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ENVIRONMENTAL CONSULTANTS



FLORA AND FAUNA ASSESSMENT

LOT 211 DP 1044292
PACIFIC HIGHWAY, MOONEE

JULY 2007

A REPORT TO IAN MAHER TOWN PLANNING
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1 INTRODUCTION

1.1 Background

James Warren and Associates have been engaged by Ian Maher Town Planning to complete a Flora and Fauna Assessment for Lot 211 DP 1044292 Pacific Highway, Moonee.

The assessment has involved the following:

- Mapping and ground truthing vegetation units and determining their conservation status with reference to the Comprehensive Regional Assessment completed for NSW Forest and Non-forest ecosystems as part of the Regional Forestry Agreement (RFA) process (CRA Unit 1999), and with reference to the Coffs Harbour Vegetation Management Strategy (2002);
- Searching for and recording Threatened (*TSC Act 1995*), ROTAP (Briggs & Leigh 1996) and regionally significant plant species (Sheringham & Westaway 1995), and assessing the occurrence of Endangered Ecological Communities (EECs);
- Determining the suite of Threatened fauna (*TSC Act 1995*) that occurs in the locality and assessing their potential occurrence in the Study area;
- Assessing habitat provided by the site in relation to adjacent habitat and making an assessment of the corridor value of the site; and
- Addressing statutory requirements including State Environmental Planning Policy No. 44 (SEPP 44 - Koala Habitat Protection), Section 5A of the Environmental Planning & Assessment Act (1979) (EPA Act) and the Commonwealth Environment Protection and Biodiversity Act 1999 (EPBC Act).

1.2 Locality

1.2.1 Introduction

The Locality is defined as the area within a 10km radius of the Subject site. The Locality therefore extends from Coffs Harbour in the south to Woolgoolga in the north and from Mt Coramba in the west to the coastline in the east (**FIGURE 1**). Prominent features in the locality include the towns of Coffs Harbour, Woolgoolga, and Moonee Beach, the coastline, Moonee Creek and its tributaries and Moonee Beach Nature Reserve.

Dominant habitat types are eucalypt forest, swamp sclerophyll forest and intertidal communities. Land uses within the locality include forestry, tourism, grazing, residential and agriculture.

There are three (3) dedicated conservation reserves in the locality:

- Moonee Beach Nature Reserve, an area of 336 hectares to the north-east of the Subject site.
- Ulidarra National Park, an area of 680 hectares to the west of the Subject site.
- Bruxner Park Flora Reserve



An unnumbered SEPP 14 wetland occurs to the south of the Moonee Creek estuary, about 1km south-east of the Subject site, while SEPP 14 No. 318 occurs about 7 km to the north. These wetlands are protected by State Environmental Planning Policy No. 14 - Coastal Wetlands (SEPP 14), and are shown in **FIGURE 2**.

A number of small areas of SEPP 26 Littoral Rainforest occur to the south of the site between Digger's Head and White Bluff, and are shown in **FIGURE 3**.

1.2.2 The Subject site

The Subject site consists of Lot 211 Pacific Highway Moonee and covers an area of approximately 5.749 hectares. A road reserve runs north-south through the western half of the site. The Subject site is shown in **FIGURE 4**.

Much of the site has been cleared and is maintained by periodic slashing. Patches of trees occur amongst this cleared community. The south of the site is zoned 7A (Environmental Protection) and consists of Wet sclerophyll forest with rainforest elements flanking a small creek.

1.2.3 The Study area

The Study area is defined as the Subject site together with any proximate areas that may be affected by the proposed development. The Study area for this assessment includes land to the north of the Petting Park Boarding Kennel which comprises part of the site, land to the immediate south abutting the 7A zoned section of the site and land to the east which is part of 7A zoned land.

1.3 Landuse Zones

The Subject site is zoned 2A Residential Low Density in the northern half of the site, and 7A Environmental Protection in the south (Coffs Harbour LEP 2000). The northern section of the site which comprises the Petting Park Boarding Kennel is zoned 3G (Business Mixed Use), as is land to the north of the site. The land use zones are shown in **FIGURE 5**.

1.4 Soils and Geology

Soils on the Subject site are part of the Newports Creek type, characterised by low, level to gently undulating coastal back barrier floodplains on Pleistocene estuarine sediments. Soils are deep, poorly drained Yellow Podzolics and Humic Gleys (DLWC 1999).

1.5 The Proposed Development

The Proposed development consists of a community title subdivision with associated dwellings to be concentrated in the northern half of the Subject site. Road access will be provided from Woodhouse Road. The concept plan for the proposed development is shown in **FIGURE 6**.



The entire southern half of the site is contained within Lot 22, and consists of the 7A Environmental Protection land which may be later acquired by Coffs Harbour City Council. Lot 23 (in the western half of the site) is to be developed as a collector road.

1.6 Literature Review

A number of Flora and Fauna Reports and other sources of information were reviewed in the course of this assessment. These include:

- DLWC (1999) Soil landscape series sheet 9537 Coffs Harbour.
- NPWS Atlas of NSW Wildlife records. Moonee Beach Nature Reserve.
- NPWS Atlas of NSW Wildlife records. Coffs Harbour Local Government Area.
- NPWS (1995) Vertebrates of Upper North East New South Wales. A Report to the National Resources Audit Council.
- Clancy, G.P. & V.A. (1998) Flora and Fauna Assessment Moonee Release Area. A report prepared for Coffs Harbour City Council.
- JWA (2003) Preliminary study. Lots 1 & 2 DP 725785, Pacific Highway, Moonee.
- JWA (2004) Flora and Fauna Assessment. Lots 6 & 7 DP 252223, Pacific Highway, Moonee.
- JWA (2004) Flora and Fauna Assessment. Lot 122 DP 1052566 Moonee Beach Road, Moonee.



2 FLORA ASSESSMENT

2.1 Introduction

This section discusses the methods used in the vegetation assessment and presents the results of the assessment.

2.2 Methods

2.2.1 NPWS Database search

A search of the NPWS database was completed to find records of Threatened species within 10km of the Subject site.

2.2.2 Site survey

A site survey was completed at the Subject site on the June 3rd 2004 and 20th of February 2007. The site was comprehensively surveyed and a general plant species list was compiled.

2.3 Results

2.3.1 NPWS Database search

A search of the NPWS Database revealed seven (7) Threatened Flora species within 10km of the Subject site. These species are shown in **TABLE 1**.

TABLE 1
NPWS DATABASE RECORDS OF THREATENED FLORA SPECIES
WITHIN 10 KM OF THE SUBJECT SITE

Common name	Botanical name
Southern swamp orchid	<i>Phaius australis</i>
Ravine orchid	<i>Sarcophilus fitzgeraldii</i>
	<i>Marsdenia longiloba</i>
Headland zieria	<i>Zieria prostrata</i>
Australian toadflax	<i>Thesium australe</i>
Rusty plum	<i>Niemeyera whitei</i>
Moonee Quassia	<i>Quassia</i> sp. 'Moonee Creek'

2.3.2 Site survey

Five (5) vegetation communities were identified in the Subject site. These communities are described in Section 2.3.3 and are shown in **FIGURE 7**.

One hundred and fifty-four (154) species were recorded at the Subject site.

Two (2) Threatened species were recorded from the Subject site:



- Moonee quassia (*Quassia* sp. 'Moonee Creek') is classified as Endangered under the *Threatened Species Conservation Act* (TSC Act 1995) and the *Environment Protection and Biodiversity Conservation Act* (EPBC Act 1999).
- Rusty Plum (*Niemeyera whitei*) is classified as Vulnerable under the *Threatened Species Conservation Act* (TSC Act 1995).

A full list of species recorded at the site is included as **APPENDIX 1**.

2.3.3 Community descriptions

2.3.3.1 Introduction

Five (5) vegetation communities were recorded. The vegetation communities are shown in **TABLE 2**. The conservation status of these communities is discussed with reference to the Comprehensive Regional Assessment completed for NSW Forest and Non-forest ecosystems as part of the Regional Forestry Agreement (RFA) process (CRA Unit 1999). The RFA establishes the framework for the management of the forests of upper north-east and lower north-east regions. The RFA document sets out percentage reservation status of forest and non-forest Ecosystems in the CAR Reserve System based on vegetation modelling to establish the pre-1750 extent of forest ecosystems in the region.

Where the RFA documents do not provide adequate information, a supplementary assessment is made using standard conservation assessments such as:

- Fisher, Body & Gill (1996) & Ecograph (2002)
- Benson (1989), Griffiths (1993), Hager & Benson (1994) and NPWS (1995).

TABLE 2
VEGETATION COMMUNITIES PRESENT ON THE SUBJECT SITE

1	Tall mid-dense forest (<i>Lophostemon confertus</i> , <i>Eucalyptus siderophloia</i>)
2	Tall sparse forest (<i>Lophostemon confertus</i> , Mixed Rainforest sp.)
3	Low dense shrubland (<i>Lantana camara</i> , <i>Senna pendula</i>)
4	Low grassland (<i>Paspalum dilatatum</i> , <i>Imperata cylindrica</i>)
5	Mixed plantings (<i>Casuarina glauca</i> , <i>Lophostemon confertus</i> etc)

2.3.3.2 Community 1 - Tall mid-dense forest (*Lophostemon confertus*, *Eucalyptus siderophloia*)

Location and area

This is a small area, approximately 0.44 hectares which occurs adjacent to the house blocks on the western side of the site.

Description

This community consists of the occasional Brushbox and Northern grey ironbark amongst a patchy midstorey of rainforest species such as Cheese tree, Common lilly pilly, White bolly gum and Sandpaper fig. There is a thick canopy of climbers such as Water vine and Prickly supplejack as well as Lantana throughout the canopy. Thickets of Lantana occur throughout the community, particularly towards the eastern half, where Cockspur is also very dense and the midstorey is less developed.



Other rainforest species in this community includes Laceflower tree, Murrogan and Banana bush. The ground layer is relatively sparse and consists of scattered Hairy psychotria, Scentless rosewood, Morinda, Rasp fern and Rough maidenhair.

Fifteen (15) stems of the Endangered *Quassia* sp. 'Moonee Creek' (TSC Act 1995) occur in this community towards the western boundary. These are all relatively juvenile, with no plants exceeding one metre in height.

Five (5) stems of the Vulnerable (TSC Act 1995) Rusty plum (*Niemeyera whitei*) also occur within Community 1.

Conservation status

Under the CRA classification, this community is best described by Forest Ecosystem 106 (Open Coastal Brushbox). The Regional Forestry Agreement document provides the following data on this ecosystem:

- Pre 1750 there was 9549 hectares of this ecosystem type in the upper north east section of the NSW North Coast Bioregion. 6533 hectares (68.4%) remains.
- The ecosystem is not considered rare, endangered or vulnerable.
- 21.7% of the total (pre-1750) forest ecosystem area is within the Comprehensive, Adequate & Representative (CAR) reserve system, consisting of 11.1% in dedicated reserves and 2.2% in informal reserves. A further 8.5% is protected by tabulated prescriptions.

This community is not adequately representative of FE 106 due to several factors: It is relatively small in size and has a poorly developed canopy, and the midstorey is disturbed by Lantana. However, the occurrence of *Quassia* sp. 'Moonee Creek' and the Rusty plums raises the conservation significance of this community.

The closest description of this community under the Fisher, Body & Gill (1996) classification system is Map Unit LR18 - Headland Brushbox, which is considered to be Regionally significant.

The Coffs Harbour Vegetation Management Strategy (CHVMS) (Ecograph 2002) notes that there is 27 hectares of this community within the Coffs Harbour area which amounts to 0.05% of the total area. Hager and Benson (1994) note that this community is inadequately conserved in the central zone.

2.3.3.3 Community 2 - Tall sparse forest (*Lophostemon confertus*, Mixed rainforest species)

Location and area

This community occurs in the southern half of the site in the designated 7A (Environmental Protection) zone. Community 2 covers an area of approximately 1.3 hectares.

Description

A small creek runs through this community from the east to the west of the site and forms the basis for much of the rainforest species present within the community. Tree species along the creek include Brush box (dominant), Pepperberry, Sandpaper fig, Smooth mock olive, Cudgerie, Cheese tree, Guoia, Bangalow palms and Common Lilly pilli. Other species recorded include: Flintwood, Red pear fruit, Red cedar, Sweet



pittosporum, Wilkeia, Celerywood, Strangler fig and Pencil cedar. A thick canopy of vines occurs throughout these trees, including Water vines, Whip vine, Lawyer vine, Prickly supplejack and Burny vine. These obscure the canopy completely in many trees and appear to have resulted in the death of several. There are particularly dense thickets of vines in the eastern section of the community. Streamside vegetation is generally a mixture of Mat-rush and Saw sedge.

There is small group of emergent Blue gum towards the western edge of the community, along with some large Cudgerie, to 20 metres in height. The occasional Blue gum also occurs throughout the community. From a distance 10 metres south of the creek, rainforest species decline and the vegetation grades into a mixture of degraded Lantana and Winter senna, with the occasional emergent Brushbox. There is evidence of prior logging within this area.

Conservation status

Under the CRA classification, this community is best described by Forest Ecosystem 103 (Northern Wet Brushbox). The Regional Forestry Agreement document provides the following data on this ecosystem:

- Pre 1750 there was 25433 hectares of this ecosystem type in the upper north east section of the NSW North Coast Bioregion. 16379 hectares (64.4%) remains.
- The ecosystem is not considered rare, endangered or vulnerable.
- 23.3% of the total (pre-1750) forest ecosystem area is within the Comprehensive, Adequate & Representative (CAR) reserve system, consisting of 18% in dedicated reserves and 1.8% in informal reserves. A further 3.6% is protected by tabulated prescriptions.

The closest description of this community under the Fisher, Body & Gill (1996) classification system is Map Unit RV1 - Coastal Riparian Vegetation, which is considered to be Locally significant and Ecologically significant.

