillslopes, small patches and scattered paddock trees within grazing and cropping paddocks, areas of crown land and linear strips along rivers, roadsides and Travelling Stock Reserves.

The project area lies on the southern edge of the Tamworth urban area. It is bounded by Duri/Werris Creek Road to the west and Burgmann's Lane to the south. It adjoins existing residential development along its northern boundary and the Long Yard Golf Course and residential development blocks currently being sold along its eastern boundary. Although the southern boundary below Burgmann's Land abuts similar agricultural land, residential and rural residential developments occur within 200m of the south western and 500m of the south eastern corners of the project area.

5.3 Landuse

Historically, the project area has been extensively cleared for grazing and/or cultivation leaving only the ground layer with or without scattered paddock trees over much of the area (refer Figure 3). Contour banks and constructed waterways readily identify areas that have been historically cropped. The area has also undergone pasture improvement. Small areas of more intact woodland structure occur towards the northern end of Burke's Gully and within Lot 1 in DP 233288, the proposed access for the Arcadia Development located in the northeast corner off Bylong Road. Infrastructure on the area includes; fencing, stockyards, farm tracks and 5 farm dams, 4 of which are located within Burke's Gully. Four fenced and planted tree shelter belts are located on the area and a powerline easement is located along the northern boundary. Soil erosion is common along Burke's Gully. At the time of inspection the project area was being grazed by cattle and horses.

6 Field Inspection

A flora survey and fauna habitat assessment of the project area was carried out by Wendy Hawes (refer Appendix 2 for qualifications and experience), over 8 hours on the 21st October 2015. The survey was conducted using a stratified random approach. Prior to undertaking the field survey the project area was stratified, taking into account geology/soil type, topographic elements, vegetation structure and disturbance regimes. Stratification was based on satellite imagery, previous reports and the author's knowledge of the area. The survey involved 7 sampling sites comprising a 20m x 50m quadrat (Q) and 1 overstorey structure site (CT) (refer Figure 3). Consistent with the Commonwealth guideline (DEH 2006) for determining the presence of the critically endangered ecological community *White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grasslands,* sampling sites within the stratification units were chosen for their apparent ground layer diversity.

Within the quadrats the following data was recorded;

- all plant species present using modified Braun-Blanquet cover/abundance categories as follows; 1=<5% (rare number of individuals at site), 2=<5% (species common at the site), 3=5-25%. 4=26-50%, 5=51-75% and 6=76-100%
- percentage cover of dominant ground layer species
- percentage of non-vascular ground layer elements (litter/dead branches, bare soil/small rocks, cryptogams and large rock/boulder), and
- presence of fauna habitat features including; large and small tree hollows, standing dead trees, stumps, mistletoe, tree/shrub regeneration and fallen logs.

This survey method is consistent with the requirements of the Commonwealth guideline for the identification of the CEEC (DEH 2006).

To establish the age structure of the vegetation community, number of trees per hectare and to quantify some the important fauna habitat features such as tree hollows a spot analysis technique was used. This involved selecting a single tree ('central tree') within a representative area of the woodland patch adjacent to Burke's Gully and recording its diameter at breast height over bark (dbh) and the presence of fauna habitat features eg hollows, canopy health and mistletoe. The same parameters were then also recorded for next 11 nearest trees including the distance of these trees from the central tree. Seedling trees less than 1.5m tall were not counted, as they were too short to measure a diameter at breast height. Data from this technique gives a quantitative indication of the age structure of the woodland, as well as the density of habitat features eg standing dead trees, mistletoe and hollows. The central tree was located at AMG Zone 56: Easting 299157 / Northing 6554462 (refer CT in Figure2).

6.1 Limitations of the inspection

The timing of the current survey, is generally within the growth, flowering and/or seed set period of many native perennial plant species. Thereby enabling detection and identification of many of the plant species present on the project area. This identification was aided by reasonable spring rains just prior to the survey. This notwithstanding, the grazing by domestic livestock may have limited the detection and identification of some palatable plant species.

FIGURE 2: Proposed Subdivision Plan for the Arcadia Development

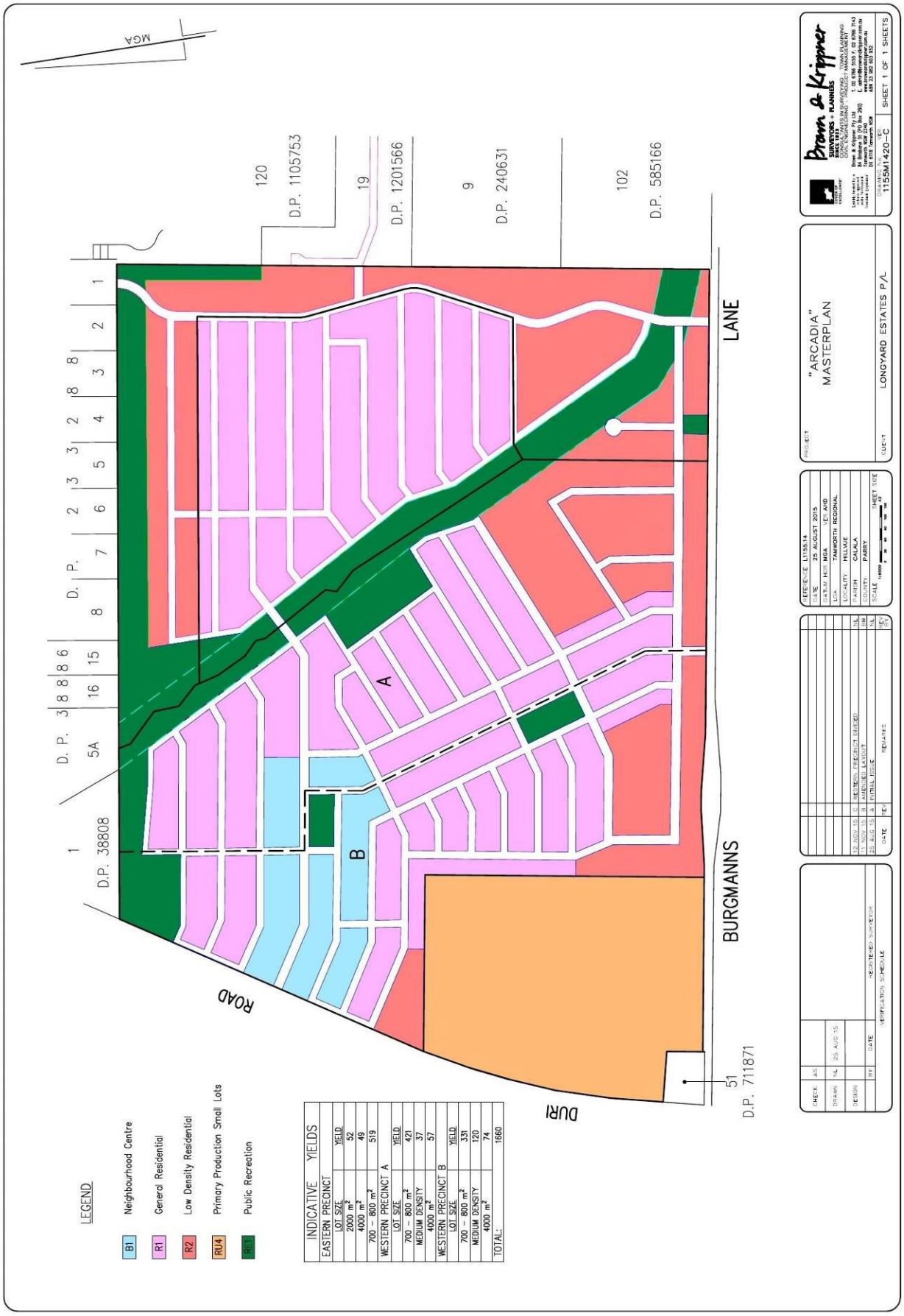

FIGURE 3: Arcadia Development project area and location of sampling sites

7 Results

7.1 Vegetation on the project area

Vegetation communities on the project area have been defined according to the NSW OEH *Vegetation Information System database* (accessed 2015). Nomenclature used for grasses is as per Wheeler *et al* 2002, all other groups as per the NSW Royal Botanic Gardens *PlantNet* database. The quadrat results and a comprehensive list of flora species identified during this field inspection carried out on 21st October 2015, along with the results of the previous surveys appear in Appendix 3.

As identified in previous reports (Mitchell Hanlon 2014 and Eco Logical Australia 2015), vegetation communities on the project area comprise small patches of grassy woodland within a much larger area of derived grassland (refer Figure 3). The composition of these communities at the time of the current survey is described in detail below.

7.1.1 White box grassy woodland

[Plant Community Type (PCT) ID 1383] - Sampling site: Q1

A small patch of this community occurs on the proposed Arcadia Development access corridor between Bylong Road and the main project area. Overstorey is dominated by white box (*Eucalyptus albens*) with occasional yellow box (*E. melliodora*) and Blakely's red gum (*E. blakelyi*). A sparse understorey of regenerating *Eucalyptus* spp is present. The shrub layer is sparse and dominated by African boxthorn (*Lycium ferocissimum*). This community comprises an uneven age stand, ie old growth trees with more than one age class of regeneration present.

Ground layer vegetation the time of inspection, although moderately weedy (5-33%), was dominated by native grasses and forbs. Dominant species include; rough speargrass (*Austrostipa scabra*), pitted bluegrass (*Bothriochloa decipiens*), hare's foot clover (*Trifolium arvense*)*, snow grass (*Poa sieberiana*), purple wiregrass (*Aristida ramosa*). Other species present include; tall windmill grass (*Chloris ventricosa*), wallaby grasses (*Rytidosperma* spp), bottle washers (*Enneapogon nigricans*), kidneyweed (*Dichondra* species A), knob sedge (*Carex inversa*), common woodruff (Asperula conferta), common everlasting (*Chrysocephalum apiculatum*), yellow burr daisy (*Calotis lappulacea*), fuzzweed (*Vittadinia* sp), many-flowered mattrush (*Lomandra multiflora*), pink tongues (*Rostellularia adscendens)* and chocolate lilies (*Dichopogon* spp). Common weed species include; bromes (*Bromus* spp)*, ryegrass (*Lolium* sp)* and Paterson's curse (*Echium plantagineum*)*. The condition of this woodland vegetation is considered to be moderate.

** introduced species*

7.1.2 Blakely's red gum – yellow box grassy woodland

(PCT – 599) – Sampling sites: Q2 & Q4

A small area of this community occurs towards the northern end of Burke's Gully. Overstorey is dominated by Blakely's red gum (Q2) and/or yellow box (Q4) with occasional white box and/or grey box (*E. moluccana*). During the initial inspection in May this author identified a red gum (*E. camaldulensis)* within this community but this was a miss identification of yellow box. The shrub layer is sparse and dominated by African boxthorn (*Lycium ferocissimum*). This community comprises a mature age/old growth stand (ie mature trees/old growth with only one or two cohorts) with little or no regeneration present.

Ground layer vegetation at the time of inspection was highly weedy (34-66%). Sampling sites selected were the most native species diverse areas observed within this community and at best were 50/50 native versus exotic species (Q4). Dominant species include; rye grass (*Lolium* sp)*, bromes (*Bromus* spp)*, rat tail grass (*Vulpia muralis*), burr medic (*Medicago polymorpha)*,* couch (*Cynodon dactylon),* climbing saltbush (*Einadia nutans)* and brassicas (*Sisymbrium* spp)*. Other species present include; rough speargrass (*Austrostipa scabra*), red grass (*Bothriochloa spp*), clovers (*Trifolium* spp)*, wallaby grasses (*Rytidosperma* spp), kidneyweed (*Dichondra* species A), and fuzzweed (*Vittadinia* sp). The condition of this woodland vegetation is considered to be poor.

This community constitutes the endangered ecological community, *White Box Yellow Box Blakely's Red Gum Woodland,* listed under the schedules of the NSW *TSC Act*. It may or may not constitute the critically endangered ecological community, *White Box Yellow Box Blakely's Red Gum grassy woodland and derived native grassland* listed under the Commonwealth *EPBC Act* depending upon quadrat data used, ie Q2 vs Q4.

If, consistent with the DEH (2006) guideline, the determination of the CEEC is made on the results of Q2 which supported the most native species in the ground layer, ie 21 species as opposed to 8 species recorded in Q4. Then the patch has a predominantly exotic understorey dominated by ryegrass*, bromes*, rat's tail grass and burr medic* and therefore does not meet the minimum condition criteria for this listed community (DEH 2006 refer Appendix 1). This notwithstanding, it does support more than 12 native species (other than grasses) and more than 1 important species.

Conversely, if the results of Q4 are used then the ground layer is predominantly native (where the vegetative cover comprises 50% native species), the patch is 4ha in size and while it does not support 12 or more native species other than grasses, it does support more than 20 trees per ha (120 trees/ha refer Table 1 – which when averaged over the patch equates to 30 trees/ha). Consequently, the patch does meet the minimum condition criteria for the CEEC (DEH 2006).

Given these somewhat conflicting results and the dynamic nature of the species composition within the ground layer, the precautionary principle has been applied and for the purpose of this assessment the patch is presumed to constitute the CEEC.

** introduced species*

TABLE 1: Results of Spot Analysis within Blakely's Red Gum – Yellow Box grassy woodland (Location: AMG Zone 56: Easting 299157 / Northing 6554462)

Tree Id	Tree Species	Distance from Central Tree (m)	DBH[1] (cm)	Small Hollows (<10cm)	Large Hollows (>10cm)	Mistletoe Present (Y/N)
Central	*Eucalyptus melliodora*	0	31-40	N	N	N
1	*Eucalyptus melliodora*	6	61+	N	N	N
2	*Eucalyptus melliodora*	7	21-30	N	N	N
3	*Eucalyptus melliodora*	8	11-20 (x2)	N	N	N
4	*Eucalyptus melliodora*	9	11-20	N	N	N
5	*Eucalyptus melliodora*	13	51-60 (x2)	Y	N	N
6	*Eucalyptus melliodora*	13	41-50	Y	N	N
7	*Eucalyptus melliodora*	15	11-20	N	N	N
8	*Eucalyptus melliodora*	18	11-20 (x2) 21-30	N	N	N
9	*Eucalyptus melliodora*	14	11-20 31-40	N	N	N
10	*Eucalyptus melliodora*	18	41-50 (x3)	N	N	N
11	*Eucalyptus melliodora*	16	61+ 41-50	N	N	N

[1] DBH = diameter at breast height (1.5m) over bark

FIGURE 4: Vegetation communities on the Arcadia Development project area

7.1.3 Derived exotic grassland

(Plant community type ID none applicable) – Sampling sites: Q3, Q5, Q6 and Q7

This community occupies the majority of the Arcadia Development project site. Overstorey comprises isolated paddock trees including white box, yellow box and Blakely's red gum. Ground layer is dense and dominated by introduced species including; ryegrass*, burr medic*, hare's-foot clover (*Trifolium campestre*)* bromes (*Bromus* spp)*, Mayne's pest (*Glandularia aristigera)*,* rat's tail grass (*Vulpia muralis)*,* barley grass (*Hordeum leporinum)** and cut-leaf peppercress (*Lepidium bonariense)**. Interspersed with small patches of native species including couch, rough speargrass and redgrass. This vegetation is in very poor condition.