The Coffs Harbour Vegetation Management Strategy (CHVMS) (Ecograph 2002) notes that there is 124 hectares of this community within the Coffs Harbour area which amounts to 0.23 % of the total area.

Two stems of the vulnerable Rusty plum (*Niemeyera whitei*) occur adjacent to the creek line, the two (2) Rusty plums are considered to have a high conservation value.

This community is well developed and has a large variety of species present, although it is limited in area, and primarily flanks the creek before becoming degraded. Conservation value is considered to be moderate to high.

2.3.3.4 Community 3 - Low dense shrubland (*Lantana camara*, *Senna pendula*)

Location and area

This community occurs in the southern section of the site and flanks the wet Brushbox/rainforest community. Community 3 covers an area of approximately 0.9 hectares.

Description

This community is extremely degraded and primarily consists of Lantana and Winter senna, with some Sydney golden wattle, Cheese tree, Sandpaper fig occurring, along



with the occasional emergent Brush box. Sections of this community towards the east of the site consist of pure Winter senna stands which are very dense. Some slashing has occurred within this community, and these areas are dominated by Blady grass with some Acacia. Towards the western boundary there are several clusters of Red ash and Mock olive amongst the Lantana.

Conservation status

The closest description of this community under the Fisher, Body & Gill (1996) classification system is Map Unit R - Regrowth, which not is considered to be Locally significant and Ecologically significant.

There is no appropriate CRA classification for this community. Due to the high level of weed invasion, conservation status is considered to be low.

2.3.3.5 Community 4 - Low grassland (*Paspalum dilatatum*, *Imperata cylindrica*)

Location and area

This community occurs over much of the Northern part of the site and is linked by a slashed vehicle access road to a small area on the western side of the site. This community covers an area of approximately 2.3 hectares.

Description

This community consists primarily of slashed grassland (Broad-leaved paspalum) along with annual weed species such as Billygoat weed and Farmers friends. Some areas of Blady grass also occur. There are several piles of fallen trees covered in Lantana, along with Winter senna and Wild tobacco. Scattered trees occur throughout, mostly Brushbox, Northern grey ironbark Blackwood wattle and Swamp oak. These occur in small patches and are surrounded by a weedy understorey and often dense thickets of Water vine.

Two main areas of dumped fill occur to the north and east of the site. There is a slashed access road which follows the 7A boundary from the east to the west of the site and links a small area of grassland on the western boundary of the site.

One (1) mature stem of Rusty plum (*Niemeyer whitei*) approximately five (5) metres high occurs within Community 4. The Rusty plum is listed as vulnerable under the *Threatened Species Conservation Act 1995* and is considered to have a high conservation value.

Conservation status

There is no appropriate CRA classification for this community. This community type is not described under the Fisher, Body & Gill (1996) classification system. This community is not considered to be locally significant and ecologically significant.

Due to the high level of disturbance and weed invasion, conservation status is considered to be low although individual trees (i.e. Rusty plums) have a high conservation value.

2.3.3.6 Community 5 - Mixed plantings (*Casuarina glauca*, *Lophostemon confertus* etc)

Location and area

This community occurs on the Northern part of the site which is occupied by the Petting Park Boarding Kennel. This community covers an area of approximately 0.8 hectares.

Description



This community consists primarily of the grounds surrounding the boarding Kennel, which comprises of a variety of landscape trees amongst a mown grassland. Species include: Swamp oak, Bottlebrush, Camphor laurel, Red bloodwood, Sweet pittosporum, Northern grey ironbark, Guioa, Wattle species and Coast Banksia. It is apparent that some of these trees are planted (Bottlebrush), while others may have already been present on the site (such as Brushbox, Ironbark), and others have regenerated naturally (Guioa, Sweet pittosporum). The southern fenceline of the kennels which adjoins the main site supports a number of exotic species such as Bananas, Umbrella tree, and Cadaghi, along with weed species such as Crofton weed, and Billygoat weed. A hedge of bamboo occurs along the western boundary of the property.

Conservation status

There is no appropriate CRA classification for this community. This community type is not described under the Fisher, Body & Gill (1996) classification system. This community is not considered to be locally significant and ecologically significant.

Due to the mixed species present, and the presence of exotic and weed species in a maintained environment, conservation status is considered to be low.

2.4 Coffs Harbour City Council Draft Vegetation Management Plan

Coffs Harbour City Council has produced a Draft Vegetation Management Plan for the Coffs Harbour Local Government Area (LGA). This plan identifies areas of vegetation of ecological value in the LGA. The ecological status of vegetation on the site as mapped by CHCC is shown in **FIGURE 8**. The Subject site contains vegetation communities of 'medium', 'high' and 'very high' ecological significance. Most significant vegetation ('high' and 'very high') on the site occurs in the southern half zoned 7A Environmental protection. Community 1 is mapped as being of high ecological significance, while some parts of the site in the north-west and south-east are mapped as being of very high ecological significance. Some of these high significance areas do not concur with ground truthed vegetation communities mapped by the JWA survey.



3 FAUNA ASSESSMENT

3.1 Introduction

This section includes a description of the methods used in determining which fauna species use the Study area and a discussion of the results of the Fauna assessment. The fauna assessment involved an opportunistic fauna survey undertaken while flora surveys were being carried out.

3.2 Methods

3.2.1 NPWS Database search

A search of the NPWS database was conducted to find records of Threatened fauna species within 10km of the Subject site.

3.2.2 Literature review

A comprehensive literature review was completed by JWA (2004) as part of a Flora and Fauna Assessment for a nearby site in the locality. This review used a number of sources to identify records of Threatened species in the locality.

3.2.3 Habitat assessment

Site habitats were assessed to determine their value for native fauna species. This assessment was completed in conjunction with the flora survey. The assessment focused on identifying habitat features associated with Threatened species as well as other native fauna groups. Particular attention was paid to habitat features such as:

- The presence of mature trees with hollows, fissures and/or other suitable roosting/nesting places.
- The presence of Koala food trees.
- The presence of preferred Glossy black cockatoo feed trees (Forest oak and/or Black she-oak).
- The presence of Yellow-bellied glider feeding scars.
- Condition, flow and water quality of drainage lines and bodies of water.
- Areas of dense vegetation.
- Presence of hollow logs/debris and areas of dense leaf litter.
- Presence of fruiting flora species.
- Presence of blossoming flora species, particularly winter-flowering species.
- Vegetation connectivity and proximity to neighbouring areas of intact vegetation.
- Presence of caves and man-made structures suitable as microchiropteran bat roost sites.



3.2.4 Fauna survey

A fauna survey was carried out on the 3rd of June 04 and again on the 20th of February 2007. The weather was generally fine and warm during the survey period.

3.2.4.1 Survey Techniques

The fauna survey was designed to target identified threatened species. The following survey technique was utilised in this assessment.

Opportunistic Sightings

The Subject site was traversed on foot using the 'random meander' method. All incidental observations of fauna were noted and recorded.

Active Searching

Logs, sheets of tin, cardboard, bark and leaves were overturned in search of reptiles and amphibians while incidentally traversing the site. Diggings and signs of droppings were searched for. The site was actively searched for scats and bones. Active observation of bird activity was undertaken during all site visits.

3.3 Results and Discussion

3.3.1 NPWS Database search

The results of the search of the NPWS database are shown in TABLE 3.

TABLE 3
NPWS DATABASE RECORDS OF THREATENED FAUNA SPECIES
WITHIN 10 KM OF THE SUBJECT SITE

Scientific name	Common name
<i>Mixophyes iterates</i>	Giant Barred Frog
<i>Macronectes giganteus</i>	Southern Giant-Petrel
<i>Ephippiorhynchus asiaticus</i>	Black-necked Stork
<i>Burhinus grallarius</i>	Bush Stone-curlew
<i>Sterna albifrons</i>	Little Tern
<i>Cyclopsitta diophthalma coxeni</i>	Double-eyed Fig-parrot
<i>Lathamus discolor</i>	Swift Parrot
<i>Xanthomyza Phrygia</i>	Regent Honeyeater
<i>Chelonia mydas</i>	Green Turtle
<i>Hoplocephalus stephensii</i>	Stephens' Banded Snake
<i>Ixobrychus flavicollis</i>	Black Bittern
<i>Lophoictinia isura</i>	Square-tailed Kite
<i>Pandion haliaetus</i>	Osprey
<i>Irediparra gallinacea</i>	Comb-crested Jacana
<i>Haematopus fuliginosus</i>	Sooty Oystercatcher
<i>Haematopus longirostris</i>	Pied Oystercatcher
<i>Ptilinopus magnificus</i>	Wompoo Fruit-Dove
<i>Ptilinopus regina</i>	Rose-crowned Fruit-Dove
<i>Ptilinopus superbus</i>	Superb Fruit-Dove
<i>Calyptorhynchus banksii</i>	Red-tailed Black-Cockatoo



Scientific name	Common name
<i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo
<i>Ninox strenua</i>	Powerful Owl
<i>Tyto capensis</i>	Grass Owl
<i>Tyto novaehollandiae</i>	Masked Owl
<i>Tyto tenebricosa</i>	Sooty Owl
<i>Todiramphus chloris</i>	Collared Kingfisher
<i>Climacteris picumnus</i>	Brown Treecreeper
<i>Grantiella picta</i>	Painted Honeyeater
<i>Monarcha leucotis</i>	White-eared Monarch
<i>Coracina lineata</i>	Barred Cuckoo-shrike
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll
<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale
<i>Phascolarctos cinereus</i>	Koala
<i>Petaurus australis</i>	Yellow-bellied Glider
<i>Petaurus norfolcensis</i>	Squirrel Glider
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox
<i>Syconycteris australis</i>	Common Blossom-bat
<i>Kerivoula papuensis</i>	Golden-tipped Bat
<i>Miniopterus australis</i>	Little Bentwing-bat
<i>Miniopterus schreibersii</i>	Common Bentwing-bat
<i>Megaptera novaeangliae</i>	Humpback Whale

3.3.2 Habitat assessment

3.3.2.1 Amphibians

Amphibians occurring in the region are poikilothermic, predominantly insectivorous and generally require free water for reproduction, with the exception of two highland genera (*Assa darlingtoni* and *Philoria* spp.) The habitat requirements of most species are unlikely to be determined by forest cover or floristics, but are more strongly influenced by factors such as climate, distance to water bodies, riparian vegetation, hydrological and morphological characteristics of water bodies and the availability of suitable micro-habitat for aestivation and shelter.

The majority of species that occur within the region lay eggs in or near temporary or permanent water bodies and rely on free water for larval development and metamorphosis. Of these species, only a few are dependent on forested habitats beyond the riparian zone or beyond areas of temporary inundation. These species include the Red-eyed tree frog (*Litoria chloris*), Leseuer's frog (*Litoria leseueri*), Fletchers frog (*Lechriodus fletcheri*) and the Barred frogs of the *Mixophyes* genus.

The Subject site is likely to provide moderate to high quality habitat for a range of frogs. The creek passing through the 7A zone of the site provides good habitat for frog species, with areas of moderately deep leaf litter and fringing vegetation for shelter. Some of the drainage lines and ditches in the southern part of the site may also provide suitable frog habitat.

Grasslands provide suitable habitat for a range of Amphibian species, particularly along drainage depressions and soaks. Species commonly encountered in grassland communities



include the Common eastern froglet, Eastern sign bearing froglet, Striped marsh frog, Spotted grass frog, Eastern dwarf tree frog, Rocket frog, Whistling tree frog and Cane toad.

Species typically encountered in or adjacent to Closed Forests include the Eastern dwarf tree frog, Red-eyed tree frog, Striped marsh frog, Cane toad and Dainty green tree frog. Relatively few species occur in conjunction with Closed Forest types when permanent water is absent. Species which typically occur in low elevation Rainforest and permanent streams such as the Giant barred frog (*Mixophyes iteratus*) may occur at the study site, although habitat is considered sub-optimal, due to the smallness of area and degree of 'edge'.

3.3.2.2 Reptiles

As reptiles are poikilothermic, and predominantly insectivorous or carnivorous, their habitat requirements are less directly determined by vegetation species composition than other taxa which feed directly on plants. Reptile distributions are strongly influenced by structural characteristics of the vegetation, climate and other factors affecting thermoregulation such as shade and availability of shelter and basking sites (Smith *et al* 1994).

In a survey of the moist forest herpetofauna of North-eastern NSW, Smith *et al* (1989) found that few species discriminated between rainforest and wet sclerophyll forest, however, most species exhibited a response to differences in elevation and the availability of microhabitat components and other substrates.

The availability of microhabitats, of varying thermal properties is particularly important for most reptile species, as behavioural thermoregulation (regulation of body heat) is important in controlling critical body functions such as digestion, foraging activity and reproduction.

Reptile diversity and abundance is often (but not always) significantly higher in drier habitat types, particularly those with a wide variety of ground substrate microhabitats. This contrasts markedly with the distribution patterns of birds, and most mammals.

The single limiting factor in terms of species diversity in coastal vegetation is the lack of shelter sites (eg. logs, tree hollows and decorticated bark). Such habitat components characterise eucalypt forests and woodlands, where species diversity may be much higher, depending on disturbance factors.

The Subject site is considered to provide moderate quality habitat for reptiles due to the presence of: the combination of shelter and basking sites (although the site lacks any rocky areas suitable for basking); fallen logs for shelter; wet sclerophyll forested areas with good canopy and leaf litter development; availability of water in drainage lines; and reliable sources of prey.

3.3.2.3 Birds

The significance of near coastal environments of the N.S.W. Far North Coast and South - East Queensland as overwintering habitat for migratory birds has been established by many observers and bird banders including Keast (1968), Robertson (1973), Gravatt (1974), Porter (1982) and Robertson and Woodall (1983). These patterns may be attributable to the relatively high winter temperatures and long growing season of this



region compared with the rest of south-eastern Australia (Fitzpatrick and Nix 1973; Edwards 1979; Nix 1982; Specht *et al* 1981).

Many insectivorous birds from higher latitudes and elevation over-winter in the locality. These include species such as the Fantail cuckoo, Sacred kingfisher, Rainbow bee-eater, Noisy pitta, Tree martin, Black-faced cuckoo-shrike, Cicada bird, Golden whistler, Rufous whistler, Rose robin, Grey fantail, White-throated gerygone, Silvereye, Olive-backed oriole and Spangled drongo.

Birds such as honeyeaters and lorikeets are Blossom nomads (*ibid.*). These birds move locally in response to variation in the availability of nectar and or pollen, important components in their diet. Porter (1982) highlights the importance of Forest red gum, Broad-leaved paperbark and Coast banksia for Scaly-breasted and Rainbow lorikeets as these species flower during the lorikeet's winter breeding period. A sequence of important nectar bearing plants in the genera Eucalyptus, Banksia, Melaleuca and Callistemon provide a continuity of food for nectarivorous birds.

Studies of bird usage in rainforest remnants by Holmes (1987), Connelly and Specht (1988) and Lott & Duigan (1993) indicate that the diversity and abundance of birds is related to the size of the Rainforest patches and their degree of isolation from major areas of native forest. Lott & Duigan (1993) and Howe *et al* (1981) also note that sites with a higher diversity of vegetation and those which are closer to water generally support a greater diversity of birds. Locally nomadic and migratory rainforest species such as the Wompoo, Rose-crowned and Superb fruit-doves, Common koel and Black-faced cuckoo-shrike are known to use scattered areas of habitat as "stepping-stones" between more intact areas of forest (Date *et al* 1992; Lott & Duigan 1993).

The variety of habitats present in the Study area is likely to result in a high diversity of resident and nomadic birds occurring on the site over the year. The site provides a fairly high diversity and abundance of fruiting species provided by rainforest elements in the south of the site, which, although small in area, represents moderate quality habitat for frugivorous birds.

The Study area is likely to provide good quality foraging and breeding habitat for a range of rainforest birds. The Subject site provides foraging resources for nectarivorous birds provided by Acacia and Eucalyptus species. The level of disturbance to the creek and its lack of any main bodies of water may preclude the occurrence of birds associated with permanent watercourses.

There is a lack of trees with hollows necessary for hollow-nesting birds, however, the Study area may represent important forage habitat for hollow-dependent avifauna breeding in forests in the locality.

3.3.2.4 Mammals

Small terrestrial mammals generally occur in highest densities in association with a complex vegetation structure. A dense understorey layer, which provides shelter from predators and provides nesting opportunities, is particularly important.

In general medium-large terrestrial mammals such as macropods select habitats which provide a dense cover for shelter and refuge and open areas for feeding. The larger species tend to occupy drier more open habitats: the smaller species, moister and more densely vegetated habitats.



All Arboreal mammals that occur in the region (with the exception of the Koala) utilise tree hollows for nesting and shelter (although the Common ringtail possum is not dependent on hollows). Smith & Lindenmeyer (1988) consider that shortage of nest hollows is likely to limit arboreal mammal populations where density of hollow bearing trees is less than 2 to 8 trees per hectare.

Arboreal folivores (e.g. Common ringtail possum, Greater glider) are widespread and abundant but exhibit local variation in response to such factors as tree species composition, foliage protein and fibre levels, leaf toughness, toxins, forest structure and the availability of shelter sites. Arboreal folivores are expected to be most abundant in areas of high productivity, high soil fertility and moderate climate, in conjunction with adequate shelter and suitable foraging substrate.

Arboreal nectarivore/insectivores feed on a wide variety of plant and insect exudates including the nectar of flowering eucalypts, and shrubs such as Banksia and Acacia sp. These species also feed extensively on insects, particularly under the shedding bark of eucalypts. The distribution of nectarivore/insectivores is considered to be related to the abundance of nectar and pollen producing plants, the abundance of bark shedding eucalypts which harbour insect prey, and the occurrence of sap and gum exudate producing trees (Sap feed trees) and shrubs (e.g. Acacia sp.). Arboreal nectarivores and insectivores are generally hollow dependent species.

There is a lack of trees with hollows necessary for hollow-dependent mammals, however, as with the birds, the Study area may represent important forage habitat for hollow-dependent mammals resident in forests in the locality. No primary Koala feed trees were recorded on the Subject site.

The structural complexity and habitat diversity of the site is likely to support a moderate diversity and abundance of ground dwelling mammals within forested areas on the Subject site. This is particularly due to the denseness of the vegetation in the southern half of the site, while dense piles of vegetation in the northern part of the site may also provide suitable habitat.

Insectivorous bats like insectivorous birds overlap considerably in diet and broad vegetation preferences (Hall 1981), but specialise in foraging in specific layers or substrates within the forest (Crome and Richards 1988). The Study area is likely to provide forage habitat for a relatively high diversity and abundance of insectivorous bats, due to the combination of open, forested and denser areas of vegetation. The site provides a relative diversity and abundance of fruiting species and represents moderate quality foraging habitat for frugivorous bats.

There is a general lack of old-growth trees for hollow-dependant bats. These areas represent suitable roost habitat for the Threatened Black flying-fox, Grey-headed flying fox and Common blossom bat.

3.3.3 Literature review

A number of studies have been completed in the locality. Threatened species recorded in Studies in the locality are shown in **TABLE 4**.



TABLE 4
THREATENED FAUNA SPECIES RECORDED IN STUDIES IN THE LOCALITY
(SOURCE: CLANCY 1998, JWA 2003)

Birds	Osprey Glossy black cockatoo Pied oystercatcher Sooty oystercatcher Black necked stork	Mammals	Common bent-wing bat Little bent-wing bat Southern myotis Grey-headed flying-fox Yellow-bellied glider
Amphibians	Wallum froglet		

3.3.4 Results of fauna survey

3.3.4.1 Reptiles

No reptiles were recorded. Reptile activity could be expected to be low due to the time of year (mid-Winter) in which the survey was completed.

3.3.4.2 Amphibians

No Amphibians were recorded during this survey. The survey was completed at a time when Amphibian activity could be expected to be low.

3.3.4.3 Birds

Twenty (20) bird species were recorded on the Subject site. No Threatened species were recorded. Bird species recorded during the field survey are shown in **TABLE 5**.

TABLE 5
BIRD SPECIES RECORDED DURING THE SURVEY

Common name	Scientific name
Australian raven	<i>Corvus coronoides</i>
Brown thornbill	<i>Acanthiza pusilla</i>
Currawong	<i>Strepera graculina</i>
Eastern yellow robin	<i>Eopsaltria australis</i>
Eastern whipbird	<i>Psophodes olivaceus</i>
Galah	<i>Cacatua roseicapilla</i>
Grey butcherbird	<i>Cracticus torquatus</i>
Grey fantail	<i>Rhipidura fuliginosa</i>
Kookaburra	<i>Dacelo novaeguineae</i>
Lewin's honeyeater	<i>Meliphaga lewinii</i>
Magpie	<i>Gymnorhina tibicen</i>
Noisy friarbird	<i>Philemon corniculatus</i>
Pied butcherbird	<i>Cracticus nigrogularis</i>
Rainbow lorikeet	<i>Trichoglossus haematodus</i>
Red browed finch	<i>Neochmia temporalis</i>
Striated pardalote	<i>Pardalotus striatus</i>
Striped honeyeater	<i>Plectorhyncha lanceolata</i>
Superb fairy wren	<i>Malurus cyaneus</i>
White-browed scrubwren	<i>Sericornis frontalis</i>
Yellow-tailed black cockatoo	<i>Calyptorhynchus funereus</i>



3.3.4.4 Mammals

There were (2) mammals recorded during the survey: Eastern grey kangaroo (*Macropus giganteus*) and dog (*Canis familiaris*). These were identified by observation and scat analysis respectively.

3.3.5 Threatened species considered possible occurrences in the Study area

Based on the assessment of habitats in the Study area, Threatened fauna species known from the locality were assessed for the likelihood of their occurrence in the Study area.

TABLE 6
LIKELIHOOD OF OCCURRENCE OF THREATENED FAUNA SPECIES IN THE STUDY AREA

Species	Likelihood of occurrence in the Study area	Notes
Barred cuckoo-shrike	Possible	This species lives in the canopy of rainforests and rainforest margins and wanders nomadically in search of fruit. Rainforest elements along the creek and edge of the 7A area may provide suitable habitat for this species.
Black bittern	Unlikely	This species occurs in riparian habitats. However, there are few local records and this species has not been recorded in nearby Moonee Beach Nature Reserve.
Black-necked stork	Unlikely	The Black-necked stork occurs in swamps, mangroves, mudflats, dry floodplains and irrigated land. Suitable habitat does not occur on the site.
Brown treecreeper	Possible	This species occurs in eucalypt woodlands, particularly open woodland lacking a dense understorey. Brushbox forest south of the site, and sparse woodland on the site itself provide suitable habitat for this species.
Brush-tailed phascogale	Possible	This species inhabits dry sclerophyll open forest as well as heathlands, swamps, rainforest and wet sclerophyll forest.
Bush stone-curlew	Unlikely	This species forages and breeds in open-grassed woodlands or sparsely treed rangelands, often with a non-existent shrub layer and abundant leaf litter.
Collared kingfisher	Unlikely	The Collared kingfisher is restricted to mangroves in Australia.
Comb-crested jacana	Unlikely	This species lives on floating vegetation in freshwater lakes and ponds.



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Species	Likelihood of occurrence in the Study area	Notes
Common bent-wing bat	Unlikely	This species generally occupies caves and tunnels during the day and, at night, forages for small insects beneath the canopy of well timbered habitats. It may occasionally roost singularly or in small collectives under the bark of mature paperbark trees.
Common blossom bat	Possible	Common Blossom Bats in NSW, the Southern part of their range, feed mostly on nectar. There are a small number of blossom producing trees (eucalypts) in the Study area.
Double-eyed fig-parrot	Unlikely	This species is very rarely recorded in the locality. It forages in fig trees and other fruiting rainforest species.
Giant barred frog	Possible	This species occurs in streams in rainforest habitats. While the creek in the rainforest area of the site has a large degree of 'edge', it may still provide some (sub-optimal) habitat for this species.
Glossy black cockatoo	Possible	Found in coastal forests and open inland woodland in eastern Australia. The Glossy black-cockatoos distribution is limited to habitat which contains sufficient seed reserves of at least one (1) of their three favoured species of food trees: <i>Allocasuarina littoralis</i> , <i>A. torulosa</i> and <i>A. verticillata</i> (Forshaw 1981) and suitable large hollow bearing trees for nesting. <i>A. torulosa</i> occurs sporadically on the site.
Golden-tipped bat	Unlikely	This species occurs in rainforest habitats.
Grass owl	Unlikely	The Grass owl occupies coastal heath and grassland across northern Australia (Reader's Digest 1993).
Grey-headed flying fox	Possible	This species travels along the east coast of Australia, foraging on fruiting and blossoming species. Eucalypts on the site provide suitable forage habitat for this species.
Koala	Possible	No preferred Koala feed tree species occur on site, although secondary species such as Blue gum and Pink bloodwood occur. Koalas may use the site when travelling, or for roosting.
Little bent-wing bat	Possible	This species generally occupies caves and tunnels during the day and, at night, forages for small insects beneath the canopy of well timbered habitats. It may occasionally roost singularly or in small collectives under the bark of mature paperbark trees. Parts of the 7A area comprise suitable forage habitat for this species.



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Species	Likelihood of occurrence in the Study area	Notes
Masked owl	Unlikely	Masked owls prefer heavier wooded eucalypt forests. Better habitat occurs to the south and west of the site.
Osprey	Unlikely	This raptor is thinly distributed in coastal Australia. It nests in singularly overtopping, generally dead trees. The Osprey hunts in coastal rivers, estuaries and streams and may gather nesting material from nearby forests.
Painted honeyeater	Unlikely	The species is locally nomadic, following flowering and fruiting of Mistletoe. In New South Wales and Queensland it is a specialist feeder on the fruits of Mistletoe growing on Boree (<i>Acacia pendula</i>), Brigalow (<i>Acacia harpophylla</i>), River Oak (<i>Casuarina cunninghamiana</i>), Red Ironbark (<i>Eucalyptus sideroxylon</i>) and Yellow-gum (<i>Eucalyptus leucoxylon</i>) (Garnett 1992). None of these species were recorded on site.
Powerful owl	Unlikely	The Powerful owl occurs in a variety of habitats, including coastal forests. Better habitat occurs to the south and west of the site.
Red-tailed black-cockatoo	Unlikely	This species inhabits open forest and woodland of primarily eucalypts, particularly near or along watercourses.
Regent honeyeater	Unlikely	This species is very rarely recorded in the locality.
Rose crowned fruit dove	Unlikely	The Rose-crowned fruit dove prefers tall tropical and subtropical evergreen or semi-deciduous rainforest, especially with a dense regrowth of vines.
Sooty owl	Unlikely	The Sooty owl occurs in rainforests, particularly rainforest gullies overtopped by eucalypts, along eastern scarp of Great Dividing Range, north to Conondale-Blackall Ranges Qld and south to Dandenong Ranges, Victoria.
Southern myotis	Unlikely	This species relies on open water bodies to catch aquatic prey and roosts in dense forest canopies.
Spotted-tailed quoll	Unlikely	The Spotted-tailed quoll occurs in a range of habitats including sclerophyll forests and woodlands, coastal heathlands and rainforests.
Square-tailed kite	Possible	This species is thinly distributed through open forests, woodland and sandplains, both coastal and subcoastal.