** introduced species*

7.2 Rare or threatened species

Consistent with the findings of previous surveys (Mitchell Hanlon 2014 and Eco Logical Australia 2015), no Rare or Threatened Australian Plants (ROTAPs) (Briggs and Leigh 1996) or threatened flora species were identified on the project area during the current survey. A fauna survey was not part of the current investigation but no threatened species were identified by a limited fauna survey conducted by Mitchell Hanlon (2014).

7.3 Fauna habitat features

Fauna habitat within the project area is suitable for species adapted to grassy woodland and grassland areas. Mature and old growth eucalypts provide feeding substrates, flowers/nectar and roosting/resting sites. Large and small hollows in old growth trees offer nesting/roosting sites, while scattered occurrences of fallen timber and native groundcover species in woodland areas provide foraging substrates and protection for a range of small woodland and grassland species. In contrast the proximity of the project area to existing residential housing is likely to reduce usage of these resources by fauna due to increased human activity, noise, vibration, lighting and vehicle movements. On-going livestock grazing has also reduced the fauna habitat value through trampling and reduced structural/floristic diversity in the ground layer. While increased risk of predation due to the presence of domestic cats and dogs will also have reduced the fauna usage of the area.

8 Impacts of the Proposal on Flora, Fauna and their Habitats

The known direct impacts of any proposed residential subdivision on flora and fauna habitat include:

1. Loss and fragmentation of habitat as a consequence of;
    - clearing native vegetation for the construction of houses and their associated infrastructure (access roads, utilities, fences, sheds and gardens),
    - clearing native vegetation for bushfire asset protection zones,
    - clearing native vegetation for boundary fencing,
    - increased firewood collection,
    - bushrock collection for gardens, and
    - "tidying up" - including mowing, removing fallen logs and/or litter, under-shrubbing[1].
2. Degradation of habitat resulting from;
    - increased weed invasion as a consequence of the introduction of exotic and non-endemic natives for gardens,
    - changes to soil hydrology resulting from garden watering,

[1] Under-shrubbing is the removal of the shrub stratum within vegetation communities to create a grassy, park-like vegetation structure, often undertaken as part of "tidying up".

- changes to soil nutrient status resulting from fertiliser use in gardens, and
- alteration of surface water flows resulting from roads, increased areas of hard surface and storm water retention basins.

3. Increased predation by domestic pets (cats and dogs).

Within the patches of woodland and derived grassland on the project area many of the above impacts have already occurred, as a consequence of historic clearing, cropping, livestock grazing, pasture improvement and disturbances associated with adjoining residential development. These activities have severely degraded the vegetation and therefore the habitat value over much of the proposed subdivision area.

The proposed development will remove approximately 236.6ha of derived exotic grassland in very poor condition, which supports approximately 65 isolated white box, yellow box and/or Blakely's red gum trees. It will also construct up to 5 storm water retention basins along Burke's Gully, one of which will impact on the existing woodland patch. It will also require the construction of two access roads across Burke's Gully as per Figure 2.

Currently within the project area Burke's Gully has 4 farm dams along its length. It is proposed to modify these structures to facilitate the temporary storage of storm water to slow water flows from the residential development, reduce soil erosion and maintain water quality. This includes the modification of an existing dam within the Blakely's red gum yellow box grassy woodland patch. This activity will result in soil and ground layer disturbance and potentially the removal of a very small number of hollow-bearing trees. Once constructed the ground layer will be allowed to regenerate consequently this disturbance will be temporary. The loss of trees and hollows within this woodland patch will be mitigated by replanting 3 eucalypt trees for every one removed and the installation of nest boxes as outlined in section 12. Thereby ensuring no loss of this resource within this better structured vegetation. Additionally, the removal of permanent water from the development site will be reinstating a more natural surface water flow regime within the gully than currently exists.

Construction of the two proposed access roads will be integrated into the proposed storm water retention structures. They will therefore not result in additional disturbance to vegetation to be retained within the public reserve area, nor further impede water flows within Burke's Gully.

As part of the proposal, 23.9ha of vegetation within the access corridor off Bylong Road (0.5ha) and within and adjacent to Burke's Gully (23.4ha) will be retained as public reserve (refer Figure 5). An additional area of approximately 16.5ha will be maintained within the powerline easement along the northern edge of the project area (refer Figure 3). This reservation will ensure not all habitat values are lost from the project site or the locality. These areas comprise:

- 0.5ha of white box grassy woodland in moderate condition
- 4.0ha of Blakely's red gum – yellow box grassy woodland in poor condition, and
- 35.9ha of derived exotic grassland with/without scattered white box, yellow box and Blakely's red gum overstorey in very poor condition.

On-going management issues as a result of the development which will potentially further degrade this vegetation include; firewood collection, bushrock removal and an increased potential for weeds and domestic predators. The implementation of recommendations in section 12 of this report is considered to protect and potentially enhance these areas, such that the proposed development will not significantly impact on remaining habitat for native flora and fauna on the project area.

8.1 State Environmental Planning Policy No 44 – Koala Habitat Protection

This policy aims to encourage the conservation and management of areas of natural vegetation that provide habitat for koalas. To ensure a permanent free-living population over their present range and reverse the current trend of koala population decline. The SEPP achieves this aim by:

(a) requiring the preparation of plans of management before development consent can be granted in relation to areas of core koala habitat; and

(b) encouraging the identification of areas of core koala habitat, and

(c) encouraging the inclusion of areas of core koala habitat in environment protection zones.

The *Atlas of NSW Wildlife* (OEH accessed 2015) indicate no koalas have been recorded on the project area. Additionally, a koala scat survey conducted by Mitchell Hanlon (2014) failed to identify any signs of koala occurrence. Consequently, there is no evidence a "*resident population*" of koalas occurs on the project area. The project area does support communities dominated by white box (*Eucalyptus albens*) and therefore constitutes "*potential koala habitat*" under SEPP No. 44. This notwithstanding, sections 10.1 and 11.3.2 of this report provides an assessment of the impact of the project on koalas and their habitat under s5A EP&A Act (7 part test) and the *Significant impact Guidelines* for the *EPBC Act*.

FIGURE 5: Approximate boundaries of the proposed public reserve on the Arcadia Development site

9 Consideration of threatened species, endangered populations and endangered ecological communities

Initially this task requires interrogation of the various threatened species databases to identify any known location of threatened species, populations and ecological communities within, or within close proximity to, the proposed impact area. These databases include:

- NSW Office of Environment and Heritage (OEH) – *Atlas of NSW Wildlife* and *Threatened Species Website*
- Department of Primary Industries (Fisheries) (DPI Fisheries) – *Threatened and Protected Species record viewer*
- Commonwealth Department of the Environment (DoE) – *Protected Matters Search Tool*.

Satellite imagery [NSW Land and Property Information (LPI) accessed 2015] is used to determine the presence and extent of broad habitat types for these species. Where it is determined the habitat of a species, population or community is not present, this species is culled from the list of potential occurrence. This list is then further refined based on the habitat features identified during a field inspection.

In the preparation of this report only threatened ecological communities identified as present on the project area, as a result of the field inspection on the 21st October 2015, will be considered. No threatened ground layer flora species were identified on the project area during the current or previous surveys (Mitchell Hanlon 2014, Eco Logical Australia 2015). However species, that because of their small size/cryptic nature may not have been detected and so cannot be discounted on the study area, will be considered under this assessment. Also considered under this assessment will be fauna species with known habitat features present on the project area. A list of threatened species, endangered populations and ecological communities either known to occur, or predicted to occur on the proposed development area, generated by this process are presented in Tables 2, 3,4, 5 and 6.

10 NSW Threatened Species Assessment

10.1 Section 5A Assessment - The 7 Part Test

Assessment of the species and communities in Tables 2 and 3 listed under the schedules of the NSW *TSC Act* will be carried out under s5A *Assessment of Significance* (7 Part Test) of the *EP&A Act 1979*. Interpretations of the factors of assessment and definitions of specific terminology used in this assessment are consistent with the NSW "*Threatened Species Assessment Guidelines - The assessment of significance"* (DECC 2007a).

TABLE 2: TSC Act - Threatened Ecological Communities Known to occur on the Project Area

Community Name	Legal Status*
White Box Yellow Box Blakely's Red Gum Woodland	EEC

TABLE 3: TSC Act - Threatened Flora and Fauna Species Known or Predicted to, occur on the Project Area

Category	Scientific Name	Common Name	Legal Status*
FLORA			
	Dichanthium setosum[1]	Bluegrass	V
	Digitaria porrecta	Finger Panic Grass	V
	Picris evae	Hawkweed	V
	Thesium australe	Austral toadflax	V
FAUNA			
Birds	*Anthochaera phrygia*[1]	Regent Honeyeater	CE

Category	Scientific Name	Common Name	Legal Status*
	Burhinus grallarius	Bush Stone-curlew	E
	Circus assimilis	Spotted Harrier	V
	Climacteris picumnus victoriae[1]	Brown Treecreeper (eastern form)	V
	Daphoenositta chrysoptera	Varied Sittella	V
	Falco subniger[1]	Black Falcon	V
	Glossopsitta pusilla[1]	Little Lorikeet	V
	Grantiella picta	Painted Honeyeater	V
	Hamirostra melanosternon	Black-breasted Buzzard	V
	Hieraaetus morphnoides	Little Eagle	V
	Lathamus discolor[1]	Swift Parrot	E
	Lophoictinia isura[1]	Square-tailed Kite	V
	Melanodryas cucullata cucullata	Hooded Robin	V
	Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	V
	Neophema pulchella [1]	Turquoise Parrot	V
	Ninox connivens	Barking Owl	V
	Petrocia boodang	Scarlet Robin	V
	Petrocia phoenicea	Flame Robin	V
	Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	V
	Stagonopleura guttata[1]	Diamond Firetail	V
	Tyto novaehollandiae	Masked Owl	V
Mammals	*Miniopterus schreibersii oceanensis*[1]	Eastern Bent-wing Bat	V
	Nyctophilus corbeni	Corben's Long-eared Bat	V
	Petaurus norfolcensis[1]	Squirrel Glider	V
	Phascolarctos cinereus[1]	Koala	V
	Pteropus poliocephalus	Grey-headed Flying-fox	V
	Saccolaimus flaviventris	Yellow-bellied Sheath-tail-bat	V
	Scoteanax rueppellii	Greater Broad-nosed Bat	V
Reptiles	*Hoplocephalus bitorquatus*	Pale-headed Snake	V
	Underwoodisaurus sphyrurus	Border Thick-tailed Gecko	V

CE = Critically Endangered: **E** = Endangered: **V** = Vulnerable: **EEC** = Endangered Ecological Community: **CEEC** = Critically Endangered Ecological Community: **EP** = Endangered Population

[1] Species records within 10km of project site OEH *Atlas of NSW Wildlife* (accessed 2015)

The following factors are to be taken into account in deciding 'significance' in the context of whether the development is likely to significantly affect a threatened species, population or ecological community, or its habitat.

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life-cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

A local population for purposes of this assessment is the population that occurs on the project area which comprises the Arcadia Development area. As well as connected habitat within remnant vegetation on private land to the south and/or west of the project area.

The project will impact on approximately 277ha of land comprising approximately 272.5ha of derived grassland and 4.5ha of woodland adjoining existing residential development on the outskirts of Tamworth, NSW. It is proposed to retain and potentially enhance the 4.5ha of woodland vegetation and 35.9ha of the derived grassland within and adjacent to Burke's Gully, along the northern boundary of the project area as part of a powerline easement and adjacent to the proposed access off Bylong Road (refer Figure 5).

The actions proposed as part of the proposal which may potentially impact on the life-cycle of the species under consideration is the removal of 236.6ha of derived exotic grassland with or without isolated old growth white box, yellow box and Blakely's red gum trees, increased predation from domestic pets (dogs and cats) and further potential for weeds (garden escapees).

The actions proposed as part of the residential development that will potentially impact on the life-cycle of the species under consideration include;

- removal of isolated mature/old growth within areas of poor native vegetation condition
- loss of tree hollows, mistletoe, food and flowering resources provided by these remnant trees
- a decline in surface water quality due to increased sediment and/or chemical contamination from the residential construction sites.

The species under consideration, those in Table 3. These species have been categorised according to movement ability and/or habitat preferences for the purposes of this matter.

Nomadic and migratory species

The primary threat to terrestrial nomadic and migratory species from the proposal is the continued loss and/or degradation of food resources and/or resting sites that sustain these species in their large-scale movements across the landscape. On the project area these are provided by *Eucalyptus* spp, standing dead trees and mistletoe. Nomadic and migratory species likely to use the project area include; the regent honeyeater, painted honeyeater, swift parrot, black-chinned honeyeater and grey-headed flying fox. Both the regent honeyeater and swift parrot have been recorded within 10km of the project area (*Atlas of NSW Wildlife* - accessed 2015).

Mature and old growth eucalypts, such as those which occur within the project area, are therefore an important food resource for these species. Consequently the loss of approximately 65 of these trees within the 236.6ha of derived exotic grasslands will have some impact of these species. However, the isolated nature of these trees, the lack of any regeneration and their proximity to existing residential development where on-going disturbance from human activity, lights, noise, vibration and domestic predators is common, severely limit their habitat value for these wide ranging species. This notwithstanding, replanting of endemic *Eucalyptus* spp on a 3 for 1 basis within the proposed public reserve (as per recommendations on section 12) will improve habitat for these species on-site in the medium to long-term.

Additionally, better quality woodland habitat within Burke's Gully and adjacent to the proposed access off Bylong Road will be protected and enhanced as a public reserve. It is proposed to expand the woodland area within Burke's Gully through overstorey regeneration and/or replanting within derived grasslands areas along the gully thereby maintaining habitat for these species on-site. Providing mitigation recommendations (outlined in section 12 of this report) are adopted, it is considered the proposed subdivision will have little impact on habitat for terrestrial nomadic and migratory species.

Birds of prey

The project area provides habitat for a number of birds of prey generally associated with grassy woodlands and/or grasslands including; the black falcon, spotted harrier, black-breasted buzzard, little eagle, masked owl and barking owl. Given these highly mobile, generally sedentary, species range over large areas of land (>200ha) it is highly likely the project area falls within the home range of one or more of these species. Records for the black falcon and square-tailed kite exist within 10km of the project area (*Atlas of NSW Wildlife* accessed 2015).

The loss of 236.6ha of supporting approximately 65 *Eucalyptus* trees and/or exotic ground layer vegetation will have some impact on these species through the loss of nesting, roosting and resting sites, as well as habitat for prey populations. The area supports live hollow-bearing trees, potential nesting sites for the masked and barking owls. Although both these species tend to prefer larger tracts of more intact woodland remnants for this purpose, rather than isolated paddock trees or the small patches of woodland present on the project site.

The predominantly exotic ground layer does provide habitat for suitable prey species (eg rabbits, mice and reptiles). However, similar to the nomadic species the proximity of the project area to existing residential development makes it at best marginal habitat for these species. Small areas of better quality woodland habitat within Burke's Gully and adjacent to the proposed access off Bylong Road will be protected and enhanced as a public reserve. It is also proposed to expand the woodland area within Burke's Gully through overstorey regeneration and/or replanting within derived grasslands areas along the gully, thereby maintaining habitat for these species on-site. Providing mitigation recommendations (outlined in section 12 of this report) are adopted, it is considered the proposed subdivision will have little impact on habitat for these large birds of prey.

Microchiropteran bats

The proposal area potentially provides habitat for 4 microchiropteran bat species; the eastern bentwing, Corben's long-eared, yellow-bellied sheathtail and greater broad-nosed bats. The eastern bent wing bat has been recorded within 10km of the project site.

Habitat for all four bat species is the small woodland patches on the development area. Only the eastern bentwing bat and yellow-bellied sheathtail bat would be expected to use both the derived grassland and woodland habitat on the project area for foraging. However, only the yellow-bellied sheathtail bat is likely to use tree hollows within the derived grasslands area for breeding, as eastern bentwing bats employ maternity caves for this purpose (OEH, website 2015).

The potential risk to these bat species from the development is therefore the loss 236.6ha of derived grassland that supports a number of isolated possibly hollow-bearing trees. This notwithstanding, the sparse nature of the tree cover, the lack of any regeneration, highly degraded ground layer and the proximity to existing residential development, where on-going disturbance from human activity (lights, noise, vibration and domestic predators) is common, make this vegetation at best marginal habitat for these two species. Additionally, being an artefact of agricultural landuse this habitat type (ie derived grassland with/without isolated trees) is relatively common within the locality and region. It is therefore considered unlikely the loss of this area of marginal foraging habitat will significantly impact on local populations of these species.

Further, areas of better structured woodland habitat within Burke's Gully (4.0ha) and adjacent to the proposed access off Bylong Road (0.5ha) will be protected and enhanced as a public reserve. It is also proposed to expand the woodland area within Burke's Gully through overstorey regeneration and/or replanting within retained derived grasslands areas along the gully (19.4ha), thereby maintaining habitat for these species on-site. Providing mitigation recommendations (outlined in section 12 of this report) are adopted, it is considered the proposed subdivision will not place a local population of these bats at risk of extinction.

Arboreal species

The project area provides habitat for three arboreal species the squirrel glider, koala and pale-headed snake. Both the koala and squirrel glider have been recorded within 10 km of the project area (*Atlas of NSW Wildlife* accessed 2015).

Habitat for the squirrel glider and pale-headed snake is the small patches of woodland on the project area. Both species are particularly reliant on the presence of old growth, hollow-bearing trees (Ayers *et al* 1996 and NPSW 2003a). Although these also exists in the derived grassland areas the widely spaced nature of the trees (ie 65 trees across 236.6ha) would make it impossible for these two small arboreal species with limited ability to move across open ground to access this resource.

While the maintenance of woodland overstorey is important for both these species, the squirrel glider also requires the presence of the native shrub layer and the pale-headed snake suitable native ground habitat for its prey, which includes lizards, frogs and small mammals. The small size of the woodland patches (ie 4ha in Burke's Gully and 0.5ha off Bylong Road), their relative isolation (surrounded by derived exotic grassland with isolated paddock trees), proximity to existing residential housing and its associated disturbances (human activity, lights, noise, vibration and domestic predators) as well as the degraded nature of the Burke's Gully woodland make these areas at best marginal habitat for these species.

In contrast, the koala is capable of utilising feed trees across the project area including those in the derived grassland areas. However, the scattered nature of these trees would require the koala to spend extended periods on the ground in order to access the feeding resources within this habitat, putting them at greater risk of predation and heat stress. Consequently, the preferred habitat for the koala on the project area is also the better structured woodland patches. Mitchell Hanlon (2014) undertook a koala scat search within these patches and found no evidence of koala usage.

Under the development proposal these woodland patches, will be retained as public reserve The woodland patch in Burke's Gully will be expanded and enhanced as regeneration and/or replanting occurs in areas of derived grassland within a corridor along the gully area. Although there will initially be a temporary disturbance to the woodland area in Burke's Gully as a result of the construction of a storm water retention basin, this disturbance will be temporary. This notwithstanding, it is considered mitigation recommendations (outlined in section 12 of this report) that require the protection of a small area of woodland, replanting of 3 white box (*Eucalyptus albens),* yellow box (*E. melliodora*) or Blakely's red gum (*E. blakelyi*) trees for each 1 removed and replacement of lost hollows with supplementary nest boxes within the adjoining public reserve area will ensure habitat for these species is retained on-site.

Woodland birds

Nine species of threatened bird dependent upon on grassy woodland habitat potentially occur within the project area. The species under consideration include; the brown treecreeper, varied sittella, little lorikeet, hooded robin, scarlet robin, flame robin, turquoise parrot, grey-crowned babbler and diamond firetail. The little lorikeet, brown treecreeper, turquoise parrot and diamond firetail have all been recorded within 10km of the project site (*Atlas of NSW Wildlife* accessed 2015).

Habitat loss and/or degradation as a result of; clearing, increased weed invasion, under-shrubbing and "tidying-up", are all significant threats for these species of small to medium birds. For all these woodland birds the derived exotic grassland areas provide very limited habitat. Their preferred habitat is the small patches of woodland vegetation (approximately 4.0ha and 0.5ha) on the project area. However, as for other species under consideration the small size of these woodland areas, their isolation and proximity to existing residential development make it at best marginal habitat for these species.

Under the development proposal these woodland patches, will be retained as public reserve The woodland patch in Burke's Gully will be expanded and enhanced as regeneration and/or replanting occurs in areas of derived grassland within the gully corridor. Although there will initially be a temporary disturbance to the woodland area in Burke's Gully as a result of the construction of a storm water retention basin this disturbance will be temporary. This notwithstanding, it is considered mitigation recommendations (outlined in section 12 of this report) that require the protection of the woodland, replanting of 3 white box (*Eucalyptus albens),* yellow box (*E. melliodora*) or Blakely's red gum (*E. blakelyi*) trees for each 1 removed and replacement of lost hollows with supplementary nest boxes within the adjoining public reserve area will ensure habitat for these species is retained on-site.

Groundcover dependent fauna species

Two species under consideration, the bush stone-curlew and border thick-tailed gecko, are dependent on the maintenance of native groundcover and fallen timber within grassy woodland and grasslands. Native groundcover, fallen logs and litter provide food resources, shelter, breeding and resting sites for these species.

While the loss of the derived grassland areas for residential development may potentially impact on available habitat for the bush stone-curlew and border thick-tailed gecko, the general lack of fallen timber, the proliferation of exotic ground layer species, on-going grazing and proximity to existing residential development severely limit the habitat value for these species. Given the degree of landscape clearing and therefore the extent of derived grassland habitat within the locality, it is unlikely the loss of this area of degraded habitat will significantly impact on any viable local population of these species.

Further, the retention of existing grassy woodland vegetation on the project site as public reserve and the expansion and enhancement of the woodland patch in Burke's Gully will ensure habitat for these species is maintained on-site. Although there will initially be disturbance to the woodland area in Burke's Gully as a result of the construction of a storm water retention basin this disturbance will be temporary. It is considered mitigation recommendations (outlined in section 12 of this report), if implemented, will protect and potentially enhance the habitat value of the proposed public reserve area within the project area and thereby retain habitat for these species on-site.

Flora species

The project area potentially provides habitat for four threatened flora species; *Dichanthium setosum* (bluegrass), *Digitaria porrecta* (finger panic grass), *Picris evae* (hawkweed) and *Thesium australe* (austral toadflax). Both the derived grasslands and woodland vegetation on the project area potentially provide habitat for these species. However, given the highly degraded nature of the vegetation communities across the majority of the project area, as a result of clearing, historic cropping, pasture improvement and on-going livestock grazing it is considered highly unlikely any of these species occur. The one exception to this is the 0.5ha area of white box grassy woodland adjoining the proposed access off Bylong Road which is considered to be in moderate condition, with a predominantly native ground layer. Nonetheless neither the current survey nor the two previous surveys (Mitchell Hanlon 2014, Eco Logical Australia 2015) identified these or any other threatened plant species on the project area.

Under the development proposal the areas supporting better quality ground layer vegetation will be retained as public reserve. This change in landuse which will involve the cessation of livestock grazing and pasture improvement is likely to enhance the native species composition of the ground layer within Burke's Gully and habitat for these species. Although there will initially be disturbance to the ground layer within the woodland area in Burke's Gully, as a result of the construction of a storm water retention basin, this disturbance will be temporary. It is considered mitigation recommendations (outlined in section 12 of this report), if implemented, will protect and potentially enhance the habitat value of the proposed public reserve area and thereby retain habitat for these species on-site. It is therefore considered the proposed development will not adversely affect habitat for these threatened flora species on the development area.

Conclusion

There is potential for the proposed subdivision to impact on the threatened species through the removal of 236.6ha of marginal habitat. Habitat that comprises derived grassland in very poor condition supporting approximately 65 mature/old growth isolated paddock trees, immediately adjacent to existing residential development. Habitat that is relatively common within the local and regional agricultural landscape. This notwithstanding, mitigation recommendations outlined in section 12 of this report will protect and enhance approximately 4.5ha of woodland and 35.9ha of derived grassland; within Burke's Gully, adjoining the proposed access off Bylong Road and within the powerline easement along the northern boundary. The maintenance and/or enhancement of these areas will ensure habitat for the species under consideration is retained on the project area. Consequently, it is unlikely the loss of this area of marginal habitat will place a viable local population of any threatened species at risk of extinction.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

No endangered populations were identified on the project area. Consequently, the proposal is unlikely to have an adverse impact on the life-cycle of any species that constitutes an endangered population such that a local population will be placed at risk of extinction.

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

One endangered ecological community (EEC) has been identified as occurring within the proposed subdivision area; *White Box Yellow Box Blakely's Red Gum Woodland* (NSW Scientific Committee 2002). On the project area this EEC is represented by two small areas of woodland; 0.5ha of white box grassy woodland adjoining the proposed access off Bylong Road and 4.0ha of yellow box Blakely's red gum grassy woodland within Burke's Gully (refer sections 7.1.1 and 7.1.2).

It is also likely the areas of derived grassland (with or without isolated trees) once comprised this EEC. However, on-going grazing, historic cropping of some areas, pasture improvement and high levels of weed infestation have significantly altered the species composition of these areas to the extent that although isolated overstorey trees remain the ground layer is no longer dominated by native species.

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

There is potential for the proposed subdivision to impact significantly on the extent of the EEC on the project area with the removal of 236.6ha of derived grassland that once constituted box-gum grassy woodland. However, due to historic and current landuse this area is considered to be in very poor condition. Given the degree of landscape clearing and the extent of similar quality derived grassland vegetation within the locality and connected to the project area to the south, it is unlikely the loss of this area of degraded habitat will have such an adverse effect such that a local occurrence of the EEC will be placed at likely extinction.

Additionally, approximately 23.9ha of similar and/or better quality EEC will be retained on-site, along Burke's Gully and adjoining the proposed development access off Bylong Road, as public reserve. This area will be maintained and enhanced by encouraging natural regeneration, replanting and weed control. A further area of derived grassland (16.5ha) will also be retained within the powerline easement along the northern boundary. Providing mitigation recommendations (as outlined in section 12 of this report) are implemented no local occurrence of the EEC will be placed at potential risk of extinction.

(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.

Clearing for the proposed subdivision will significantly impact on the composition of the 236.6ha of derived exotic grassland. However, this area is already substantially and significantly modified as a consequence of; historic clearing, pasture improvement, cropping, on-going grazing and weed invasion. Areas of similar and/or better quality EEC will however be retained on-site, along Burke's Gully (approximately 23.4ha) and adjoining the proposed access off Bylong Road (0.5ha) as public reserve. A further area of derived grassland (approximately 16.5ha) will also be retained within the powerline easement along the northern boundary. The removal of grazing from these areas and the regeneration and/or replanting of the Burke's Gully corridor is likely to significantly improve the species composition of these areas and the quality of the EEC on-site. The implementation of mitigation recommendations (as outlined in section 12 of this report) will assist in remediating some of the existing degradation and as a consequence, this local occurrence of the EEC will continue to exist on the project area.

(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 subdivision area comprises approximately 277ha, comprising 4.5ha of woodland and 272.5ha of derived exotic grassland. With the exception of 0.5ha of woodland in moderate condition these vegetation communities are in poor to very poor condition as a result of historic clearing, cropping, pasture improvement, on-going grazing and weed invasion. At best this vegetation constitutes marginal habitat for threatened flora and fauna species.