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Species	Likelihood of occurrence in the Study area	Notes
Squirrel glider	Possible	The Squirrel glider occupies wet and dry sclerophyll forests with open dry sclerophyll forests regarded as optimum habitat. Brushbox forest to the south of the site provides suitable habitat for this species, while sparse Brushbox & Blue gum on the site may also be utilised.
Stephens' banded snake	Possible	The key elements of the preferred habitat for Stephen's banded snake are a dense understorey and canopy structure which are required for foraging and movement. The dense understorey within the 7A area provides suitable habitat for this species.
Superb fruit-dove	Unlikely	This species occurs in rainforest habitats. Rainforest canopy structure on the site is not well developed to suit this species.
Swift parrot	Unlikely	Mainland populations of this species favour winter-flowering eucalypt forest and woodland, usually where abundant supplies of Eucalypt nectar exist. This species is rarely recorded in the locality. The last record within 5kms of the site was from 1983.
Wallum froglet	Unlikely	The Wallum froglet is found in Paperbark swamps growing in areas with acid sandy (Wallum) soils, warm temperate grassland or near the edge of ponds. Suitable habitat does not occur on the site.
White-eared monarch	Unlikely	This species occurs in rainforest, particularly the edges of subtropical rainforest, contiguous wet sclerophyll forest and occasionally into mangrove swamps or streamside vegetation in Eucalypt woodland.
Wompoo fruit dove	Unlikely	This species is primarily associated with large undisturbed patches of tropical or subtropical evergreen rainforest. Occasionally this species will occur in patches of monsoon forest, closed gallery forest, wet sclerophyll forest, tall open forest, open woodlands or vine thickets near rainforests (Marchant and Higgins 1993). Canopy structure on the site is not well developed to suit this species.
Yellow-bellied glider	Possible	Preferred habitats are tall open mature sclerophyll forests with a range of eucalypt species in areas of high rainfall. Brushbox forest to the south of the site provides suitable habitat for this species, while sparse Brushbox & Blue gum on the site may also be utilised.



4 IMPACTS AND AMELIORATION

4.1 Impacts of the Proposed Development

4.1.1 Introduction

This section examines the likely impacts of the proposed community title sub-division. The possible direct and indirect impacts of the proposal are outlined and the amelioration measures are recommended to minimise the impact on the flora and fauna on the site.

4.1.2 Flora

4.1.2.1 Introduction

This section examines the likely impacts of the proposed development on the flora which occurs within the Subject site, including the likely impacts on the threatened flora which occur on the Subject site.

4.1.2.2 Impact on Flora.

The Proposed development will result in the loss of vegetation for the construction of buildings, access roads, driveways and associated infrastructure, and is shown in **FIGURE 9**. A proposed collector road in the western half of the site is also included, as it is required by CHCC as part of the Proposed development.

Vegetation communities in the southern section of the site (zoned 7A Environmental Protection) will be retained. The actual area proposed for development is 2.51 hectares (or 44 %) of the 5.75 hectares of the Subject site. Vegetation to be lost consists largely of grassland with scattered trees, a small area of Tall mid-dense forest and a small area of Tall sparse forest. Vegetation to be lost is shown in **TABLE 7**.

TABLE 7
VEGETATION TO BE LOST TO DEVELOPMENT

Community	Area to be lost (ha)	Modified APZ (ha)	Retained
1. Tall mid-dense forest (<i>Lophostemon confertus</i> , <i>Eucalyptus siderophloia</i>)	0.25	0.18	0.02
2. Tall sparse forest (<i>Lophostemon confertus</i> , Mixed Rainforest sp.)	0.006	0.029	1.24
3. Low dense shrubland (<i>Lantana camara</i> , <i>Senna coluteoides</i>)	0	0	0.93
4. Low closed grassland (with scattered trees)	1.46	0.17	0.65
5. Mixed plantings (<i>Casuarina glauca</i> , <i>Lophostemon confertus</i> etc)	0.79	0	0
TOTAL	2.5 ha	0.38	2.84



Additional impacts on vegetation communities and plants include:

- Disturbance to the Subject site creates opportunities for weeds to colonise. Weeds may be introduced to the Study site in construction materials or by vehicles. Occupation of the Subject site creates opportunities for weeds to become established. Landscape species may escape to retained areas of vegetation.
- The removal of vegetation from the Subject site represents the loss of organic material from the site.
- Clearance of areas of the Subject site represents a loss of habitat available for dispersal for plants and will reduce visits by pollination and dispersal vectors.
- Visitation to the 7A section of the site may result in creation of walking tracks and disturbance to flora. This may result in direct loss of vegetation, change in vegetation structure and increased opportunities for weeds and disturbance adapted animal species.
- Occupation of the site may increase the risk of fire release into the surrounding bushland.
- Earth works associated with the construction of the development (roads & town houses) may increase erosion and sedimentation entering the creek, altering the hydrological conditions necessary for the semi-aquatic vegetation communities.

Moonee Quassia

A small group of the endangered Moonee quassia (*Quassia* Sp. Moonee Creek) appears to occur within the road reserve in the western half of the site as shown in **FIGURE 9**. The road reserve has been designated for a collector road to be acquired by CHCC.

Fifteen (15) stems of the Moonee quassia occur, these shrubs have been surveyed by JWA using a hand held G.P.S. The proposed development will result in the loss of approximately ten (10) of the Moonee quassia which currently occur on the subject site.

Removal of vegetation from the subject site will make retained Moonee quassia within Lot 20 more susceptible to edge effects: increased light, exposure and disturbance, greater susceptibility to weed invasion and alteration of microclimate.

Rusty plum

The vulnerable (TSCA 1995) Rusty plum was recorded within the development footprint. Five (5) mature stems, one (1) intermediate stem, and approximately fifteen (15) saplings occur. All of the saplings occur around one (1) of the mature Rusty plums.

The location of the Rusty plums was surveyed using a hand held G.P.S. and is shown in **FIGURE 9**.

The proposed development will result in the loss of three (3) mature Rusty plums for the construction of town-houses and access roads. The majority of the Rusty plums occur within the Bushfire Asset Protection Zone (APZ) and will be retained.



4.1.3 Fauna

4.1.3.1 Introduction

This section examines the likely impacts of the proposed development on the fauna which possibly occurs within the Study area, including the likely impacts on the Koala, which is considered as a possible occurrence on the Subject site.

4.1.3.2 Impact on Fauna

The proposed development will result in the minor loss of habitat for the local native fauna species, other impacts on fauna include:

- The Proposed development will require the clearance of native vegetation. This represents a loss of habitat for a range of native reptiles, birds and mammals and, to a lesser extent, amphibians.
- Loss of sub-mature eucalypts represents a decrease in the future recruitment of hollows.
- Loss of eucalypts decreases the food supply for nectarivores.
- Reduces the potential grazing area for the local Eastern grey kangaroos;
- Animals may be killed or injured during the clearance of vegetation.
- Domestic dogs and cats prey on native fauna and may have significant impacts on the populations of native species.
- Development of the Subject site may favour native and introduced disturbance adapted competitors. For example, Cane toads may out-compete other Amphibians and Reptiles, aggressive open country birds species (eg Noisy miner, Crow, Pied currawong) may out-compete other Birds, and non-native mammals (Black rat and House mouse) may out-compete other native small mammals).
- Increased light, noise and activity may cause reclusive species to move away from habitat edges.
- The Proposed development will result in an increase in traffic in the Study area. This increases the likelihood of animals being killed or injured by vehicles.
- Disturbance to fauna in 7A communities may occur from resident visitation.

Koalas

Much of the site is classified as Secondary Koala Habitat by CHCC, along with a small area of Tertiary habitat (as shown in **FIGURE 10**). A small number of tree species present on the subject site have been identified in the Coffs Harbour Koala Plan of Management (KPOM) as feed tree species. These are:

- Blue gum
- Pink bloodwood
- Forest oak

The proposed development will result in the loss of some of these secondary feed tree species. The site survey did not identify any sign of Koala activity on the subject site.

The proposed development will contribute toward the loss of some secondary Koala habitat in the locality as mapped by CHCC.



4.1.4 Corridors Impacts

The southern 7A section of the site has good connectivity to Brushbox forest immediately south of the site. This 7A section will be retained. Connectivity to the north and east is restricted by residential development, while connectivity to the west is marred by the Pacific Highway.

The NPWS 'Key Habitats and Corridors' database identifies the following corridors in the Study area:

- Moonee Nature Reserve - Sapphire Regional Corridor, which links Moonee NR and Hills Beach. This corridor occurs to the east of the site.
- Moonee Nature Reserve - Orara East Subregional corridor, which links the Moonee coastal corridor with Orara State Forest along Sugar Mill Creek. This corridor occurs to the south of the site.

The proximity of the two (2) corridors to the Subject site is shown in **FIGURE 11**.



4.2 Amelioration

4.2.1 Introduction

This section discusses possible ameliorative measures and opportunities for enhancing the natural environment on the Subject site.

4.2.2 Flora

4.2.2.1 Introduction

This section discusses possible ameliorative measures for the flora occurring on the Subject site, including the Threatened flora species.

4.2.2.2 Amelioration for Flora

The proposed development will have relatively little impact on the significant vegetation communities occurring in the south of the site. However, there will be a loss of the vegetation communities occurring in the north of the Subject site. It is recommended that a Vegetation Management Plan be developed as a condition of consent. The Vegetation Management Plan is to contain, a species list and planting layout for the revegetation zones, a weed control plan and a detailed description of the maintenance and monitoring that will be completed.

It is further recommended that weed infestation to the south of the site (Lantana, Winter Senna) be controlled and this area be regenerated.

A program of bush regeneration will control weed species and complement existing vegetation by allowing natural regeneration on the site. A program of planting will also serve to further extend the existing vegetation on the site and reduce edge effects.

Other amelioration measures include:

- Retention of mature trees (Brushbox, Blue gum) within grassland areas where possible.
- Six (6) areas of grassland outside of the development envelope will be converted into revegetation zones and rehabilitated into wet sclerophyll forest;
- Weeds should be controlled during construction.
- Vegetation removed during construction should be mulched for use on the site. This will prevent the introduction of weeds from seeds in mulch brought in from elsewhere.
- Weeds should be controlled in landscaped areas and areas of retained vegetation.
- Known environmental weeds (e.g. Umbrella tree) should be avoided.
- Landscape plantings should include a majority of species that will provide forage habitat for nectarivorous and frugivorous birds and bats.
- Professional bush regenerators are to be engaged to control weeds and implement the planting program within the revegetation zones.



Moonee quassia

The most significant flora amelioration issue is the occurrence of Moonee Quassia on the site. However, the fifteen (15) stems recorded of this species appear to occur within the road reserve on Lot 23 of the site. CHCC have indicated that a collector road is to be constructed for the proposed development.

Prior to earthworks/clearing it is recommended that the Moonee quassia to be retained are clearly fenced off to minimise the possibility of any damage or removal. Machine operators should also be briefed appropriately.

A vegetation management plan will be developed for the revegetation and rehabilitation of the Subject site. Six (6) revegetation areas have been identified by (JWA) to be rehabilitated as wet sclerophyll communities. Any Moonee quassia that are removed as a result of the proposed development will be replaced within these six (6) rehabilitation areas. Replacement will occur at a ratio of five (5) new plants for every one (1) which is lost.

Rusty plum

The vulnerable (TSCA 1995) Rusty plum was recorded within the development footprint. The proposed development will result in the loss of three (3) mature Rusty plums for the construction of town-houses and access roads. The majority of the Rusty plums occur within Bushfire Asset Protection Zone (APZ) and will be retained, other amelioration for the Rusty Plums, includes:

- Rusty plums to be retained within the APZ are to be located and clearly fenced before any vegetation clearance occurs;
- Any Rusty plums which are removed will be replaced at a appropriate position within the revegetation areas;
- Any Rusty plums which are removed will be replaced at a ratio of five (5) trees for each of the trees removed;
- Genetic material (seeds) are to be obtained from the trees which are to be lost, seed should be propagated and used with the six (6) revegetation areas.



4.2.3 Fauna

4.2.3.1 Introduction

This section discusses possible ameliorative measures for the local fauna occurring on the Subject site, including the Koala which is listed as a Threatened species.

4.2.3.2 Amelioration for Fauna

While vegetation clearance for the proposed development will result in some loss of habitat for fauna utilising the site, this will be relatively minimal, with the best quality habitat on the site being retained.

The following amelioration measures apply:

- Landowners should control dogs and cats. All animals should reside within fenced enclosures and be on a leash when outside of the enclosure.
- Appropriate disposal of rubbish and food scraps reduces opportunities for non-native predators and disturbance adapted competitors.
- Landscape and landfill materials should be sourced from a supplier where Cane toads do not occur.
- 40 km/hr speed limit to be imposed on internal access roads.

Amelioration measures for the Koala have been based on the need to address the requirements for Secondary Koala Habitat within Coffs Harbour shire. These requirements are:

- the proposal will not result in significant barriers to koala movement;
- boundary fencing does not prevent the free movement of koalas;
- lighting and koala exclusion fencing is provided where appropriate on roadways adjacent to koala habitat;
- tree species listed in the KPOM for Secondary Koala Habitat are retained, where possible;
- new local roads are designed to reduce traffic speed to 40 kph in potential koala blackspots;
- preferred koala trees are used in landscaping where suitable;
- Koala habitat tree removed are replanted within the vicinity.
- threats to koalas by dogs have been minimised i.e. banning of dogs or confining of dogs to koala proof yards;
- fire protection zones, including fuel reduced zones and radiation zones, are provided generally outside of Secondary Koala Habitat.

The proposed development will not result in the loss of any of the tree species listed in the KPOM for secondary Koala habitat (Tallowood, Swamp mahogany, Flooded gum, Forest red gum or Small-fruited grey gum).

It is recommended that:

- Traffic speeds be reduced to 40kph within the development.



- Compensatory Koala habitat trees to be planted within road reserves or elsewhere outside the development envelope for any Koala habitat trees removed.
- Dogs should be strictly controlled within the proposed development.
- Building envelopes be located to reduce the extent of Bushfire Asset Protection Zones. If possible, houses backing onto bushland should be designed to a higher fire resistant rating to reduce the extent of APZs.
- Swimming pools should be fenced to restrict access by Koalas.