As discussed previously, the proposed development will involve the removal of 236.6ha highly modified habitat for residential development; houses and their associated infrastructure (fencelines, powerlines and tracks). It is however proposed to retain and potentially enhance the existing habitat values of 23.9ha within an area designated as a public reserve. It is considered the implementation of mitigation recommendations (outlined in section 12) will ensure habitat for threatened species, populations and ecological communities is retained on-site.

(ii) whether the area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

While the highly modified vegetation on the project area has connectivity with similarly disturbed vegetation to the south, across Duri/Werris Creek Road to the west and along Burke's Gully to the north-west, it abuts existing residential development to north, east, south-east and south-west. Consequently, the area generally forms a habitat cul-de-sac within existing residential development. However, the proposed retention and enhancement of vegetation within a public reserve along Burke's Gully will ensure the continued connectivity along the ephemeral drainage line. Similarly, the retention of existing derived grassland within the powerline easement along the northern boundary will maintain what connectivity exists for the small woodland patch adjoining the access corridor off Bylong Road. Consequently, areas of currently interconnected habitat will not be isolated or fragmented by the proposed subdivision for any threatened species, population or ecological community.

(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,

As outlined previously, the Arcadia development will involve the removal of 236.6ha of highly modified grassland habitat in very poor condition adjacent to existing residential housing. This vegetation is at best marginal habitat for threatened species. The degree of landscape clearing means there are extensive areas of similar quality habitat within the locality and region indicating its removal is unlikely to be significant for any species, population or ecological community. Additionally, any potential to fragment existing habitat has been minimised by the retention and enhancement of a 23.4ha corridor along Burke's Gully and the retention of 16.5ha of derived grassland within the powerline easement along the northern boundary (refer Figure 5). As a consequence, the area of habitat to be removed as part of the proposed development is not considered critical to the long-term survival of any species, population or ecological community under consideration.

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

The proposal site does not contain, nor lie within the locality, of any area that has been identified and declared as critical habitat under the *TSC* or *FM Acts.* Additionally the proposed action will not have any off-site impacts that will affect any areas of declared critical habitat within the catchment.

It is therefore considered critical habitat will not be affected (either directly or indirectly) should the proposed Arcadia Development proceed.

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

Recovery or threat abatement plans exist for the following species and ecological community under consideration:

- *Bush Stone-curlew Recovery Plan* (DEC 2006)
- *Barking Owl Draft Recovery Plan* (NPWS 2003b)
- *National Recovery Plan for the Swift Parrot* (Saunders and Tzaros 2011)
- *Draft National Recovery Plan for the Grey-headed Flying-fox* (DECC 2009)

- *White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland National Recovery Plan* (DECCW 2010)

Additionally, OEH has prepared '*Priorities Action Statements*' (PAS) to promote the recovery of threatened species, populations and communities and abatement of threatening processes (DECC 2007b).

The objectives of these recovery plans and the PAS' generally involve the protection and enhancement of existing habitat, by preventing clearing and adverse modification of native vegetation communities. The proposed action, which involves; the subdivision of approximately 236.6ha, construction of houses and their associated infrastructure (gardens, sheds fencelines), establishment of bushfire asset protection zones and intensification of landuse will potentially impact on habitat for these species through habitat loss and modification.

As discussed previously, the area to be removed comprises highly modified/degraded vegetation immediately adjacent to existing residential development. At best the subdivision area is marginal habitat for the threatened species under consideration. Additionally, approximately 23.9ha of woodland and derived grassland vegetation will be retained and enhanced along Burke's Gully (23.4ha) and adjoining the proposed access off Bylong Road (0.5ha) (refer Figure 5). A further 16.5ha of derived grassland will also be retained as a powerline easement along the northern boundary (refer Figure 3). Vegetation within the public reserve area will be enhanced by encouraging overstorey regeneration, replanting and/or weed control. Consequently, it is considered the project will not significantly impact on the recovery of any of threatened fauna species or ecological community.

Currently only one threat abatement plan relevant to the proposed development is available; *Threat abatement plan for predation by feral cats* (Commonwealth of Australia 2015). This plan focuses on the impacts of feral cat predation on threatened fauna populations. However, it emphasises the need for improvement in the management of domestic and stray cats particularly near areas of human habitation to reduce recruitment to the feral cat population. Eradication and control efforts for feral cat populations can only be sustained if the transition of cats from domestic or stray to feral is prevented.

The proposed residential developments will potentially increase the number of domestic cats in the locality. Consequently, the proposed development is potentially in conflict with the objectives of this threat abatement plan. However, given vegetation on the project area is at best marginal habitat for the threatened species under consideration it is unlikely the increased threat from cat predation will significantly impact on any threatened fauna species population.

(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 following key threatening processes declared under the *TSC Act* are considered relevant to the proposed action:

Clearing of Native Vegetation

Clearing of native vegetation is recognised as a major factor contributing to the loss of biological diversity (NSW Scientific Committee 2001). As discussed previously, the proposal will remove 236.6ha of derived grassland in very poor condition.

While the development under consideration will result in the operation of this key threatening process (ie native vegetation will be cleared) the landscape setting of the area (ie adjoining existing residential development) and poor condition make it at best marginal habitat for the species under consideration. Areas of better structured woodland (4.5ha) on the project area as well as 35.9ha of similar condition derived grassland will be retained on the project area. Of this 23.9ha will be protected and enhanced by encouraging overstorey regeneration, replanting and weed control (as outlined in section 12). It is therefore unlikely the loss of this marginal habitat will significantly affect any local population of threatened species and thereby increase the impact of this key threatening process.

Bushrock Removal

Bushrock removal is the removal of natural surface rock from rock outcrops or from areas of native vegetation (NSW Scientific Committee 1999). The consequence of this activity is a reduction in available habitat for native species dependent upon surface rock for shelter, foraging or growth.

No areas of rock outcropping and/or surface rock were recorded on the project site, consequently the proposed development will not result in the operation of this threatening process.

Invasion of native plant communities by exotic perennial grasses

Exotic perennial grasses [eg Coolatai grass *(Hyparrhenia hirta),* African lovegrass (*Eragrostis curvula),* phalaris *(Phalaris aquatica),* buffel grass *(Cenchrus ciliaris),* Rhodes grass *(Chloris gayana)* and kikuyu *(Pennisetum clandestinum)*] have the capacity to invade native plant communities, competing with, and excluding native species (NSW Scientific Committee 2003a). The invasion of these grasses also reduces habitat value for many native fauna species.

The woodland patches and derived grassland areas on the project area are already highly infested with exotic species, including Rhodes grass. Consequently, the proposed development is unlikely to significantly increase the impact of this key threatening process.

Loss of hollow bearing trees

Hollows are a well-documented fauna resource with up to 400 species reliant on them for shelter and nest sites (Gibbons and Lindenmayer 1997, NSW Scientific Committee 2007). They are also recognised for their slow development time (100-140 years). In the context of this assessment hollow-dependent fauna include; the brown treecreeper, little lorikeet, turquoise parrot, barking owl, masked owl, squirrel glider, pale-headed snake, eastern bentwing bat, yellow-bellied sheathtail bat, Corben's long-eared bat and greater broad-nosed bat.

The current project will remove 236.6ha of derived grassland in very poor condition, but which supports approximately 65 eucalypt trees a number of which will be hollow bearing. Consequently, the proposed action will involve the operation of this key threatening process. It is however unlikely hollow bearing trees within the derived grassland would be preferentially chosen by hollow-dependent species given their isolated nature and proximity to existing residential development and its associated disturbances/threats. A small number of hollow-bearing trees may also be removed from the woodland patch within Burke's Gully for the construction of a storm water retention basin. Hollows within this better structured vegetation is likely to be preferentially chosen for use by hollow-dependent species. This detrimental impact may be mitigated the installation of supplementary nest boxes to replace any hollows removed from this vegetation. Thus ensuring retention of this important habitat element within woodland habitat. Providing mitigation measures, outlined in section 12, are implemented, it is considered the proposed action will not significantly increase the impact of this threatening process.

Removal of dead wood and dead trees

The ongoing removal of standing dead trees and fallen timber as part of the process of clearing, under-shrubbing and/or 'tidying up', as well as for collection for firewood, is recognised as a major factor contributing to the loss of biodiversity (NSW Scientific Committee 2003b).

Standing dead timber is generally absent from the project areas but a small amount of fallen dead timber is present within the woodland patches within Burke's Gully and adjoining the access corridor off Bylong Road. Under the proposed development these areas will be retained as public reserve and this resource preserved on the project area. Mitigation measures outlined in section 12 will increase the availability of this resource within the public reserve, thereby ensuring this important habitat element is retained on site in the medium to long-term. Hence, the proposed development will not significantly increase the impact of, this threatening process.

10.2 7 Part Test Conclusions

The vegetation on the proposed Arcadia development area; Lots 1 and 2 in DP1213875, Lot 1 in DP233288, Lot 6 in DP121122 and part of Lot 1 in DP1198645 at Tamworth, NSW provides habitat for;

- 1 endangered ecological community
- 4 threatened flora species and
- 30 threatened fauna species.

The vegetation on the site comprises the endangered ecological community; *White Box Yellow Box Blakely's Red Gum Woodland* in varying structural types and condition, ie woodland (4.5ha) and derived exotic grassland with/without isolated overstorey trees (272.5ha). One patch of woodland (0.5ha) adjoining the access corridor off Bylong Road is considered to be in moderate condition, while a second woodland patch (4.0ha) in Burke's Gully is in poor condition, the remaining derived grassland areas are in very poor condition. No threatened flora species were identified.

It is considered the proposed subdivision may potentially lead to impacts on threatened species, ecological communities and/or endangered populations through:

- clearing of 236.6ha of derived exotic grassland (with/without isolated trees) for house and/or infrastructure construction and bushfire asset protection zones
- degradation of habitat by changes in soil hydrology / nutrient status or increased weeds, and
- loss of habitat elements such fallen timber and hollow bearing trees (live and dead).

However, it is the conclusion of this s5A assessment that the proposed subdivision will have no significant impact on any threatened species, populations or ecological communities providing;

- mitigation recommendations outlined in section 12 of this report are implemented, and
- approximately 23.4ha of vegetation (woodland and derived grassland) along Burke's Gully and 0.5ha of woodland adjoining the access corridor off Bylong Road is retained as public reserve, and
- 16.5ha of derived grassland is retained within the powerline easement along the northern boundary.

Providing these conditions are adhered to the proposed development is considered unlikely to:

- place a viable local population for any threatened species at risk of extinction, or
- place a viable local population of any species that constitutes an endangered population at risk of extinction, or
- have an adverse effect on the extent or composition of an ecological community such that a local occurrence of the community is placed at risk of extinction, or
- remove, modify, fragment or isolated habitat important to the long-term survival of any species, population or ecological community, or
- have an adverse effect on critical habitat (either directly or indirectly), or
- result in the operation of, or increase the impact of, a key threatening process.

With the mitigation recommendations the proposed actions are also considered to be consistent with the objectives of relevant recovery plans and threat abatement plans.

11 Matters of National Environmental Significance

The *Environment Protection and Biodiversity Conservation Act 1999* requires consideration of the effect of an action on the following 9 matters of national environmental significance:

- World Heritage Properties,
- National Heritage Places,
- Ramsar wetlands of international importance,
- nationally threatened species and ecological communities,
- migratory species protected under international agreements,
- nuclear actions, including uranium mining, and
- the Commonwealth marine environment
- the Great Barrier Reef Marine Park
- a water resource, in relation to coal seam gas development and large coal mining development

The impact of an action on these matters is assessed under the criteria specified in; *Matters of National Significance - Significant Impact Guidelines1.1* (DoE 2013).

11.1 Consideration of EPBC matters

A search was undertaken using the *EPBC Protected Matters Search Tool* (DoE 2015) to generate a list of; World Heritage Properties, National Heritage Sites, Ramsar wetlands, and nationally threatened species and communities and migratory species protected under international agreements that may occur on, or within a 10km radius of the project area.

11.2 Results of database search

The *EPBC Protected Matters Search Tool* (PMST) does not list any World Heritage Properties, National Heritage Places or Ramsar wetlands on the project area, or within a 10km radius, therefore the proposal is not considered to impact on these matters. Additionally, the proposal does not involve nuclear actions, the marine environment, the Great Barrier Reef Marine Park or a water resource in relation to coal seam gas or large coal mining development, therefore these matters are also not relevant to this assessment.

Nationally threatened species and communities and migratory species protected under international agreements have been initially defined by a 10km radius search using the PMST. Only those species and/or communities, either known to occur, or predicted to occur on the project area (using the process outlined in section 9) are considered under the *Significant Impact Guidelines 1.1 (*DoE 2013*)*. These species and communities are listed in Tables 4, 5 and 6.

Considered as part of this assessment will be threatened ecological communities known to occur on the project area, flora species, which because of their small size and/or cryptic nature, cannot be discounted from occurring on the project area, and all fauna species for which the project area provides potential habitat.

TABLE 4: Threatened Ecological Communities Known to occur on the Project Area

Community Name	Legal Status*
White Box Yellow Box Blakely's Red Gum grassy woodland and derived native grassland	CEEC

* Critically endangered ecological community

TABLE 5: Threatened Flora and Fauna Species potentially occurring on the Proposal Area

Category	Scientific Name	Common Name	Legal Status*
FLORA			
	Dichanthium setosum[1]	Bluegrass	Vulnerable
FAUNA			
Birds	*Anthochaera phrygia*[1]	Regent Honeyeater	Critically Endangered
	Lathamus discolor[1]	Swift Parrot	Endangered
Mammals	*Nyctophilus corbeni (previously N. timoriensis)*	Corben's Long-eared Bat	Vulnerable
	Phascolarctos cinereus[1]	Koala (combined populations of Qld, NSW and ACT)	Vulnerable
	Pteropus poliocephalus	Grey-headed Flying-fox	Vulnerable
Reptiles	*Underwoodisaurus sphyrurus (syn Uvidicolus sphyrurus)*	Border Thick-tailed Gecko	Vulnerable

TABLE 6: Migratory Species potentially occurring on the Proposal Area

Category	Scientific Name	Common Name	Legal Status*
Terrestrial Birds	*Apus pacificus*	Fork-tailed Swift	CAMBA/JAMBA/ROKAMBA
	Hirundapus caudacutus	White-throated Needletail	CAMBA/JAMBA/ROKAMBA
	Merops ornatus [1]	Rainbow Bee-eater	JAMBA
	Myiagra cyanoleuca	Satin Fly-catcher	Bonn

* **CAMBA** = China Australia Migratory Bird Agreement; **JAMBA** = Japan Australia Migratory Bird Agreement; **ROKAMBA** = Republic of Korea Australia Migratory Bird Agreement; **Bonn** = Bonn Convention on the Conservation of Migratory Species of Wild Animals

[1] Species identified within 10km of the project site OEH *Atlas of NSW Wildlife* (accessed 2015)

11.3 Assessment of Significance

As described in section 8, the project area comprises approximately 277ha of which 236.6ha of derived exotic grassland will be developed for residential housing. An area of approximately 23.9ha comprising woodland (4.5ha) and derived grassland (19.4ha) will be retained and enhanced as public reserve, and a further 16.5ha of derived grassland will also be retained within a powerline easement. Vegetation on the project area comprises one small patch of white box *(Eucalyptus albens)* grassy woodland (0.5ha) in moderate condition, one patch of yellow box-Blakely's red gum grassy woodland (4.0ha) in poor condition within a larger area of derived grassland dominated introduced species in very poor condition.

11.3.1 Critically endangered or endangered species

An action has, or will have, or is likely to have a significant impact on critically endangered or endangered species if is a real chance or possibility that it will:

- ***lead to a long-term decrease in the size of a population;***

The proposal area is considered to support habitat for one critically endangered species, the regent honeyeater and one endangered species, the swift parrot.

The regent honeyeater and swift parrot are nomadic and/or migratory species. The primary threat to these species from the proposed development is the continued loss and degradation of food resources (*Eucalyptus* spp and mistletoe) that sustain these species in their large scale movements across the landscape. The regent honeyeater and swift parrot have both been identified within 10km of the subdivision area.

Consequently the loss of 65 mature/old growth eucalypt trees within the 236.6ha of derived grassland to be developed will potentially have some impact of these species. However, the isolated nature of these trees, the lack of any regeneration and their proximity to existing residential development where on-going disturbance from human activity (lights, noise, vibration and domestic predators) is common, severely limit

their habitat value for these wide ranging species. Additionally, better quality and preferred woodland habitat within Burke's Gully (4.0ha) and adjacent to the proposed access off Bylong Road (0.5ha) will be protected and enhanced as a public reserve. It is proposed to expand the woodland area within Burke's Gully through overstorey regeneration and/or replanting within derived grasslands areas along the gully, thereby maintaining habitat for these species on-site. Providing mitigation recommendations (outlined in section 12 of this report) are adopted, it is considered the proposed subdivision will have little impact on habitat for these terrestrial nomadic and migratory species and will not lead to a long-term decrease in the size of a population.

- ***reduce the area of occupancy of the species;***

The clearing of 236.6ha of derived grassland that supports approximately 65 mature/old growth trees will remove habitat for both the swift parrot and regent honeyeater. This habitat is however at best marginal for these species due the isolated nature of the trees and its location adjacent to existing residential development and its associated disturbances (human activity, noise, vibration, lights, vehicle movements and domestic predators). Additionally, it is proposed to retain all areas of existing woodland within Burke's Gully (4.0ha) and adjoining the access off Bylong Road (0.5ha), as well as 19.4ha of derived grassland along Burke's Gully as public reserve. This habitat area will be enhanced and expanded by encouraging overstorey regeneration, replanting and weed control (as outlined in section 12). These measures will ensure food resources for these species are retained on-site and improved in the long-term, such that there will be no significant reduction in the area occupied by the regent honeyeater and swift parrot.

- ***fragment an existing population into two or more populations;***

While the highly modified vegetation on the project area has connectivity with similarly disturbed vegetation to the south, to the west and along Burke's Gully to the north-west, it abuts existing residential development to north, east, south-east and south-west. Consequently, the area generally forms a habitat cul-de-sac within existing residential development. However, as migratory species both the regent honeyeater and swift are capable of crossing large tracts of non-habitat. It is therefore unlikely the proposed development will fragment an existing population.

This notwithstanding, the proposed retention and enhancement of vegetation within a public reserve along Burke's Gully will ensure the continued vegetative connectivity along the ephemeral drainage line. Similarly, the retention of existing derived grassland within the powerline easement along the northern boundary will maintain what connectivity exists for the small woodland patch adjoining the access corridor off Bylong Road. Consequently, areas of currently interconnected habitat will not be isolated or an existing species population fragmented into two or more populations.

- ***adversely affect habitat critical to the survival of a species;***

There is no evidence the 236.6ha of derived exotic grassland to be removed as part of this development proposal, or the approximately 65 isolated trees it supports, is critical to the survival of either the regent honeyeater or the swift parrot. Neither species are likely to use the area for reproduction, as the swift parrot breeds only in Tasmania while the regent honeyeater preferentially uses mistletoe in riparian areas for this purpose. At best this vegetation on the project area is marginal foraging habitat for these species. Further, it is proposed to retain 4.5ha of existing woodland and enhance 19.4ha of derived grassland along Burke's Gully by encouraging overstorey regeneration, replanting and weed control. These measures (as outlined in section 12) will ensure foraging habitat for these species is retained on site in the long-term. Consequently, it is considered any impacts resulting from habitat loss will be minor and not adversely affect habitat critical to the long-term survival of the regent honeyeater or swift parrot.

- ***disrupt the breeding cycle of a population;***

As discussed above, neither species are likely to use the habitat on the project area for breeding. Further it is considered the proposal will not lead to a long-term decline in a local population, fragment existing important habitat or adversely affect habitat critical to any species' survival. It is therefore considered, that providing mitigation measures (outlined in section 12) are implemented, the proposal will not disrupt the breeding cycle of any fauna which constitute a population of an endangered or critically endangered species.

- ***modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;***

The proposed subdivision will remove 236.6ha of derived grassland with/without isolated trees that at best is marginal foraging habitat for the species under consideration. Further, this vegetation lies within an agricultural landscape where this habitat type is relatively common. It is also proposed to retain 23.9ha, comprising two small areas of woodland (4.0ha and 0.5ha) and 19.4ha similar quality derived grassland, as public reserve. Vegetation on this retained area will be enhanced by encouraging overstorey regeneration, replanting and weed control as outlined in section 12. It is therefore considered, the area of highly modified habitat to be removed for houses and their associated infrastructure is unlikely to significantly impact on habitat availability or quality to such an extent as to cause any critically endangered or endangered species to decline.

- ***result in invasive species that are harmful to a critically endangered or endangered species becoming established in the critically endangered or endangered species' habitat;***

The proposed actions could potentially contribute to the spread of invasive exotic perennial grasses (eg Coolatai grass, African lovegrass and Rhodes grass) and other weed species through the movement of people, vehicles and/or machinery across the landscape. However, the project area and its surrounds are already heavily infested with these and other weed species. Consequently, the proposed subdivision will not result in the introduction of invasive species' to habitat areas that are harmful to any critically endangered or endangered species under consideration. Conversely, it is considered the weed control proposed as part of the management of the 23.9ha retained as public reserve (refer section 12) will potentially improve the habitat values for critically endangered and endangered species.

- ***introduce disease that may cause the species to decline; or***

As for invasive species, the potential for the introduction of disease results from the movement of people, vehicles and/or machinery across the landscape, inappropriate stockpiling and/or spreading of contaminated materials and poor machinery hygiene procedures. Similarly, it is considered that providing mitigation measures (outlined in section 12) are adhered to, the proposed subdivision will not introduce disease that may cause any endangered or critically endangered species to decline.

- ***interfere substantially with the recovery of the species.***

Ensuring the recovery of a species generally involves the protection and enhancement of existing habitat, by preventing clearing and modification of native vegetation communities. As discussed previously, it is considered unlikely the removal of 236.6ha of highly degraded derived grassland with/without isolated trees will lead to a decline in a local population, significantly reduce the area of occupancy or fragment existing habitat for either the regent honeyeater or the swift parrot. Conversely, the implementation of mitigation recommendations (as outlined in section 12) will retain and potentially enhance 23.9ha of existing vegetation on the project area thereby retaining habitat for these species on-site. Consequently, it is considered the proposed subdivision will not substantially interfere with the recovery of any critically endangered or endangered species.

11.3.2 Vulnerable species

The subdivision area is considered to support "important populations" for the 5 species listed in Table 4. These populations are important because the subdivision area either lies near the limit of their distribution, or they have a restricted and/or patchy distribution making individual populations important for maintenance of genetic diversity (DoE 2013).

Dichanthium setosum has a distribution that extends along the New England Tablelands, west to Bellata on the western plains and south to central western NSW (OEH website 2015). Often associated with heavy basaltic black soils and red-brown loams with clay subsoil this species can tolerate some level of disturbance (NPWS 2003a). The population that exists in and around the project area lies at the eastern edge of this species range and is therefore considered an 'important population'.

The distribution of Corben's long-eared bat lies west of the tablelands (Ayers et al 1996, NPWS 2003a). The population that exists in and around the project area lies at the eastern edge of this species range and is therefore considered an 'important population'.

The combined populations of the koala within Qld, NSW and ACT, ranges from northeast south to the NSW-Victoria border, although their distribution is not continuous within this range as some populations are isolated by cleared land and/or unsuitable habitat (NSW DECC 2008). In NSW, the population extends from the coast west into the western plains (DoE 2014). White box (*Eucalyptus albens*), yellow box (*E. melliodora)* and Blakely's red gum (*E. blakelyi)* are important koala food trees (Phillips 2000). It is unknown whether the population of koala that may occur on the project area is a key source population for breeding, or necessary for maintaining genetic diversity. However, under the 'precautionary principle', the population on the project area will be considered an 'important population'.

The grey-headed flying-fox is a highly mobile nomadic species with a distribution that generally extends 200km from the Australian east coast, but which in times of food shortage will often extend west onto the tablelands and western slopes (OEH website 2015). It is unknown whether the population of grey-headed flying-fox that may intermittently occur on the project area is a key source population for breeding, or necessary for maintaining genetic diversity. However, under the 'precautionary principle', the population on the project area will be considered an 'important population'.

The border thick-tailed gecko has a distribution which extends across the northern tablelands and northwest slopes of NSW (NPWS 2003a). The subdivision area lies at the eastern edge of this distribution. Further, the border thick tailed gecko has a patchy distribution and consequently, the population that may occur on the project area is potentially a key source population for breeding/dispersal or necessary for the maintenance of genetic diversity. The population that occurs on the project area will therefore be considered an 'important population'.

An action has, or will have, or is likely to have a significant impact on a vulnerable species if there is a real chance or possibility it will:

- ***lead to a long-term decrease in the size of an important population of a species;***

Habitat for the Corben's long-eared bat, koala, grey-headed flying-fox and border thick-tailed gecko is the small patches of woodland (0.5 and 4.0ha) on the project area. While habitat for *Dichanthium setosum* potentially occurs across the subdivision area.

The primary threat to the grey-headed flying-fox is the continued loss and/or degradation of food resources (*Eucalyptus* spp) that sustain this species when food resources are in short supply in coastal areas. For Corben's long-eared bat it is the loss of roosting/breeding hollows and foraging habitat and for the koala a loss of known feed trees. While for the border-thick-tailed gecko it is the loss of fallen timber and areas of rock outcropping and *Dichanthium setosum* the removal of the ground layer vegetation and soil disturbance for house construction, associated infrastructure and gardens.

The proposed subdivision involves the removal 236.6ha of degraded derived grassland vegetation with/without isolated trees (approximately 65 *Eucalyptus* spp in total) adjacent to existing residential development. For the fauna species, the very poor condition of the vegetation, the sparse tree cover and its landscape setting (ie adjacent to existing residential development and its associated disturbances and threats) make it at best marginal habitat for all these species. However, mitigation recommendations (outlined in section 12 of this report) will protect and potentially enhance 23.9ha of habitat within the proposed public reserve. Within this area overstorey regeneration will be encouraged, fallen timber will be protected, replanting of native overstorey and weed control will occur. A further 16.5ha of derived grassland will also be retained within the powerline easement along the northern boundary. These measures will retain habitat for these species on-site, making it unlikely the proposed subdivision will lead to a long-term decrease in the size of any important population vulnerable species.

- ***reduce the area of occupancy of an important population;***

The clearing of 236.6ha of degraded derived grassland with/without isolated trees will remove habitat for; Corben's long-eared bat, koala, grey-headed flying-fox border thick-tailed gecko and *Dichanthium setosum*. This habitat is at best marginal habitat for these species, given the ground layer is predominantly non-native, the extremely sparse tree cover and located as it is immediately adjacent to existing residential development and its associated disturbances (human activity, noise, vibration, lights, vehicle movements and domestic predators). Additionally, it is proposed to retain 23.9ha comprising existing woodland (4.5ha) and derived grassland (19.4ha) along Burke's Gully and adjoining the access corridor off Bylong Road as public reserve. The habitat values of this vegetation will be enhanced by encouraging overstorey regeneration, replanting and weed control (as outlined in section 12). A further 16.5ha of derived grassland will also be retained

within the powerline easement along the northern boundary. These measures will ensure habitat for these species is retained on-site and improved in the long-term, such that there will be no significant reduction in the area occupied by any important population of vulnerable species.

- ***fragment an existing important population into two or more populations;***

While the highly modified vegetation on the project area has connectivity with similarly disturbed vegetation to the south, across the Duri/Werris Creek Road to the west and along Burke's Gully to the north-west, it abuts existing residential development to north, east, south-east and south-west. Consequently, the area generally forms a habitat cul-de-sac within existing residential development. However, the proposed retention and enhancement of vegetation within a public reserve along Burke's Gully will ensure the continued connectivity along the ephemeral drainage line. Similarly, the retention of existing derived grassland within the powerline easement along the northern boundary will maintain what connectivity exists for the small woodland patch adjoining the access corridor off Bylong Road. Consequently, areas of currently interconnected habitat will not be isolated or an existing important population fragmented into two or more populations.