It is unlikely that Koala feed trees will be retained within the development envelope and it is not considered desirable that Koalas be able to access or move through areas of the site. This is particularly so given the limitations of property to the north, which is subject for future development. Some limited movement habitat occurs along the western boundary of the site, and the road reserve adjacent to the Pacific Highway. However, it is noted that this creates the potential for dispersing Koalas to be killed or injured if they stray onto the Highway itself.

4.2.4 Corridors

The Proposed development is unlikely to have a significant effect on corridor habitat, as the area to be cleared for development is largely grassland with scattered trees and some small pockets of vegetation. While some disturbance to the 7A section in the south of the site may occur from visitation by residents, it is not considered that this will have a significant impact on the corridor capacity of this area. The revegetation of the six (6) rehabilitation areas will increase the corridor values in the south of the Subject site.

4.3 Moonee Development Control Plan (2004)

The Moonee Development Control Plan (DCP) came into force in September 2004 with the objective of achieving Economic, Social and Environmental sustainability within the Moonee Release Area. The Moonee DCP is Councils endorsed strategy for development of identified areas of land in the Moonee area, and is based on detailed constraints mapping (*pers comm.* Sharon Smith Coffs Harbour City Council 16th March 2005).

The Subject site is not mapped under any of the constraints listed in the Moonee Development Control Plan. The land is deemed to be appropriate for development. The Subject site is mapped in the Moonee DCP as having a minimum target density of forty (40) residential dwellings.

The constraints mapping of the site under the Moonee DCP is shown as **FIGURE 12**.



5 STATUTORY CONSIDERATIONS

5.1 Introduction

This section includes assessments of the impacts of the Proposed development with regard to:

- Section 5A of the *Environment Protection & Assessment Act (1979)*;
- *State Environmental Planning Policy No. 44 (SEPP 44) - Koala Habitat Protection*; and
- the *Commonwealth Environment Protection and Biodiversity Conservation Act (1999)*.

5.2 Assessment of Significance (Seven Part Test)

5.2.1 Background

Under the *Threatened Species Conservation Amendment Act 2002*, the factors to be considered when determining whether an action, development or activity is likely to significantly affect threatened species, populations or ecological communities, or their habitats (known previously as the "8-part test"), have been revised. This affects s5A *EP&A Act*, s94 *Threatened Species Conservation Act 1995 (TSC Act)* and s220ZZ *Fisheries Management Act 1994 (FM Act)*.

The revised factors maintain the same intent but focus consideration of likely impacts in the context of the local rather than the regional environment as the long-term loss of biodiversity at all levels arises primarily from the accumulation of losses and depletions of populations at a local level. This is the broad principle underpinning the *TSC Act*, State and Federal biodiversity strategies and international agreements. The consideration of impacts at a local level is designed to make it easier for local government to assess, and easier for applicants and consultants to undertake the Assessment of Significance because there is no longer a need to research regional and statewide information. The Assessment of Significance is only the first step in considering potential impacts. Further consideration is required when a significant effect is likely and is more appropriately considered when preparing a Species Impact Statement.

The Assessment of Significance should not be considered a "pass or fail" test as such, but a system allowing proponents to undertake a qualitative analysis of the likely impacts and ultimately whether further assessment needs to be undertaken via a Species Impact Statement. All factors must be considered and an overall conclusion must be drawn from all factors in combination. Where there is any doubt regarding the likely impacts, or where detailed information is not available, a Species Impact Statement should be prepared.



5.2.2 Flora

5.2.2.1 Introduction

Two (2) Threatened flora species were recorded from the subject site.

- The *Quassia* sp. 'Moonee Creek' was recorded within patchy mid-dense forest towards the western side of the site.
- The vulnerable Rusty plum occurs north of the creek, within two (2) different vegetation communities.

An assessment of Significance will be completed for each of these threatened flora species.

The location of Quassias and Rusty plums are shown in **FIGURE 7**.

5.2.2.2 Moonee Quassia

(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.

Extent of the local population

The NPWS database contained nineteen (19) records of this species within 10 kilometres of the Study area.

The NPWS online database contained twenty-four (24) sightings of this species within the Coffs Harbour LGA.

Stages of the life-cycle affected by the proposed development

Moonee Quassia is a slender or bushy shrub only growing to about 1.5 metres tall. It usually occurs as a shrubby layer beneath tall moist eucalypt forest and tall dry eucalypt forest, including forest edges. The species occurs mostly at lower altitudes and has a scattered distribution from the Moonee Creek area north of Coffs Harbour to north-east of Grafton.

Likelihood of local extinction

The National Parks and Wildlife Service have listed the major issues which are threatening the survival of the Moonee quassia, some of these threats include:

- Destruction, degradation and fragmentation of forest habitat in coastal areas through clearing, urban development and repeated disturbance.
- Frequent fire.
- Timber harvesting and associated road works.
- Weed invasion, particularly Lantana.
- Risk of local extinction because populations are so small.
(NPWS 2002)

The small population of Moonee Quassia has been recorded within the road reserve (Lot 23). As this lot is to be developed as a collector road, required by CHCC, approximately ten (10) of the Moonee quassia will be disturbed/removed. Five (5) of the Moonee quassia will be retained within the bushfire asset protection zone.



A habitat Compensation Plan will be completed. This plan will include a Threatened species Translocation and Regeneration Plan. This plan will involve regenerating habitat in areas shown in **FIGURE 13**. Five (5) plants will be planted in the rehabilitation areas for each plant affected by the development.

(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.

Twenty six (26) endangered populations have been identified under the TSC Act. The following endangered populations occur in north-eastern NSW:

- Emu population in the NSW North Coast Bioregion and Port Stephens LGA
- *Cryptandra longistaminea* in the vicinity of Ellandgrove Road, South Grafton
- Low growing form of *Zieria smithii*, Diggers Head
- *Glycine clandestina* (Broad-leaf form) in the Nambucca LGA

The proposed development will not affect any of these endangered populations.

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

- (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or*
- (ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.*

Not applicable

(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*
- (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and*
- (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.*

Response to (i)

The habitat of the Moonee quassia at Moonee and other coastal sites is wet sclerophyll forest, typically comprising canopy species such as Tallowwood, Brushbox, Turpentine and Forest oak (DEC 2005).



Approximately 2.9 hectares of vegetation is to be lost for the proposed development, of which, only 0.46 hectares is considered to represent wet sclerophyll forest, hence, only 0.46 hectares of potential habitat will be removed or modified.

Response to (ii)

The proposed development is to occur adjacent to a residential subdivision within an area which is already fragmented. To the north of the site there is a large commercial shopping complex, to the west of the site, habitat is fragmented by the Pacific highway and to the east a large residential sub-division occurs. The subject site does have good connectivity with the forested habitat in the south, which will be retained.

The proposed development will only cause minor fragmentation of habitat within the locality. No areas of habitat will become isolated due to the proposed development.

Response to (iii)

The Moonee quassia has been recorded at eighteen (18) locations between Moonee Beach and McCraes Knob in the north. Approximately 6000 individuals of this quassia species are known to occur in the wild (DEC 2005). Very little is known about the life history and ecology of the Moonee quassia, but it has been recorded flowering between November and December.

Five (5) of the known localities of the Moonee quassia occur within Moonee creek catchment. All of these populations occur within the locality, hence, the importance of the 0.46 hectares habitat to be removed or modified, with regard to the long term survival of the species within the locality, is considered to be of moderate importance.

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

Critical habitat areas listed under the Threatened Species Conservation Act (1995) currently consist only of habitat for:

- Mitchell's Rainforest Snail in Stotts Island Nature Reserve - critical habitat declaration
- Little penguin population in Sydney's North Harbour - critical habitat declaration
- Wollemi Pine - critical habitat declaration
- Gould's Petrel - critical habitat declaration

There will be no adverse effects on these critical habitats from the action proposed.

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

An approved recovery plan was gazetted in June 2005, the recovery plan lists the following threats to the species, including:

- Low population numbers;
- Weed infestation;
- Grazing;
- Fire.



The recovery plan outlines proposed recovery objectives, actions and performance criteria for 2005 - 2010. These proposed recovery actions include:

- To co-ordinate the recovery of the Moonee quassia;
- To increase the level of understanding of the ecology and life history of the species;
- To locate any additional populations
- To ensure the broader community has access to information about the distribution, conservation and management of the Moonee quassia and its habitat; and
- Retention of each known population at its current site.

With the implementation of the amelioration measures contained within Section 4.2.2.2, this proposed action will be consistent with the objectives of this recovery plan.

(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.

A “threatening process” means a process that threatens, or may have the capability to threaten, the survival or evolutionary development of a species, population or ecological community. Key Threatening Processes have been listed in Schedule 3 of the TSC Act (1995) and are shown in **APPENDIX 3**.

The proposed development will contribute towards the clearing of native vegetation, a key threatening process listed on Schedule 3 of the TSC Act (1995). The final determination of the NSW Scientific Committee notes that clearing of native vegetation is recognised as a major factor contributing to loss of biological diversity, with impacts such as: destruction of habitat; fragmentation of habitat; riparian zone degradation; increased greenhouse gas emissions; increased habitat for invasive species; loss of leaf litter layer; loss or disruption of ecological function (e.g. loss of populations of pollinators or seed dispersers) and changes to soil biota.

The amount of native vegetation to be cleared consists of 2.9 hectares, the majority of which is grassland with scattered trees. Amelioration measures have been recommended to minimise the loss of native vegetation on the Subject site. Clearance of native vegetation will include clearance for building envelopes, access roads, fire buffers and fire trails.

Habitat loss is the main threatening process affecting all Subject species. The Proposed development will make a minor contribution towards the loss of habitat in the region.



5.2.2.3 Rusty plum

(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.

Extent of the local population

The NPWS database contained nineteen (19) records of this species within 10 kilometres of the Study area.

The NPWS online database contained twenty-four (24) sightings of this species within the Coffs Harbour LGA.

Stages of the life-cycle affected by the proposed development

The Rusty plum is a small to medium-sized tree to 20 metre tall with a very fluted or irregular trunk. The Rusty plum occurs in the coast and adjacent ranges from northern NSW from the Macleay River, into southern Qld. Flowering period for the Rusty plum is between September and October.

Likelihood of local extinction

The entire population of Rusty plums recorded within the subject site includes five (5) mature stems approximately eight (8) to twelve (12) metres high, one (1) intermediate stem, two and a half (2.5) metres in height and approximately ten (10) to fifteen (15) seedlings not more than fifty (50) centimetres high.

The National Parks and Wildlife Service have listed the major issues which are threatening the survival of the Rusty plum, some of these threats include:

- Destruction, degradation and fragmentation of forest habitat in coastal areas through clearing, urban development and repeated disturbance.
- Frequent fire.
- Timber harvesting and associated road works.
- Weed invasion, particularly Lantana (NPWS 2002).

Only three (3) mature Rusty plums will be removed resulting from the proposed action. The two (2) remaining mature Rusty plums occur within the Bushfire Asset Protection Zones (APZ) and will be retained.

With the adoption of the amelioration measures recommended in Section 4.2.2.2 it is considered unlikely that the proposed development will cause the local extinction of the Rusty plum.

(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.

Not applicable

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



- (i) *is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or*
- (ii) *is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.*

Not applicable

(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*
- (ii) *whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and*
- (iii) *the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.*

Response to (i)

The optimal habitat for the Rusty plum is Rainforest and the adjacent understorey of moist eucalypt forest (NWPS 2002).

Approximately 2.9 hectares of vegetation is to be lost for the proposed development, of which, only 0.46 hectares is considered to represent suitable habitat. It should be noted that on the subject site Rusty plums currently occur within the open grassland.

Approximately two (2.1) hectares of potential habitat for the Rusty plum will be removed or modified as a result of the proposed development.

Response to (ii)

The proposed development is to occur adjacent to a residential subdivision within an area which is already fragmented. To the north of the site there is a large commercial shopping complex, to the west of the site, habitat is fragmented by the Pacific highway and to the east a large residential sub-division occurs. The subject site does have good connectivity with the forested habitat in the south, which will be retained.

The proposed development will only cause minor fragmentation of habitat within the locality. No areas of habitat will become isolated due to the proposed development.

Response to (iii)

The majority of the vegetation to be removed for the proposed development is not considered to be suitable habitat for the vulnerable Rusty plum. Approximately 2.8 hectares of potential habitat is to be retained on the subject site and will be conserved.



The Rusty plum flowers between September and October, with ripe fruit occurring between September and November. Fruit is red turning black with one (1) seed contained inside. The 2.9 hectares of vegetation that is to be removed is considered to have a low impact on the life cycle of this species.

With the retention of the two (2) mature Rusty plums and the compensatory plantings, the proposed development is unlikely to cause the long-term extinction of the species within the locality.

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

Not applicable

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

No recovery plan has been gazetted for the Rusty plum.

(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 test for part (g) has previously been discussed in Section 5.2.2.2.



5.2.3 Fauna

A Section 5A assessment has been undertaken for each species considered a possible occurrence at the Subject site.

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

Tables showing the distribution, habitat and life cycle requirements of each species considered a possible occurrence at the Subject site are included as **APPENDIX 2**.

5.2.3.1 Barred cuckoo-shrike

Extent of the local population

The NPWS database contained two (2) records of this species within 10 kilometres of the Study area, one of these within 0.5 km of the Subject site.

The NPWS online database contained six (6) sightings of this species in the Coffs Harbour LGA.

Stages of the life-cycle affected by the proposed development

As part of the RFA process, Environment Australia (1999) conducted an analysis of the responses of forest fauna to various forms of land cover disturbance in the North-east region. The analysis identified breeding and sheltering sites for the Barred cuckoo shrike as consisting of low elevation subtropical and littoral rainforest and coastal wet sclerophyll close to fruiting figs with the preferred habitat being a mature canopy. The Barred cuckoo-shrike forages in mature canopy and feeds on fruit and large insects including cicadas and phasmids with other small fruited figs as their preferred food.