- ***adversely affect habitat critical to the survival of a species;***

There is no evidence the 236.6ha of derived exotic grassland with/without isolated paddock trees to be removed as part of this development proposal is critical to the survival of any vulnerable species under consideration. At best this vegetation on the project area is marginal habitat for these species. Further, it is proposed to retain 4.5ha of existing woodland and enhance 19.4ha of derived grassland along Burke's Gully by encouraging overstorey regeneration, replanting and weed control. These measures (as outlined in section 12) will ensure habitat for these species is retained on site in the medium to long-term. Consequently, it is considered any impacts resulting from habitat loss will be minor and not adversely affect habitat critical to the long-term survival of any important population of vulnerable species.

- ***disrupt the breeding cycle of an important population;***

As discussed previously, the proposal will not lead to a long-term decline in a local population, fragment existing important habitat or adversely affect habitat critical to any vulnerable species' survival. It is therefore considered, that providing mitigation measures (outlined in section 12) are implemented, the proposal will not disrupt the breeding cycle of Corben's long-eared bat, the koala, grey-headed flying-fox, border thick-tailed gecko or *Dichanthium setosum*.

- ***modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;***

The proposed subdivision will remove 236.6ha of derived grassland with/without isolated trees that at best is marginal habitat for the species under consideration, in an agricultural landscape where this habitat type is relatively common. It is also proposed to retain 23.9ha, comprising two small areas of woodland (4.0ha and 0.5ha) and 19.4ha similar quality derived grassland, as public reserve. Vegetation on this retained area will be enhanced by encouraging overstorey regeneration, replanting and weed control as outlined in section 12. It is therefore considered, the area of highly modified habitat to be removed for houses and their associated infrastructure is unlikely to significantly impact on habitat availability or quality to such an extent as to cause any important population of a vulnerable species to decline.

- ***result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;***

The proposed actions could potentially contribute to the spread of invasive exotic perennial grasses (eg Coolatai grass, African lovegrass and Rhodes grass) and other weed species through the movement of people, vehicles and/or machinery across the landscape. However, the project area and its surrounds are already heavily infested with these and other weed species. Consequently, the proposed subdivision will not result in the introduction of invasive species' to habitat areas that are harmful to any critically endangered or endangered species under consideration. Conversely, it is considered the weed control proposed as part of the management of the 23.9ha retained as public reserve (refer section 12) will potentially improve the habitat values for important populations of vulnerable species.

- ***introduce disease that may cause the species to decline, or***

As for invasive species, the potential for the introduction of disease results from the vegetation clearing, soil disturbance, movement of people, vehicles and/or machinery across the landscape, inappropriate stockpiling and/or spreading of contaminated materials and poor machinery hygiene procedures. Similarly it is considered, that precluding these activities from vegetation adjoining the project area will minimise the potential disease spread. Providing all mitigation measures (outlined in section 12) are implemented, the proposed subdivisions will not introduce disease that may cause any vulnerable species to decline.

- ***interfere substantially with the recovery of the species.***

Ensuring the recovery of a species generally involves the protection and enhancement of existing habitat, by preventing clearing and modification of native vegetation communities. As discussed previously, it is considered unlikely the removal of 236.6ha of degraded derived grassland with/without isolated trees will lead to a decline in a local population, significantly reduce the area of occupancy or fragment existing habitat for any vulnerable species. Consequently, it is considered the proposed subdivision will not substantially interfere with the recovery of any vulnerable species. Conversely, the implementation of mitigation recommendations (as outlined in section 12) will retain and potentially enhance 23.9ha of existing vegetation on the project area thereby retaining habitat for these species on-site.

11.3.3 Critically endangered and endangered ecological communities

One critically endangered ecological community (CEEC) has been identified within the project area; *White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland* (DEH 2006). This CEEC is represented by two small patches (refer Figure 4) comprising;

- white box grassy woodland (0.5ha) which occurs adjacent to the proposed subdivision access corridor off Bylong Road in the northeast corner of the project area, and
- Blakely's red gum yellow box grassy woodland (4.0ha) towards the northern end of Burke's Gully.

The derived grasslands which comprise the majority of the project area would once have comprised box-gum grassy woodlands as indicated by the isolated overstorey trees that remain. However, the dominance of exotic species in the ground layer means this vegetation does not meet the minimum condition criteria for this listed ecological community.

An action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will:

- ***reduce the extent of an ecological community;***

There is potential for the proposed subdivision to impact significantly on the extent of these small areas of CEEC through clearing and/or further degradation. It is however proposed to retain and enhance these patches of CEEC within a public reserve. The patch of Blakely's red gum yellow box woodland (4.0ha) will be retained together with 19.4ha of derived grassland along the length of Burke's Gully. Enhancement of this vegetation by encouraging overstorey regeneration, replanting and weed control will improve the condition and potentially increase the area of CEEC on the project area in the long-term. Consequently, providing the mitigation recommendations (as outlined in Section 12 of this report) are implemented there will be no reduction in the extent the CEEC on the project area.

- ***fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines;***

While the highly modified vegetation on the project area has connectivity with similarly disturbed vegetation to the south, across the Duri/Werris Creek Road to the west and along Burke's Gully to the north-west, it abuts existing residential development to north, east, south-east and south-west. Consequently, the area generally forms a habitat cul-de-sac within existing residential development. However, the proposed retention and enhancement of vegetation within a public reserve along Burke's Gully will ensure the continued connectivity of the CEEC along the ephemeral drainage line. Similarly, the retention of existing derived grassland within the powerline easement along the northern boundary will maintain what

connectivity exists for the small patch of CEEC adjoining the access corridor off Bylong Road. Hence, providing mitigation recommendations (outlined in Section 12) are implemented, the proposed subdivision will not fragment or increase fragmentation of this patch of critically endangered ecological community.

- ***adversely affect habitat critical to the survival of an ecological community;***

By restricting all development activities to previously cleared land (ie areas of derived exotic grassland) and protecting and enhancing the two small patches of CEEC through encouragement of natural regeneration, replanting and weed control, as per mitigation recommendations outlined in Section 12, habitat for this occurrence CEEC will be maintained. As a consequence, it is considered the proposed subdivision will not adversely affect habitat critical to the survival of this patch of ecological community.

- ***modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction in groundwater levels, or substantial alteration of surface water drainage patterns;***

There is potential for the proposed subdivision to modify abiotic factors (such as water, nutrients or soil) necessary for the survival of this CEEC community should development occur within remnant woodland on the project area. However, providing development is restricted to areas of derived exotic grassland (not the CEEC) and mitigation recommendations (as outlined in Section 12) are implemented, it is considered unlikely the development will modify or destroy abiotic factors necessary for the survival for this community. Further the removal of existing farm dams along Burke's Gully and their replacement with storm water retention structures that only hold water temporarily, should assist in returning a more natural surface water flow regime to the ephemeral drainage line and the patches of CEEC.

- ***cause a substantial change in species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora and fauna harvesting;***

There is potential for the proposed subdivision to impact significantly on the composition of this CEEC through clearing, increased weeds and changes to soil hydrology and nutrient status. However it is proposed to retain and protect the small patches of CEEC that currently exist on the project area as public reserve. This change in landuse which will remove livestock grazing, encourage natural regeneration, replanting and weed control will potentially improve the species composition of these patches. Therefore providing mitigation recommendations (as per Section 12) are implemented the species composition of this ecological community within the subdivision area will not be substantially changed or adversely modified.

- ***cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to;***
  - ***assisting invasive species, that are harmful to the listed ecological community , to become established; or***

    As discussed previously, the proposed actions could potentially contribute to the spread of invasive exotic perennial grasses (eg Coolatai grass and Rhodes grass) and other weed species through the movement of people, vehicles and/or machinery across the landscape. However, it is considered any risk posed by environmental/noxious weeds to this ecological community will be mitigated by the restricting development to areas of derived grassland not comprising part of the CEEC, and the implementation of mitigation recommendations as outlined in Section 12. Providing these measures are adhered to, the proposed subdivision will not assist the establishment of invasive species that are harmful to this critically endangered ecological community.

  - ***causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit growth of species in the ecological community; or***

    The proposed subdivision development will involve the use of fertilisers and herbicides (garden establishment and maintenance) and other chemicals associated with human habitation (eg pesticides). Chemical substances and potential pollutants associated with the works are those related to machinery operation (fuel and oil), pipe joining (adhesives) and construction materials (concrete). All transport, storage and handling of these materials and any waste will comply with requirements of *Protection of the Environment Operations Act 1997.*

- ***interfere with the recovery of an ecological community.***

Ensuring the recovery of an ecological community generally involves the protection and enhancement of existing occurrences of the community, by preventing further clearing and modification. As discussed previously, the retention and management of these small areas of CEEC as public reserve and the implementation of mitigation recommendations (outlined in Section 12) will maintain the existing occurrence of this community on the subdivision area. Additionally, the retention of the patch of Blakely's red gum yellow box woodland (4.0ha) and 19.4ha of derived grassland within Burke's Gully and enhancement of this vegetation by encouraging natural regeneration, replanting and weed control will potentially increase the area of CEEC on the project area in the medium to long-term. Consequently it is considered the proposed subdivision will not substantially interfere with the recovery of this critically endangered ecological community.

11.3.4 Migratory species

An action has is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:

- ***substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat of the migratory species;***

Vegetation on the project area provides habitat for 4 species of migratory bird listed under international agreements. These include; the fork-tailed swift, white-throated needletail, rainbow bee-eater and satin flycatcher. Additionally, the rainbow bee-eater has been recorded within 10km of the project area.

The proposal will remove approximately 236.6ha of derived grassland with/without isolated trees in very poor condition. As with other migratory species the primary threat to these species is the continued loss and/or degradation of food resources, and/or resting sites that sustain them in their large-scale movements across the landscape/globe. However, the isolated nature of these trees, the lack of any regeneration and their proximity to existing residential development where on-going disturbance from human activity (lights, noise, vibration and domestic predators) is common, severely limit their habitat value for these wide ranging species. There is no evidence this area of derived grassland is important habitat for any of the migratory species under consideration.

This notwithstanding, it is proposed to retain all areas of existing woodland (and better habitat for migratory species) within Burke's Gully (4.0ha) and adjoining the access corridor off Bylong Road (0.5ha), as well as 19.4ha of derived grassland as public reserve. This habitat area will be enhanced and expanded by encouraging overstorey regeneration, replanting and weed control (as outlined in section 12). A further 16.5ha of derived grassland will also be retained within the powerline easement along the northern boundary of the project area. Consequently, the proposed development will not substantially modify, destroy or isolate any area of habitat important for migratory species.

- ***result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat of the migratory species; or***

Vegetation on the project area and its surrounds is already dominated by introduced species, including the invasive Rhodes grass. Consequently, the proposed subdivision will not result in the introduction of invasive species to habitat areas that are harmful to any migratory species under consideration. Conversely, it is considered the weed control proposed as part of the management of the 23.9ha retained as public reserve (refer section 12) will potentially improve the habitat values for migratory species.

- ***seriously disrupt the life-cycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of the species.***

As discussed above, it is considered the proposal will not lead to a long-term decline in a local population, fragment existing important habitat or adversely affect habitat critical to any migratory species' survival. It is therefore considered, the proposal will not seriously disrupt the life-cycle of an ecologically significant proportion of the population of any migratory species under consideration. This notwithstanding, the implementation of mitigation recommendations (as outlined in section 12) will retain and enhance 23.9ha of vegetation within the subdivision area, potentially improving the habitat values for migratory species on-site.

11.4 Assessment of Significance Conclusions

The vegetation on the proposed Arcadia development area; Lots 1 and 2 in DP1213875, Lot 1 in DP233288, Lot 6 in DP121122 and part of Lot 1 in DP1198645 at Tamworth, NSW provides habitat for the following species and communities of national significance;

- 1 critically endangered fauna species
- 1 endangered fauna species
- 5 important populations of vulnerable species (1flora and 4 fauna)
- 1 critically endangered ecological community, and
- 4 migratory bird species.

The vegetation on the site comprises box-gum in varying structural types and condition including; white box grassy woodland (0.5ha) in moderate condition, Blakely's red gum yellow box grassy woodland (4.0ha) in poor condition and derived exotic grassland with/without isolated overstorey trees (272.5ha) in very poor condition. The small patches of woodland constitute the critically endangered ecological community; *White Box Yellow Box Blakely's Red Gum grassy woodland and derived native grasslands.* No threatened flora species were identified on the area.

It is considered the proposed subdivision may potentially lead to impacts on threatened species, endangered populations and/or ecological communities of national significance through;

- clearing of 236.6ha of derived exotic grassland with/without isolated trees for house and/or infrastructure construction and bushfire asset protection zones
- degradation of habitat by changes in soil hydrology / nutrient status or increased weeds, and
- loss of habitat elements such fallen timber, rock outcropping and hollow bearing trees (live and dead).

However, it is the conclusion of this assessment that no significant impact will occur for any species, population or ecological community of national environmental significance as a consequence of the proposed subdivision providing;

- mitigation recommendations outlined in section 12 of this report are implemented, and
- approximately 23.4ha of vegetation (woodland and derived grassland) along Burke's Gully and 0.5ha of woodland adjoining the access corridor off Bylong Road is retained as public reserve, and
- 16.5ha of derived grassland is retained within the powerline easement along the northern boundary.

Consequently, there is no requirement to refer this development to the Commonwealth, Department of Environment.

12 Threatened Species Mitigation Recommendations

To maintain and potentially enhance the environmental values of vegetation adjoining the project area, maintain flora and fauna habitat and one critically endangered/endangered ecological community on-site, as well as protect surface water quality and prevent the further spread of invasive species, the following mitigation is required:

1) All clearing and construction activities required for houses and their associated infrastructure must be located within the area marked for development shown in Figure 2.

2) Construction of the storm water retention structures within Burke's Gully must avoid wherever possible the removal of trees. Where trees must be removed for construction purposes replanting on a 3 for 1 basis with species identified in recommendation 4) below must occur elsewhere along Burke's Gully and within the boundaries of the proposed public reserve (refer Figure 5). Any planting for soil stabilisation must use endemic native grasses. Best practice erosion and sediment control must be implemented before, during and after construction of these structures to minimise the movement of sediment and/or chemicals in surface water.

3) Construction of the two access roads across Burke's Gully (refer Figure 2) must avoid the woodland area (refer Figure 4) and where practicable be associated with the storm water retention structures. Any clearing, soil stabilisation, erosion and sediment control must comply with recommendation 2) above.

4) Prior to the commencement of any construction works within Burke's gully consultation with Department of Primary Industry (Fisheries) must be undertaken and any approvals under the *Water Management Act 2000 (WMA)* must be obtained.

5) Activities which **must not** occur within remnant woodland and/or the public reserve areas on the project area (excluding those areas requiring disturbance for the construction of storm water retention structures and/or access roads) include;

   a) clearing native vegetation including native regrowth

   b) stockpiling of construction materials, spoil etc

   c) machinery/vehicle movement or parking

   d) excavation or spreading of soil/mulch

   e) 'tidying-up', under-shrubbing or disturbance of fallen timber

   f) planting non-native or non-endemic native; tree, shrub and ground layer species

   g) collection of standing or fallen dead timber for firewood

   h) grazing of domestic stock

   i) inappropriate fire regimes, and

   j) dumping of rubbish and/or garden waste.

6) Activities which **can** occur within the public reserve area and which will enhance its habitat value include;

   a) replanting of endemic native overstorey [white box (*Eucalyptus albens*), yellow box (*E. melliodora*), Blakely's red gum (*E. blakelyi*) only]

   b) replanting of endemic native shrubs [native olive (*Notelaea microcarpa*), hickory wattle (*Acacia implexa*), western golden wattle (*Acacia decora*) only]

   c) planting endemic native grasses and forbs

   d) supplementation of key habitat elements such as the addition of woody debris and/or nest boxes

   e) control of introduced species trees shrubs and ground layer species.

7) The public reserve area as identified in (Figures 2 and 5) must be protected as flora and fauna habitat by a covenant on title. This covenant must be registered on title within 12 months of construction work commencing and managed for conservation purposes.

8) For each tree removed from the derived exotic grassland, 3 endemic *Eucalyptus* spp [see species listed in recommendation 4) above] must be replanted within the public reserve area along Burke's Gully. Trees should be planted in clumps and tree guards used that to give some protection from water stress and pests. Trees should not be staked. Plantings must be monitored for 2 years post-planting and any losses in this time replaced.

9) Best practice erosion and sediment control must be implemented before, during and after house and infrastructure construction to minimise the movement of sediment and/or chemicals in surface water.

10) Prior to felling, all trees must be inspected for potential sheltering or nesting fauna species.

11) Live trees with a diameter at breast height greater than 30cm and all dead standing trees are potentially hollow-bearing and therefore must be cleared using the following prescriptions;

    a) where applicable all other vegetation must be cleared around these trees a minimum of two days before actual felling. The noise and vibration of the machinery and the time lag will encourage any fauna to move away prior to felling.

    b) when felling, the trunk should be hit several times (eg with the bucket of a front-end loader) to alert any sheltering fauna to potential danger and encourage them to move away.

    c) where possible these large, potentially hollow-bearing trees should be felled in stages, again to alert fauna to the danger and encourage their flight.

    d) once felled these trees must be inspected for hollows. Any hollows removed must be replaced with artificial nest-boxes of similar dimensions in trees within the public reserve area or where trees within this area are unsuitable at other appropriate sites within the locality on a one-for-one basis (ie one nest box for each hollow removed). Nest-boxes must be located in trees without hollows, with a diameter at breast height greater than 20cm, at a minimum height of 5m and using attachment methods that allow for tree growth in live trees.

12) Felled timber may be used to supplement the habitat values of the public reserve area. To avoid creating a feral pest harbour (for rabbits and foxes) this timber must not be stacked or windrowed but must be laid individually on the ground across the area.

13) Any native fauna species discovered inhabiting areas to be cleared and/or disturbed must be removed by persons licensed under the *NPW Act 1974*.

14) Contact WIRES or a local veterinarian should any orphaned, injured and/or sick fauna be discovered.

15) For each tree removed from the project site 3 endemic *Eucalyptus* spp [see species listed in recommendation 4) above] must be replanted within the public reserve area along Burke's Gully. Trees should be planted in clumps and tree guards used that to give some protection from water stress and pests. Trees should not be staked. Plantings must be monitored for 2 years post-planting and any losses in this time replaced.

16) Any soil from project site is to be treated as 'contaminated' by weed seed and stockpiled/re-spread only on areas with similar levels of infestation.

17) Any bare soil areas created by the works must be re-vegetated with native grasses.

18) Machinery used in the project must be thoroughly cleaned, in accordance with NSW Agriculture Regulations and best practice, to remove all soil and vegetative material before being brought on-site and then before being moved to a new location to prevent the spread of noxious pests, weeds and diseases.

19) A weed control and management plan should be developed for the public reserve area to improve the habitat value of this area. Removal of weeds (introduced species) must be carried out using appropriate control methods including:

    a) Removing weeds by hand ensuring that all plant parts which can reproduce are removed and soils do not become prone to erosion.

b) Use of carefully selected herbicide according to label directions and/or current off label permit, ensuring minimal off target damage.

c) Using appropriate control measures as recommended in the Department of Primary Industries *Noxious and Environmental Weed Control* 5th Edition 2011 or equivalent replacements for control of weeds, ensuring minimal off-target damage.

20) The transportation, storage, handling and waste disposal of all chemical substances and potential pollutants used on the project area; including those related to machinery operation (fuel and oil), construction materials (lime and concrete mix) and rehabilitation (fertilisers), must comply with the requirements of *Protection of the Environment Operations Act 1997*.

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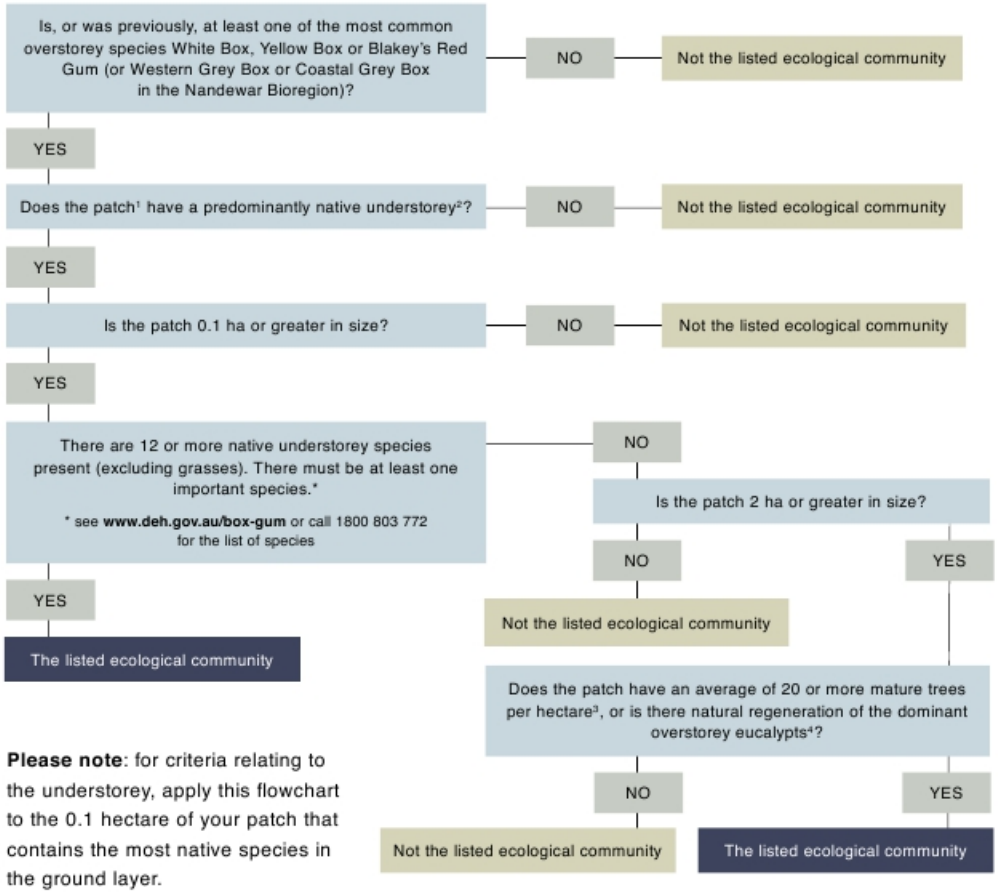
APPENDIX 1:

IDENTIFICATION FLOWCHART for THE CRITICALLY ENDANGERED *WHITE BOX YELLOW BOX BLAKELY'S RED GUM GRASSY WOODLAND and DERIVED NATIVE GRASSLAND* ECOLOGICAL COMMUNITY LISTED UNDER the EPBC Act (DEH 2006)

The flowchart below represents the lowest condition at which patches are included in the listed ecological community. This is not the ideal state of the ecological community. Large patches, those that link remnants in the landscape, those that occur in highly cleared areas, those that contain rare, declining or threatened species, and those that represent the entire range of the ecological community, are important for the long-term future of the ecological community.

Determining if your land has an area of the listed ecological community



Please note: for criteria relating to the understorey, apply this flowchart to the 0.1 hectare of your patch that contains the most native species in the ground layer.

[1] Patch – a patch is a continuous area containing the ecological community (areas of other ecological communities such as woodlands dominated by other species are not included in a patch). In determining patch size it is important to know what is, and is not, included within any individual patch. The patch is the larger of:
- an area that contains five or more trees in which no tree is greater than 75 m from another tree, or
- the area over which the understorey is predominantly native.

Patches must be assessed at a scale of 0.1 ha (1000m²) or greater.

[2] A predominantly native ground layer is one where at least 50 per cent of the perennial vegetation cover in the ground layer is made up of native species. The best time of the year to determine this is late autumn when the annual species have died back and have not yet started to regrow. (At other times of the year, you can determine whether something is perennial or not is if it is difficult to pull out of the soil. Annual species pull out very easily.)

[3] Mature trees are trees with a circumference of at least 125 cm at 130 cm above the ground.

[4] Natural regeneration of the dominant overstorey eucalypts when there are mature trees plus regenerating trees of at least 15 cm circumference at 130 cm above the ground.

5

APPENDIX 2

CONSULTANT'S QUALIFICATIONS AND EXPERIENCE

Wendy Hawes – Ecologist

Wendy has over 18 years experience in vegetation investigations and assessment of impacts on threatened species and ecological communities. She has a Bachelor of Science and Master of Science (prelim) majoring in Ecology and Zoology from the University of New England.

Scientific Licence: S11105

Her experience includes:

- Undertaking numerous assessments under the NSW *Environmental Planning and Assessment Act 1979* (including Part 3A and Section 5A assessments) and EPBC Act - *Administrative Guidelines* for urban and rural development.
- Writing guidelines for State Government departments on floristic survey, vegetation mapping, threatened species assessment.
- Sitting on Department of Environment expert panels to advise on definitions and condition criteria for threatened ecological communities under consideration by the commonwealth Scientific Committee including; Grassy White Box Woodlands, Coolabah/Black Box Woodlands, Bluegrass Grasslands and Myall Woodlands.
- Writing the draft national recovery plan for *White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland*.
- Preparing environmental harm reports and remediation plans for breaches of NSW native vegetation and Commonwealth environmental legislation.
- Sitting on NSW Department of Natural Resources and Department of Environment and Conservation, Border Rivers Community Conservation Advisory Committee. A member of expert panels benchmarking woodland communities for condition assessment that have been utilised for state incentive funding programmes and in the Property Vegetation Planning Developer, for assessments under the *Native Vegetation Act 2003*.
- Conducting training courses in both threatened species and general ecological assessment, for a range of clients, including government agencies, community groups and landholders
- Development of environmental education resources for government and NGOs.

APPENDIX 3:

FLORA SPECIES IDENTIFIED ON THE ARCADIA DEVELOPMENT PROJECT AREA, TAMWORTH NSW

(Lots 1 and 2 in DP1213875, Lot 1 in DP233288 , Lot 6 in DP121122 and part of Lot 1 in DP1198645)

October 2015

Current Survey: Q# = quadrat number; ✓ = opportunistic sighting outside quadrat; ***** - introduced species; **Modified Braun Blanquet cover abundance: 1**=<5% (rare number of individuals in quad); **2**= <5% (species common in quad); **3**= 5-25%; **4**= 25-50%; **5**=51-75%; **6**= 76-100%; **(x%) –** percentage cover of dominant ground layer species

Quadrat locations: Q1 = E 0300186/N 6554502; **Q2** = E 0299195/N 6554300; **Q3** = E 0298954/ N 6553481; **Q4** = E 0299169/N6554490; **Q5** = E 0299987/N6553965; **Q6** = E 0299658/N 6553252**; Q7** = E 0300214/N 6554533

Previous surveys: MH = Mitchell Hanlon 2013 survey; **EL** = Eco Logical 2015 data validation survey

[1] **Orange gum (*Eucalyptus prava*)** identified by Mitchell Hanlon (2014) on the project site this species was not identified by either subsequent survey. It is considered highly unlikely by the current author that this species, which naturally occurs on shallow, infertile granite soils, is present on the project area.