The RFA analysis (Environment Australia 1999) ranked the significance of various forms of disturbance for the Barred cuckoo-shrike, with the following results:

1 st order disturbances	Urban development Weed invasion Loss of habitat trees (fig trees) in agricultural land Intensive horticulture
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Vegetation clearance for the residential development in the north of the site is not considered to have a significant impact on this species. Suitable habitat for the Barred cuckoo-shrike will be retained within the 7A zone.

Likelihood of local extinction

The proposed development is unlikely to result in the local extinction of this species.

5.2.3.2 Brown treecreeper

Extent of the local population

The NPWS database contained one (1) record of this species within 10 kilometres of the Study area.



The NPWS online database contained two (2) sightings of this species in the Coffs Harbour LGA.

Stages of the life-cycle affected by the proposed development

This species inhabits dry forests, woodlands and scrub that contain fallen branches as well as River red gums on watercourses and around lakeshores. This species can also be found in paddocks with standing dead timber, stumps and margins of denser wooded areas.

Threats include loss of habitat through clearing, fragmentation of habitat and loss of hollow bearing trees.

The proposed development will result in the loss of 2.9 hectares of vegetation, consisting of mostly grassland with scattered trees. Much of this habitat is considered sub-optimal for this species, with superior habitat occurring to the south and west.

Likelihood of local extinction

The proposed development is unlikely to result in the local extinction of this species.

5.2.3.3 Brush-tailed phascogale

Extent of the local population

The NPWS database contained one (1) records of this species within 10 kilometres of the Study area.

The NPWS online database contained three (3) sightings of this species in the Coffs Harbour LGA.

Stages of the life-cycle affected by the proposed development

As part of the RFA process, Environment Australia (1999) conducted an analysis of the responses of forest fauna to various forms of land cover disturbance in the North-east region. The analysis identified breeding and sheltering sites for the Brush-tailed phascogale as consisting of nests in tree hollows. The Brush-tailed phascogale forages in a broad range of habitats, more common in dry sclerophyll forest and woodlands associated with flatter landscapes where foxes are scarce or absent.

The RFA analysis (Environment Australia 1999) ranked the significance of various forms of disturbance for the Brush-tailed phascogale, with the following results:

1 st order disturbances	Predation by cats Predation - fox Baiting for dingoes Clearing - loss of habitat
2 nd order disturbances	Intensive horticulture - Clearing for tea tree horticulture

The proposed development will result in the loss of 2.9 hectares of vegetation, consisting of mostly grassland with scattered trees. Better habitat for this species occurs within the 7A area and immediately to the south. While the proposed development will result in higher levels of disturbance to appropriate habitat (from visitation), it is not considered to have a significant impact on the Brush-tailed phascogale.

Likelihood of local extinction



The proposed development is unlikely to result in the local extinction of this species.

5.2.3.4 Common blossom bat

Extent of the local population

The NPWS database contained five (5) records of this species within 10 kilometres of the Study area.

The NPWS online database contained eight (8) sightings of this species in the Coffs Harbour LGA.

Stages of the life-cycle affected by the proposed development

As part of the RFA process, Environment Australia (1999) conducted an analysis of the responses of forest fauna to various forms of land cover disturbance in the North-east region. The analysis identified breeding and sheltering sites for Common blossom bat as consisting of subtropical and littoral rainforest. This species breeds twice, in the coastal complex and riverine rainforest in spring and in the coastal complex in autumn. It needs a diverse array of nectivorous plant communities nearby. The Common blossom bat forages in a diverse range of nectar producing plant communities year round; occasionally eating some rainforest fruits.

The RFA analysis (Environment Australia 1999) ranked the significance of various forms of disturbance for the Common blossom bat, with the following results:

1 st order disturbances	Clearing - habitat loss Management burns, including illegal
2 nd order disturbances	Clearing resulting in fragmentation, increasing predation and decreasing food availability Wildfire Apiary Weed invasion Drainage of swamps Sand mining
3 rd order disturbances	Logging of coastal sclerophyll forests with Banksia understorey Aerial spraying of bitou bush
4 th order disturbances	Sand dune disturbance from recreational 4WDs
5 th order disturbances	Barbed wire fences Introduced predators

The proposed development will result in the loss of 2.9 hectares of vegetation, consisting of mostly grassland with scattered trees, including some flowering eucalypt species. Loss of this forage habitat is considered to be relatively minor, considering the availability of other suitable forage resources in the vicinity.

Likelihood of local extinction

The proposed development is unlikely to result in the local extinction of this species.

5.2.3.5 Giant barred frog

Extent of the local population

The NPWS database contained thirty-seven (37) records of this species within 10 kilometres of the Study area.



The NPWS online database contained sixty-three (63) sightings of this species in the Coffs Harbour LGA.

Stages of the life-cycle affected by the proposed development

Giant barred frogs occur within damp leaf litter in rainforests, moist eucalypt forest and nearby eucalypt forest below elevations of 1000 metres. Breeding occurs around shallow, flowing rocky creeks. However, when not breeding, this species may disperse several hundred metres from water sources.

Threats to the species includes:

- Reduction in water quality from sedimentation or pollution
- Changes in water flow
- Reduction of leaf litter and cover of fallen logs through burning
- Timber harvesting and other forestry practices
- Vegetation clearance
- Predation on eggs and tadpoles by introduced fish
- Herbicide use near streams

The creek in the 7A area to the south of the site may constitute sub-optimal habitat for this species. While vegetation within the 7A area will be retained, impacts from the proposed development may include stormwater impacts on the creek. Appropriate stormwater management should minimise the potential for any changes of hydrology. There is also an increased potential for any Giant barred frogs on the site being killed by cars on the access road. Overall, impacts on this species are not considered to be significant.

Likelihood of local extinction

The proposed development is unlikely to result in the local extinction of this species.

5.2.3.6 Glossy Black cockatoo

Extent of the local population

The NPWS database contained sixty-two (62) records of this species within a 10 kilometres of the study area.

The NPWS online database contained one hundred and eighteen (118) sightings of this species within the Coffs Harbour LGA.

Stages of the life cycle affected by the proposed development

As part of the RFA process, Environment Australia (1999) conducted an analysis of the responses of forest fauna to various forms of land cover disturbance in the North-east region. The analysis identified breeding sites for the Glossy black cockatoo as consisting of nests in large trees with large hollows (dead and alive) near streams and within 5-20km of a food source. The Glossy black cockatoo will shelter in stands of tall trees in elevated locations like ridgelines within range of the feeding resource. There is a relationship between roost sites and surface water sites. The Glossy black cockatoo usually forages close to the nest but is capable of travelling up to 20km away. It feeds on adult *Allocasuarina littoralis* and *A. torulosa* with individual trees believed to be selected on the basis of the nitrogen content of seeds. It will occasionally use alternative foods.

The RFA analysis (Environment Australia 1999) ranked the significance of various forms of disturbance for the Glossy black cockatoo, with the following results:



1 st order disturbances	Clearing for agriculture Grazing and associated burning Urban development Logging that reduces age classes of eucalypts and <i>Allocasuarina</i>
3 rd order disturbances	Cats climbing into nests Firewood collection

Some scattered Forest oak occurs around the grasslands on the site, however no evidence of chewed cones was observed, despite some trees being in fruit at the time of the survey. The proposed development will result in the loss of some minor forage trees on the site. It is recommended that these trees be retained, where possible. No suitable nesting trees occur on the site.

Likelihood of local extinction

The proposed development is unlikely to result in the local extinction of this species.

5.2.3.7 Grey-headed flying fox

Extent of the local population

The NPWS database contained thirty-four (34) records of this species within 10 kilometres of the Study area.

The NPWS online database contained fifty-six (56) sightings of this species in the Coffs Harbour LGA and three (3) sightings of this species in the Moonee Beach Nature Reserve.

Stages of the life-cycle affected by the proposed development

As part of the RFA process, Environment Australia (1999) conducted an analysis of the responses of forest fauna to various forms of land cover disturbance in the North-east region. The analysis identified breeding and sheltering sites for the Grey-headed flying fox as consisting of mainly rainforest and moist riparian forest with a complex mosaic of rainforest, swamp and sclerophyll forest resources less than 40-50km from roost. There is high site fidelity with roosts often in riverine rainforest. The Grey-headed flying fox forages in subtropical rainforest with a mosaic of resources - rainforest fruit, nectar and pollen. The Grey-headed flying fox is less restricted to rainforest remnants than the Black flying fox.

The RFA analysis (Environment Australia 1999) ranked the significance of various forms of disturbance for the Grey-headed flying fox, with the following results:

1 st order disturbances	Clearing - habitat loss
2 nd order disturbances	Direct disturbance to camps Drainage of swamps
3 rd order disturbances	Powerlines Logging of Sclerophyll Management burns Shooting
4 th order disturbances	Clearing resulting in fragmentation Wildfire
5 th order disturbances	Disease - lyssavirus Apiary Barbed wire fences



	Weed invasion
6 th order disturbances	Climate change

The proposed development will result in the loss of a small number of trees that provide suitable forage habitat for this species. Eucalypts in the 7A area will be retained. Suitable roosting habitat does not occur on site.

Likelihood of local extinction

This species ranges widely when searching for food, therefore the proposed development is unlikely to result in the local extinction of this species.

5.2.3.8 Koala

Extent of the local population

The NPWS database contained fifty-eight (58) records of this species within 10 kilometres of the Study area.

The NPWS online database contained four hundred and ninety (490) sightings of this species in the Coffs Harbour LGA.

No evidence of Koalas occurring on the site was recorded during the site survey. It is possible that dispersing Koalas move through the site occasionally.

Stages of the life-cycle affected by the proposed development

As part of the RFA process, Environment Australia (1999) conducted an analysis of the responses of forest fauna to various forms of land cover disturbance in the North-east region. The analysis identified feeding sites for Koalas in coastal forested environments (not woodland) as areas with stands with a high diversity of known food trees (three or more) including Tallowwood, Grey gum, Forest oak, Sydney blue gum, Swamp mahogany and Red gums. The Koala shelters in larger trees with big lateral branches (not necessarily food trees). The Koala disperses over any open habitat (including pasture and grassland) as long as scattered trees are present.

The RFA analysis (Environment Australia 1999) ranked the significance of various forms of disturbance for the Koala, with the following results:

1 st order disturbances	Habitat clearing
2 nd order disturbances	Introduced predators - foxes and dogs
3 rd order disturbances	Intensive logging that removes the critical tree size classes from the stand (may be frequent or single and intensive) Logging that fails to retain stems in the 30-80 DBH size class.
4 th order disturbances	Wildfire
5 th order disturbances	Road kills
6 th order disturbances	Disease

Parts of the Subject site have been classified as Secondary and Tertiary Koala Habitat by CHCC. The proposed development will result in the loss of a small number of secondary Koala food trees, notably Blue gum and Pink bloodwood. Blue gum in the 7A area will be retained. No primary food tree species occur on the site. The part of the site to be developed does not represent good quality habitat for Koalas. Retained vegetation on



the site is mostly poor habitat for Koalas, with better habitat to the south and west of the site. However, Koalas may very occasionally pass through the site. The proposed development may have the potential to impact on rare vagrant Koalas on the site from vehicle strike. With the adoption of amelioration measures in Section 4.2.3.2 significant impacts on Koalas will be minimised.

Likelihood of local extinction

The proposed development is unlikely to result in the local extinction of this species.

5.2.3.9 Little bent-wing bat

Extent of the local population

The NPWS database contained four (4) records of this species within 10 kilometres of the Study area.

The NPWS online database contained ten (10) sightings of this species in the Coffs Harbour LGA.

Stages of the life-cycle affected by the proposed development

As part of the RFA process, Environment Australia (1999) conducted an analysis of the responses of forest fauna to various forms of land cover disturbance in the North-east region. The analysis identified breeding sites for Little bent-wing bat as consisting of limestone caves, where it usually occurs in association with the Common bent-wing bat. It congregates in high numbers in maternity roost (in 1000's). It also shelters in a range of artificial structures including culverts, drains, mines etc. The Little bent-wing bat forages on flying insects in forested areas, predominantly swamp forest, moist eucalypt forest, rainforest and some dry forests.

The RFA analysis (Environment Australia 1999) ranked the significance of various forms of disturbance for the Little bent-wing bat, with the following results:

1 st order disturbances	Clearing - habitat loss
2 nd order disturbances	Disturbance to camps/caves by limestone mining (cave collapse, altered air flow, noise, dust etc) and recreational activities.
3 rd order disturbances	Clearing - fragmentation Logging - loss of foraging habitat Frequent burning Altered hydrology/microclimate - old growth-regrowth
4 th order disturbances	Grazing Wildfire Pesticides
5 th order disturbances	Introduced predators

The proposed development will result in the loss of 2.9 hectares of moderate quality forage habitat for this species. Suitable forage habitat will be retained within the 7A area.

Likelihood of local extinction

The proposed development is unlikely to result in the local extinction of this species.



5.2.3.10 Square-tailed kite

Extent of the local population

The NPWS database contained one (1) record of this species within 10 kilometres of the Study area.

The NPWS online database contained seven (7) sightings of this species in the Coffs Harbour LGA and no sightings in the Moonee Beach Nature Reserve.

Stages of the life-cycle affected by the proposed development

As part of the RFA process, Environment Australia (1999) conducted an analysis of the responses of forest fauna to various forms of land cover disturbance in the North-east region. The analysis identified breeding sites for the Square-tailed kite as consisting of nests in tall trees with large branches in tall, open sclerophyll forest and woodland with or adjacent to areas of high densities of passerine birds. It typically occurs on tablelands and coastal plains. The Square-tailed kite forages on a high density of passerine birds, particularly honeyeaters. It will occasionally take lorikeets, quail, pipits and canopy foliage gleaners.