			Current survey+							Previous surveys	
Family	Scientific Name	Common Name	Q1	Q2	Q3	Q4	Q5	Q6	Q7	MH~	E
Acanthaceae	*Rostellularia adscendens*	Pink Tongues	2								
Adiantaceae	*Cheilanthes sieberi*	Rock Fern	1								X
Aizoaceae	*Galenia pubescens**	Galenia		1	2		1				
Anthericaceae	*Dichopogon fimbriatus*	Chocolate Lily	2								
	Dichopogon strictus	Chocolate Lily	2	1							
Apiaceae	*Ammi majus**	Bishop's Weed								X	
	*Cyclospermum leptophyllum**	Slender Celery		1			1				
	Daucus sp										X
	Hydrocotyle laxiflora	Stinking Pennywort		1							X
Asphodelaceae	*Bulbine bulbosa*	Native Leek	1								
Asteraceae	*Arctotheca calendula**	Capeweed									X
	Biden's pilosa	Cobbler's Pegs									X

			Current survey+							Previous surveys	
Family	Scientific Name	Common Name	Q1	Q2	Q3	Q4	Q5	Q6	Q7	MH~	E
	Brachyscome scapigera	Tufted Daisy								X	
	Calotis cuneata	Mountain Burr-daisy									X
	Calotis lappulacea	Yellow Burr-daisy	2	1	2		1		2		
	*Carthamus lanatus**	Saffron Thistle		1	1		2				
	*Centaurea solstitialis**	St Barnaby's Thistle							1	X	
	*Chondrilla juncea**	Skeleton Weed			1						
	Chrysocephalum apiculatum	Common Everlasting	2								X
	*Cirsium vulgare**	Black Thistle		1							
	*Conyza sumatrensis** (Syn *C. albida)*	Tall Fleabane								X	
	Conyza sp	Fleabane									X
	Cotula australis	Common Cotula			1						
	Euchiton sphaericus	Japanese Cudweed			1		1				
	*Hedypnois rhagadioloides**	Cretan Weed		2			1				
	*Hypochaeris microcephala**	White Flatweed		1							
	*Hypochaeris radicata**	Flatweed								X*	
	*Senecio madagascariensis**	Fireweed									X
	Senecio sp										X
	*Soliva sessils**	Bindyi									X
	*Sonchus oleraceus**	Common Sowthistle	1	1	1						
	*Onopordum acanthium**	Scotch Thistle		1							
	*Tragopogon porrifolius**	Salsify	1						1		
	*Taraxacum officinale**	Dandelion									X
	Vittadinia cuneata	Fuzzweed	1				2				
	Vittadinia sp	Fuzzweed		2	1				2		
Boraginaceae	*Echium plantagineum* *	Paterson's Curse	2	1	2			2	2		X
	*Heliotropium amplexicaule**	Blue Heliotrope	1						1		
Brassicaceae	*Brassica napus**	Canola								X	

			Current survey+							Previous surveys	
Family	Scientific Name	Common Name	Q1	Q2	Q3	Q4	Q5	Q6	Q7	MH~	E
	*Lepidium bonariense**	Cut-leaf Peppercress	1	1	1	3(10%)	1	3(15%)			
	Lepidium sp										X
	*Sisymbrium irio**	London Rocket				3(20%)					
	*Sisymbrium officinale**	Hedge Mustard		2							
Campanulaceae	*Wahlenbergia communis*	Tufted Bluebell									X
	Wahlenbergia luteola	Bluebell			2					X	
	Wahlenbergia sp	Bluebell	1	1			1		1		
Caryophyllaceae	*Petrorhagia dubia**	Hairy Pink		2							
Chenopodiaceae	*Einadia nutans*	Climbing Saltbush				3(10%)		2			X
Clusiaceae	*Hypericum perforatum**	St John's Wort									X
Colchicaceae	*Wurmbea dioica*	Early Nancy	1	1							
Convolvulaceae	*Convolvulus graminetinus*	Bindweed		1		1					
	Dichondra repens	Kidneyweed									X
	Dichondra sp A	Kidneyweed	2	2							
Cyperaceae	*Carex inversa*	Knob Sedge	2	1							
Euphorbiaceae	*Chamaesyce drummondii*	Caustic Weed							1		
Fabaceae	*Glycine clandestina*	Twining Glycine		1	1						
	Glycine tabacina	Variable Glycine	1								
	*Medicago polymorpha**	Burr Medic	1	3(10%)			3(20%)	2			
	*Medicago sativa**	Lucerne			1					X	X
	*Trifolium angustifolium**	Narrow-leaved Clover		2			2				
	*Trifolium arvense**	Hare's-foot Clover	3(20%)	3	3(10%)		2		2		
	*Trifolium campestre**	Hop Clover	1	3			2		2		
	*Trifolium glomeratum**	Clustered Clover			2		2	2			
	*Trifolium repens**	White Clover									X
	Trifolium sp										X
Geraniaceae	*Erodium crinitum*	Blue Storksbill									X

			Current survey+							Previous surveys	
Family	Scientific Name	Common Name	Q1	Q2	Q3	Q4	Q5	Q6	Q7	MH~	E
	Geranium solanderi	Australian Cranesbill	1	1						X	X
Goodeniaceae	*Goodenia hederacea*	Forest Goodenia		1							
	Goodenia pinnatifida	Scrambled Eggs	1	1							
Juncaceae	*Juncus* sp	Pin Rush									
Lamiaceae	*Marrubium vulgare**	White Horehound									X
	*Salvia reflexa**	Mintweed		2							
Linaceae	*Linum marginale*	Native Flax	1								
Lomandraceae	*Lomandra multiflora*	Many-flowered Mattrush	2	1	1						X
Malvaceae	*Malva parviflora**	Small-flowered Mallow					1		1		
	Sida corrugata	Corrugated Sida	1	1				1			
	*Sida rhombifolia **	Paddy's Lucerne		1							
	Sida spinosa	Sida			1		1		1		
Myrtaceae	*Angophora floribunda*	Rough-barked Apple		✓							
	Eucalyptus albens	White Box	3				1			X	X
	Eucalyptus blakelyi	Blakely's Red Gum	✓	3							X
	Eucalyptus melliodora	Yellow Box	1	✓		4	1			X	X
	Eucalyptus moluccana	Coastal Grey Box				3					
	Eucalyptus prava[1]	Orange Gum								X	
	Eucalyptus sideroxylon	Mugga Ironbark								X	
Myrsinaceae	*Anagallis arvensis**	Pimpernel									X
Nyctaginaceae	*Boerhavia dominii*	Tarvine			1	2		1			
Oxalidaceae	*Oxalis perennans*	Soursob									X
Papaveraceae	*Argemone ochroleuca* ssp *ochroleuca**	Mexican Poppy		✓							
Plantaginaceae	*Plantago debilis*	Plantain		1			1				X
	*Plantago lanceolata**	Ribwort	1	3	1			2	2		X
Poaceae	*Aristida ramosa*	Purple Wiregrass	2	1			1				X
	Arundinella nepalensis	Reed Grass									X

			Current survey+							Previous surveys	
Family	Scientific Name	Common Name	Q1	Q2	Q3	Q4	Q5	Q6	Q7	MH~	E
	Austrostipa nitida									X	
	Austrostipa scabra	Rough Speargrass	3(20%)	3	3(10%)				3(20%)		X
	Austrostipa verticillata	Slender Bamboo Grass		1		2	1	1			
	*Avena fatua**	Wild Oats	1				2		1		
	Bothriochloa decipiens	Pitted Bluegrass	3(10%)								X
	Bothriochloa macra	Redleg Grass								X	
	Bothriochloa sp	Redgrass		2	3(20%)		3(15%)		1		
	*Bromus catharticus** (syn *Bromus unioloides**)	Prairie Grass		1		2				X	
	*Bromus diandrus**	Great Brome	2	2					1		
	*Bromus hordeaceus**	Soft Brome	2	3(15%)	3(15%)	2	3(10)	2	3		
	*Bromus tectorum**	Drooping Brome			1						
	*Chloris gayana**	Rhodes Grass							1		
	Chloris truncata	Windmill Grass			1		2		2	X	X
	Chloris ventricosa	Tall Windmill Grass	2							X	
	Cynodon dactylon	Couch Grass				4(30%)		2		X	X
	Dichanthium sericeum	Queensland Bluegrass			1				1		
	Digitaria hystrichoides	Umbrella Grass								X	
	Echinopogon caespitosus	Bushy Hedgehog Grass									X
	Elymus scaber	Common Wheatgrass	1								
	Enneapogon nigricans	Niggerheads	2							X	
	Enteropogon acicularis	Curly Windmill Grass	1								
	Eragrostis leptostachya	Paddock Lovegrass								X	
	*Festuca pratensis**	Meadow Fescue								X	
	*Hordeum leporinum**	Barley Grass			3(10%)		1	3(20%)		X	
	Lolium sp*	Ryegrass	2	3(20%)	3(20%)	3	4(30%)	3(20%)	3(20%)		X
	Panicum effusum	Hairy Panic									X
	Panicum sp	Panic Grass	1							X	

			Current survey+							Previous surveys	
Family	Scientific Name	Common Name	Q1	Q2	Q3	Q4	Q5	Q6	Q7	MH~	E
	Paspalidium sp										X
	Poa sieberiana	Snow Grass	2							X	
	Rytidosperma laeve (syn *Austrodanthonia laevis)*	Wallaby Grass								X	
	Rytidosperma racemosum	Wallaby Grass	1						2		
	Rytidosperma richardsonii	Wallaby Grass	1		2	2	2	1			
	Rytidosperma setaceum	Small-flowered Wallaby Grass	2	2							
	Setaria pumila *	Pale Pigeon Grass		1					2		X
	Sporobolus creber	Rat's Tail Grass		1					1		
	Themeda australis	Kangaroo Grass								X	
	Tragus australianus	Small Burr Grass	1								
	*Vulpia muralis**	Rat-tail Fescue	1	3(10%)					3(15%)		
Polygonaceae	*Acetosella vulgaris**	Sheep Sorrel								X	
	*Polygonum aviculare**	Wireweed						1			
	Rumex brownii	Slender Dock	1		1				1		X
	Rumex sp										X
Rosacea	*Acaena agnipila*									X	
Rubiaceae	*Asperula conferta*	Common Woodruff	2						1		
	Galium gaudichaudii	Rough Bedstraw	1								
Solanaceae	*Lycium ferocissimum* *	African Boxthorn	✓	✓		1	✓				X
	*Solanum nigrum**	Blackberry Nightshade									X
Verbenaceae	*Glandularia aristigera**	Mayne's Pest							3(15%)		
	*Verbena bonariensis**	Purple Top								X	

APPENDIX 4:

PHOTOGRAPHS of the PROJECT AREA and QUADRAT SAMPLING SITES

PLATE 1: Quadrat 1 looking SW adjoining access corridor off Bylong Rd. (easting 0300186/northing 6554502: datum WGS84).

White box (*Eucalyptus albens*) grassy woodland with ground layer dominated by native grasses and forbs. This vegetation comprises the critically endangered box-gum woodland under NSW and Commonwealth legislation

PLATE 2: Looking SSW along Quadrat 7 (easting 300186 / northing 6554502: datum WGS84). Derived exotic grassland dominated by Mayne's pest (*Glandularia aristigera*) rat's tail grass (*Vulpia muralis*) and ryegrass (*Lolium* sp)

PLATE 3: Quadrat 2 looking NW within Burke's Gully (easting 0299195 / northing 6554300: datum WGS84).

Blakey's red gum (*Eucalyptus blakelyi)* yellow box (*E. melliodora*) grassy woodland ground layer dominated by exotic grasses and forbs but supporting 12 native species (excluding grasses). This vegetation comprises the critically endangered box-gum woodland under NSW and Commonwealth legislation

PLATE 4: Looking SW along Quadrat 4 (easting 299169 / northing 6554490: datum WGS84). Blakey's red gum (*Eucalyptus blakelyi)* yellow box (*E. melliodora*) grassy woodland ground layer 50/50 native versus exotic species but with 120 trees/ha. This vegetation comprises the critically endangered box-gum woodland under NSW and Commonwealth legislation

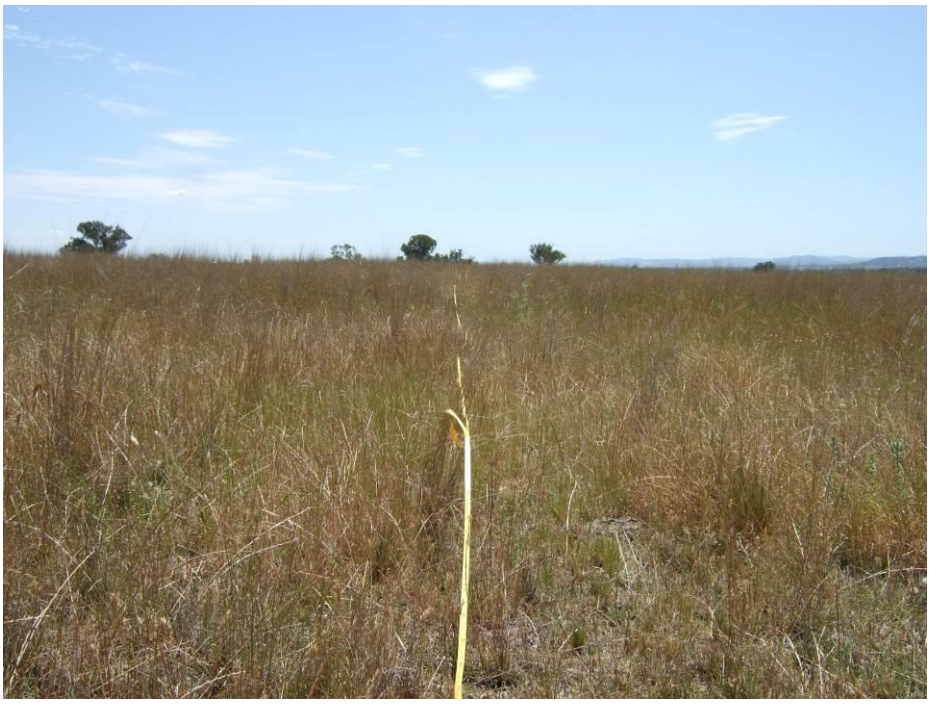


PLATE 5: Quadrat 3 looking NW (easting 0298954 / northing 6553481: datum WGS84).

Derived exotic grassland dominated by ryegrass (*Lolium* sp) soft brome (*Bromus hordeaceus*) and hare's-foot clover (*Trifolium arvense*).

PLATE 6: Looking NW along Quadrat 6 within Burke's Gully (easting 299658 / northing 6553252: datum WGS84). Derived exotic grassland with isolated yellow box (*E. melliodora*). The ground layer dominated by ryegrass (*Lolium* sp), barley grass (*Hordeum leporinum)* cut-leaf peppercress (*Lepidium bonariense)*

PLATE 7: P1 - within Burke's Gully looking SW below dam wall. Blakey's red gum (*Eucalyptus blakelyi)* yellow box (*E. melliodora*) grassy woodland

PLATE 8: P2 – looking NW across dam within Burke's Gully evident is a small fenced planted trees lot.

PLATE 9: P3 – looking NE across project area from Quadrat 3 showing derived exotic grassland with isolated paddock trees

PLATE 10: P4 – looking SW across project area eastern boundary showing derived exotic grassland with isolated paddock trees