The RFA analysis (Environment Australia 1999) ranked the significance of various forms of disturbance for the Square-tailed kite, with the following results:

1 st order disturbances	Clearing for agriculture
2 nd order disturbances	Grazing and associated burning Logging which increases the structural density through reducing age classes, decreased nectar production Intensive horticulture Nest site loss
3 rd order disturbances	Urban development
4 th order disturbances	Egg collecting

This species forages over a wide area and is may forage over the Study area at times. The proposed development will result in the loss and fragmentation of 2.9 hectares of minor forage habitat for this species. Superior forage habitat occurs to the south and west of the site.

Likelihood of local extinction

The proposed development is unlikely to result in the local extinction of this species.

5.2.3.11 Squirrel glider

Extent of the local population

The NPWS database contained three (3) records of this species within 10 kilometres of the Study area.

The NPWS online database contained eight (8) sightings of this species in the Coffs Harbour LGA.

Stages of the life-cycle affected by the proposed development

As part of the RFA process, Environment Australia (1999) conducted an analysis of the responses of forest fauna to various forms of land cover disturbance in the North-east region. The analysis identified breeding sites for Squirrel glider as tree hollows with a



preference for small hollow entrances. A single study found that densities declined linearly when the abundance of trees with hollows fell below 6/ha (Smith, 1998). The preferred feeding habitat contains winter flowering eucalypts or banksias including Swamp mahogany, Spotted gum, Coast banksia and Swamp paperbark. Probable association with larger trees with high nectar flows. The Squirrel glider shelters in hollow bearing trees.

The RFA analysis (Environment Australia 1999) ranked the significance of various forms of disturbance for the Squirrel glider, with the following results:

1 st order disturbances	Habitat clearing
2 nd order disturbances	High frequency burning
3 rd order disturbances	Intensive logging that removes the critical tree size classes from the stand (may be frequent or single and intensive). Removal of large trees and hollows, includes firewood collection
4 th order disturbances	Apiary - competition for hollows
5 th order disturbances	Introduced predator - foxes, dogs and cats

The proposed development will result in the loss and fragmentation of 2.9 hectares of sub-optimal habitat for this species. Superior habitat occurs to the south and west of the site. Suitable (but marginal) habitat in the 7A area will be retained. It is considered that the proposed development will have relatively little impact on this species.

Likelihood of local extinction

The proposed development is unlikely to result in the local extinction of this species.

5.2.3.12 Stephen's banded snake

Extent of the local population

The NPWS database contained seven (7) records of this species within 10 kilometres of the Study area.

The NPWS online database contained ten (10) sightings of this species in the Coffs Harbour LGA.

Stages of the life-cycle affected by the proposed development

As part of the RFA process, Environment Australia (1999) conducted an analysis of the responses of forest fauna to various forms of land cover disturbance in the North-east region. The analysis identified breeding and sheltering sites for Stephens' banded snake as consisting of nests in stags, strangler figs, creepers and vines, hollow bearing trees, decorticating bark, stumps, rock crevices and slabs and arboreal termitaria in wet and dry sclerophyll forest, woodland and heath and rainforest in low to high elevation. The Stephens' banded snake feeds on small mammals, frogs and lizards in riparian vegetation and water (frogs).

The RFA analysis (Environment Australia 1999) ranked the significance of various forms of disturbance for the Stephens' banded snake, with the following results:

1 st order disturbances	Any fire Grazing and associated burning changes the structure of understorey and ground cover
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2 nd order disturbances	Predation by introduced species Clearing for urban development Logging -changing canopy structure Road-kills
3 rd order disturbances	Clearing for agriculture Clearing - partial for grazing Weed invasion

The proposed development will have little significant impact on this species. Suitable habitat within the 7A area will be retained.

Likelihood of local extinction

The proposed development is unlikely to result in the local extinction of this species.

5.2.3.13 Yellow-bellied glider

Extent of the local population

The NPWS database contained four (4) records of this species within 10 kilometres of the Study area.

The NPWS online database contained twenty-one (21) sightings of this species in the Coffs Harbour LGA.

Stages of the life-cycle affected by the proposed development

As part of the RFA process, Environment Australia (1999) conducted an analysis of the responses of forest fauna to various forms of land cover disturbance in the North-east region. The analysis identified breeding and sheltering sites for Yellow-bellied gliders as consisting of large hollow trees. It requires trees within gliding distance (on flat ground in tall forest >40m. In steep forest, glides may be much longer (up to 300m). Trees may be quite scattered. The Yellow-bellied glider forages in high eucalypt species diversity, winter flowering eucalypts, smooth-barked eucalypts, sap trees. Larger trees have higher nectar/sap yields.

The RFA analysis (Environment Australia 1999) ranked the significance of various forms of disturbance for the Yellow-bellied glider, with the following results:

1 st order disturbances	Intensive logging that removes the critical tree size classes from the stand (may be frequent or single and intensive). Logging that fails to retain a high proportion of large trees and hollows.
2 nd order disturbances	Habitat clearing
3 rd order disturbances	High frequency burning

The proposed development will result in the loss and fragmentation of 2.9 hectares of sub-optimal habitat for this species. Superior habitat occurs to the south and west of the site. Suitable (but marginal) habitat in the 7A area will be retained. It is considered that the proposed development will have relatively little impact on this species.

Likelihood of local extinction

The proposed development is unlikely to result in the local extinction of this species.



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

Twenty six (26) endangered populations have been identified under the TSC Act. The following endangered populations occur in north-eastern NSW:

- Emu population in the NSW North Coast Bioregion and Port Stephens LGA
- *Cryptandra longistaminea* in the vicinity of Ellandgrove Road, South Grafton
- Low growing form of *Zieria smithii*, Diggers Head
- *Glycine clandestina* (Broad-leaf form) in the Nambucca LGA

The proposed development will not affect any of these endangered populations.

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

- (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or*
- (ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.*

Not applicable

(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*
- (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and*
- (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.*

Response to (i)

The proposed development will result in the removal or modification of only 2.9 hectares of vegetation, which approximately 1.6 hectares consists of grassland with scattered trees and is not considered to represent suitable habitat for the threatened fauna species considered a possible occurrence at the subject site.

Approximately 0.4 hectares of Community 1 - Tall mid-dense forest will be removed or modified by the proposed development. Community 1 is considered to represent sub-optimal habitat for a range of threatened fauna including:

- Brown tree creeper
- Common blossom bat
- Brush-tailed phascogale
- Grey headed flying fox



- Little bent winged bat
- Squirrel glider
- Yellow-bellied glider

Approximately 0.006 hectares or 60 square metres of Community 2 - Tall sparse forest will be removed. Approximately 0.029 hectares or 290 square metres of Community 2 will be modified to comply with the requirements for an outer Asset Protection Zone (APZ) under Planning for Bushfire Protection 06(RFS 2006). Community 2 is considered to represent the habitat values required for the threatened fauna listed above and also the Giant Barred frog and Stephens' banded snake.

Response to (ii)

The proposed development is to occur adjacent to a residential subdivision within an area which is already fragmented. To the north of the site there is a large commercial shopping complex, to the west of the site, habitat is fragmented by the Pacific highway and to the east a large residential sub-division occurs. The subject site does have good connectivity with the forested habitat in the south, which will be retained.

The proposed development will only cause minor fragmentation of habitat within the locality. No areas of habitat will become isolated due to the proposed development.

Response to (iii)

The southern portions (7A) of the subject site represent foraging resource and also contain habitat values for a range of threatened fauna listed above. The optimal habitat on the Subject site will be retained and improved through rehabilitation and revegetation which is to be outlined in a Vegetation Management Plan for the Subject site.

The Grassland communities in the north of the Subject site are not considered to represent the habitat which is important to the life cycles (breeding etc) of the threatened species which are a possible occurrence at the subject site

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

Critical habitat areas listed under the Threatened Species Conservation Act (1995) currently consist only of habitat for:

- Mitchell's Rainforest Snail in Stotts Island Nature Reserve - critical habitat declaration
- Little penguin population in Sydney's North Harbour - critical habitat declaration
- Wollemi Pine - critical habitat declaration
- Gould's Petrel - critical habitat declaration

These habitats will not be affected by the proposed development.

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



An Approved recovery plan exists for the Yellow-bellied glider which is considered a possible occurrence on the Subject site. The objectives of this recovery plan are:

- Co-ordinate the recovery of the Yellow-bellied glider in NSW
- Encourage and assist in improving the protection and management of the Yellow-bellied glider and its habitat.
- Identify and monitor significant populations of this species.
- Facilitate strategic research into the ecology of the Yellow-bellied glider that is relevant to its conservation.
- Increase community awareness of the Yellow-bellied glider and encourage community involvement in its conservation.

The Yellow-bellied glider feed tree has previously been recorded adjacent to the Subject site in the south (*Pers comm.* Mark Graham 2004), but was not recorded during this assessment. However, it is considered that this species may occasionally forage over the Study area. No den sites or feeding scars (sap trees) were located at the Subject site. It is considered that the proposed development is consistent with the objectives and actions of the Recovery Plan for the Yellow-bellied glider.

An Approved recovery plan exists for the Square tailed kite which is considered a possible occurrence on the Subject site. The objectives of this recovery plan are:

- Improve the co-operation and co-ordination of recovery efforts between NSW and QLD;
- Review the legal status of the species at a National level;
- Standardise survey methods;
- Increase awareness of the conservation status and threats of the Red Goshawk;
- and
- Identify and protect any known habitat or nest sites that occur in NSW.

No records of the Square-tailed kite were recorded at the subject site, although it is considered a possible occurrence over the subject site for time to time. It is considered that the proposed development is consistent with the objectives and actions of the Recovery Plan for the Square-tailed Kite.

A Draft recovery plan exists for the Koala which is considered a possible occurrence on the Subject site. The objectives of this recovery plan are:

- To conserve Koalas in their existing habitat;
- To rehabilitate and restore Koala habitat and populations;
- To develop a better understanding of the conservation biology of Koalas;
- To ensure that the community has access to factual information about the distribution, conservation and management of Koalas at a national, state and local level;
- To manage captive, sick or injured Koalas and orphaned wild Koalas to ensure consistent and high standards of care; and
- To manage over-browsing to prevent both Koala starvation and ecosystem damage in discreet patches of habitat.



The proposed development will result in some minor loss and fragmentation of habitat for this species. The proposed development will also result in the loss of Secondary Koala habitat as mapped under the CHCC KPOM. Suitable habitat will be retained on the site, however there is the potential of injury or mortality from vehicle strike, or harassment by dogs. A number of amelioration measures have been proposed to satisfy the requirements of the CHCC Koala Plan of Management. It is considered that the proposed development is consistent with the objectives and actions of the Recovery Plan for the Koala.

Two Approved Threat abatement plans have been completed:

- Predation by the Plague Minnow
- Predation by the Red fox

The Plague Minnow has little relevance to the terrestrial fauna considered in this assessment. The occurrence of the Red fox constitutes a threat to ground nesting birds and ground dwelling mammals. No ground dwelling Threatened species were recorded on the site.

(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.

A “threatening process” means a process that threatens, or may have the capability to threaten, the survival or evolutionary development of a species, population or ecological community. Key Threatening Processes have been listed in Schedule 3 of the TSC Act (1995) and are shown in **APPENDIX 3**.

Threatening processes for each species are shown in the species tables in **APPENDIX 2**.

The proposed development will contribute towards the clearing of native vegetation, a key threatening process listed on Schedule 3 of the TSC Act (1995). The final determination of the NSW Scientific Committee notes that clearing of native vegetation is recognised as a major factor contributing to loss of biological diversity, with impacts such as: destruction of habitat; fragmentation of habitat; riparian zone degradation; increased greenhouse gas emissions; increased habitat for invasive species; loss of leaf litter layer; loss or disruption of ecological function (e.g. loss of populations of pollinators or seed dispersers) and changes to soil biota.

The amount of native vegetation to be cleared consists of 2.9 hectares, the majority of which is grassland with scattered trees. Amelioration measures have been recommended to minimise the loss of native vegetation on the Subject site. Clearance of native vegetation will include clearance for building envelopes, access roads, fire buffers and fire trails.

Habitat loss is the main threatening process affecting all Subject species. The Proposed development will make a minor contribution towards the loss of habitat in the region.

On the basis of this assessment, it is considered that a Species Impact Statement (SIS) is not required.



5.3 Koala Habitat Assessment

A Comprehensive Koala Plan of Management (KPoM) was prepared by the NSW NPWS in close consultation with Coffs Harbour City Council (CHCC) under the statutory provisions of SEPP 44 - Koala Habitat Protection. The adoption of the KPoM replaces the requirement under SEPP 44 for developments in Coffs Harbour LGA to address Koala issues individually and sets out a framework for conserving Koalas in Coffs Harbour LGA (Lunney *et al* 1999). The adoption of the KPoM does not negate the responsibility of Council or a proponent considering undertaking a development requiring Council consent to fully consider whether such an activity is likely to result in a significant effect on a threatened species, population or ecological community or their habitat.

The Subject site is mapped as having areas of both Secondary and Tertiary Koala habitat under the Coffs Harbour Koala Plan of Management. This is shown in **FIGURE 8**. Much of the Secondary habitat is contained within the 7A area of the site which will be retained. Vegetation within the remainder of the site generally consists of scattered Brushbox, Blue gum, Pink bloodwood, Red bloodwood and Grey ironbark among grassland or Tall sparse forest or tall mid-dense forest. Due to the lack of primary feed trees, and the patchiness of secondary feed trees occurring on the site, the Koala habitat value for the northern (mostly cleared) half of the site where the proposed development is to occur is considered to be Tertiary, rather than the value ascribed by CHCC mapping.

Secondary Koala Habitat includes areas that generally have lower koala activity levels than those in primary habitat, but do support many koala populations particularly away from coastal areas. The KPoM notes that secondary habitat is important to dispersing and juvenile koalas, provides seasonal and drought foraging habitat and may act as fire refuges.

The aim of the Coffs Harbour Koala Plan of Management (KPoM) in relation to Secondary Habitat is:

“To minimise further loss, fragmentation or isolation of existing secondary koala habitat and the creation of barriers to koala movement and, where appropriate, to encourage restoration of koala habitat.”

The consent authority shall not grant consent to the carrying out of development in areas identified as Secondary Koala Habitat unless it is satisfied that:

- the proposal will not result in significant barriers to koala movement;
- boundary fencing does not prevent the free movement of koalas;
- lighting and koala exclusion fencing is provided where appropriate on roadways adjacent to koala habitat;
- tree species listed above under Secondary Koala Habitat are retained, where possible;
- new local roads are designed to reduce traffic speed to 40 kph in potential koala blackspots;
- preferred koala trees are used in landscaping where suitable;
- threats to koalas by dogs have been minimised i.e. banning of dogs or confining of dogs to koala proof yards;



- fire protection zones, including fuel reduced zones and radiation zones, are provided generally outside of Secondary Koala Habitat.

In addition Koala habitat trees identified in the Coffs Harbour CKPOM are protected under the local Tree Preservation Order. Any of these trees required to be removed for development must be replaced in the vicinity according to the “*Guidelines for Planting Koala Trees In Coffs Harbour LGA*” contained in the Coffs Harbour CKPOM.

Tertiary Koala Habitat supports lower koala activity levels than Primary Koala Habitat, and occurs predominantly within rural parts of Coffs Harbour LGA. Threats to Koalas in these areas are usually linked to agricultural activities such as clearing or selective logging, which has the potential to impact on Koalas from the removal of key resource trees.

The aim of the Coffs Harbour Koala Plan of Management (KPOM) in relation to Tertiary Habitat is:

“ To protect koalas and their habitat within the rural areas of the LGA by encouraging minimal removal or disturbance to preferred koala tree species and reducing barriers to koala movement”.

The consent authority shall not grant consent to the carrying out of development in areas identified as Tertiary Koala Habitat unless the proposal demonstrates that appropriate measures are taken to:

- minimise barriers to koala movement;;
- reduce the risk of koala mortality by road kill by appropriate road design, lighting and traffic speed limits;
- minimise the removal of koala tree species listed under Tertiary Koala Habitat;
- provide preferred koala trees in landscaping where suitable;
- minimise threats to koalas by dogs i.e. banning of dogs or confining of dogs to koala proof yards;
- minimise removal or disturbance of Tertiary Koala Habitat in fire protection zones, including fuel reduced zones and radiation zones.

Impacts on Koalas have been discussed in Section 4 of this report. Amelioration measures have been recommended to satisfy the requirements of the Coffs Harbour KPOM.



5.4 Commonwealth Environment Protection and Biodiversity Conservation Act (1999)

5.4.1 Introduction

The *Environment Protection & Biodiversity Conservation (EPBC) Act (1999)* was passed by Commonwealth Parliament in June 1999 and came into force on 16 July, 2000. A person must not, without an approval under the Act, take an action that has or will have, or is likely to have, a significant impact on a matter of National Environmental Significance (NES). These matters are listed as:

- (a) the world heritage values of a declared World Heritage property;
- (b) the ecological character of a declared Ramsar wetland;
- (c) a threatened species or endangered community listed under the Act;
- (d) a migratory species listed under the Act; or
- (e) the environment in a Commonwealth marine area or on Commonwealth land.

The Act also prohibits the taking, without an approval under the Act, of:

- (a) a nuclear action; or
- (b) an action in a Commonwealth marine area or on Commonwealth land that has or will have, or is likely to have, a significant impact on the environment.

An action includes a project, development, undertaking or an activity or series of activities. An action does not require approval if it is a lawful continuation of a use of land, sea or seabed that was occurring before the commencement of the Act. An enlargement, expansion or intensification of a use is not a continuation of a use.

The *EPBC Act (1999)* does not require Commonwealth approval for the rezoning of land. It does, however, suggest that when rezoning land, planning authorities should consider whether to allow actions that could significantly affect NES matters or the environment of Commonwealth land.

Matters of NES in NSW are:

- (a) Declared World Heritage Areas;
- (b) Declared Ramsar Wetlands;
- (c) Listed Threatened Species (Schedule 1 and 2 of Commonwealth Endangered Species Protection Act 1992);
- (d) Listed Ecological Communities in Queensland; and
- (e) Listed migratory species (JAMBA and CAMBA).

5.4.2 Occurrence of Matter of NES on Subject Site

5.4.2.1 Background



A Commonwealth Assessment will be required for proposed activities on the subject site if they affect a matter of NES. Matters of NES in NSW were identified in the previous section. There are no declared World Heritage Areas or Ramsar Wetlands in the locality, study area or subject site.

5.4.2.2 Listed Threatened Species

One (1) Commonwealth Threatened flora species were recorded on the subject site - Moonee Quassia (*Quassia sp Mooney Creek*). With the implementation of the Amelioration measures listed in Section 4.2.2.2. The proposed development will not affect the current population of this species.

One (1) Commonwealth Threatened fauna species, Grey-headed flying-fox (*Pteropus poliocephalus*) is considered a possible occurrence on the subject site. Regeneration and rehabilitation of vegetation along the creek will assist in increasing the habitat value for these species.

5.4.2.3 Listed Ecological Communities

None of the ecological communities currently listed in the *EPBC Act (1999)* occur in the study area or wider locality.

5.4.2.4 Listed Migratory Species

Listed migratory species in Queensland are considered predominantly in the Japan-Australia Migratory Bird Agreement (JAMBA) and China-Australia Migratory Bird Agreement (CAMBA).

No listed migratory species were recorded on the subject site.

5.4.3 Assessment against EPBC Act Principal Significant Impact Guidelines

5.4.3.1 Background

The Commonwealth DEH has prepared EPBC Act Policy Statements, including the EPBC Act - Principal Significant Impact Guidelines 1.1 (2005) which outline a self-assessment process to assist in determining whether an action should be referred to the Department for a decision on whether assessment and approval is required under the Act. The following sections assess the proposed development (the action) against these guidelines.

5.4.3.2 Critically Endangered and Endangered Species

Significant Impact Criteria



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

- lead to a long-term decrease in the size of a population; or
- reduce the area of occupancy of the species; or
- fragment an existing population into two or more populations; or
- adversely affect habitat critical to the survival of a species; or
- disrupt the breeding cycle of a population; or
- modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline; or
- result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat; or
- interfere with the recovery of the species.

Assessment of Proposed Action

The subject site does contain habitat for populations of Endangered species listed in the *EPBC Act (1999)* however, with implementation of the amelioration listed in Section 4.2 a significant impact on such species will not be incurred.

5.4.3.3 Vulnerable Species

Significant Impact Criteria

An action has, will have, or is likely to have a significant impact on a vulnerable species if it does, will, or is likely to:

- lead to a long-term decrease in the size of an important population of a species; or
- reduce the area of occupancy of an important population; or
- fragment an existing important population into two or more populations; or
- adversely affect habitat critical to the survival of a species; or
- disrupt the breeding cycle of an important population; or
- modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline; or
- result in invasive species that are harmful a vulnerable species becoming established in the vulnerable species' habitat; or
- interferes substantially with the recovery of the species.

An important population is one that is necessary for a species' long-term survival and recovery. This may include populations that are:

- key source populations either for breeding or dispersal;
- populations that are necessary for maintaining genetic diversity; and/or
- populations that are near the limit of the species range.



Assessment of Proposed Action

The subject site does contain habitat for populations of vulnerable species listed in the *EPBC Act (1999)* however, a significant impact on such species will not be incurred.

5.4.3.4 Migratory Species

Significant Impact Criteria

An action has, will have, or is likely to have a significant impact on a migratory species if it does, will, or is likely to:

- 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; or
- result in invasive species that is harmful to the migratory species becoming established* in an area of important habitat of the migratory species; or
- seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of the species.

(* Introducing an invasive species into the habitat may result in that species becoming established. An invasive species may harm a migratory species by direct competition, modification of habitat, or predation.)

An area of important habitat is:

1. habitat utilised by a migratory species occasionally or periodically within a region that supports an *ecologically significant proportion* of the population of the species, or
2. habitat utilised by a migratory species which is at the limit of the species range, or
3. habitat within an area where the species is declining.

Assessment of Proposed Action

A number of listed migratory species are known or likely to occur occasionally in the study area. The proposed development will not remove, or damage important habitat for these species.

5.4.3.5 Wetlands of International Importance

Significant Impact Criteria



An action is likely to have a significant impact on the ecological character of a declared Ramsar wetland if there is a real chance or possibility that it will result in:

- areas of the wetland being destroyed or substantially modified, or
- a substantial and measurable change in the hydrological regime of the wetland for example, a substantial change to the volume, timing, duration and frequency of ground and surface water flows to and within the wetland, or
- the habitat or lifecycle of native species, including invertebrate fauna and fish species, dependant upon the wetland being seriously affected, or
- a substantial and measurable change in the water quality of the wetland for example, a substantial change in the level of salinity, pollutants, or nutrients in the wetland, or water temperature which may adversely impact on biodiversity, ecological integrity, social amenity or human health, or
- an invasive species that is harmful to the ecological character of the wetland being established in the wetland.

Assessment of Proposed Action

No Wetlands of International Importance occur in the locality of the subject site.

5.4.3.6 Requirement for Commonwealth Referral

Based on the assessment provided above, Referral to the Commonwealth DEH is not required. The proposed action is unlikely to result in a significant impact on any matter of NES.

5.4.4 Requirement for Commonwealth Assessment

On the basis of the above assessment, it is concluded that Commonwealth Assessment is not required for the proposed development of the subject site.



6 SUMMARY AND CONCLUSIONS

James Warren and Associates have been engaged Ian Maher Town Planning to complete a Flora and Fauna Assessment for Lot 211 DP 1044292 Pacific Highway, Moonee.

The assessment has involved the following:

- Mapping and ground truthing vegetation units and determining their conservation status.
- Searching for and recording Threatened and regionally significant plant species.
- Determining the suite of Threatened fauna that occurs in the locality.
- Completion of a fauna survey program.
- Assessing habitat provided by the site in relation to adjacent habitat and making an assessment of the corridor value of the site.
- Addressing statutory requirements including State Environmental Planning Policy No. 44 (SEPP 44 - Koala Habitat Protection), Section 5A of the Environmental Planning & Assessment Act (1979) and the Commonwealth EPBC Act (1999).

The Subject site covers an area of approximately 5.749 hectares. A road reserve runs north-south through the western half of the site. Much of the site has been cleared and is maintained by periodic slashing. Patches of trees occur amongst this cleared community. The south of the site is zoned 7A (Environmental Protection) and consists of Wet sclerophyll forest with rainforest elements flanking a small creek.

The southern half of the site is contained within one lot (Lot 22), and consists of 7A zoned Environmental Protection land which may be later acquired by Coffs Harbour City Council.

The remaining northern part of the Subject site is zoned 2A Residential Low Density, with the Petting Park Boarding Kennel (included within the site) zoned 3G (Business Mixed Use).

The Proposed development consists of a community title subdivision with associated dwellings to be concentrated in the northern half of the Subject site. Road access will be provided from Woodhouse Road and a constructed collector road in the west of the subject site.

A site survey was completed at the Subject site on the June 3rd 2004 and February 20th 2007. The site was comprehensively surveyed and a general plant species list was compiled.

One hundred and fifty-four (154) flora species were recorded at the Subject site. Two (2) threatened species were recorded;

- Moonee Quassia (*Quassia* sp. 'Moonee Creek') was recorded on the site. This species is classified as Endangered under the Threatened Species Conservation Act (TSC Act 1995).



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- Rusty Plum (*Niemeyera whitei*) is classified as Vulnerable under the Threatened Species Conservation Act (TSC Act 1995).

Five (5) vegetation communities were identified on the Subject site, the majority of which is grassland with scattered trees. Tall mid-dense forest (*Lophostemon confertus*, *Eucalyptus siderophloia*) on the site is best described by Forest Ecosystem 106 (Open Coastal Brushbox) under the CRA (1999) classification, while Tall sparse forest (*Lophostemon confertus*, *Eucalyptus saligna*, *Cryptocarya obovata*) is best described by Forest Ecosystem 103 (Northern Wet Brushbox). Neither of these vegetation communities are considered rare, endangered or vulnerable.

The Subject site contains vegetation communities of 'medium', 'high' and 'very high' ecological significance according to the Coffs Harbour Draft Vegetation Management plan. Most significant vegetation ('high' and 'very high') on the site occurs in the southern half of the site zoned 7A Environmental protection. Some of the 'high' significance areas mapped by CHCC do not concur with ground truthed vegetation communities mapped by the survey.

Fauna recorded on the site included twenty (20) bird species and two (2) mammal species. No Threatened species were recorded. A full fauna survey was completed earlier in 2003 at a site approximately 1 kilometre to the north-east of the Subject site, and recorded three (3) Threatened bird species (Osprey, Pied oystercatcher and Glossy black cockatoo) and three (3) Threatened mammal species (Grey-headed flying fox, Little bentwing bat and Southern myotis). The results of this study were utilised in the assessment of flora and fauna occurring in the Study area.

The Subject site is mapped as having areas of both Secondary and Tertiary Koala habitat under the Coffs Harbour Koala Plan of Management. No primary Koala feed trees occur on the Subject site, and Koalas were not recorded on the site from the survey.

The proposed development will result in the loss of 2.9 hectares of vegetation, the majority of which is grassland with scattered trees. Of significance is the occurrence of the two threatened species;

- Endangered Moonee Quassia, which occurs within a lot (Lot 23) designated as a future road in the western half of the site.
- Vulnerable Rusty plum, which occurs within proposed lot 20.

Fifteen (15) stems of the Moonee quassia occur, these shrubs been surveyed by JWA using a hand held G.P.S. The proposed development will result in the loss of approximately ten (10) of the Moonee quassia which currently occur on the subject site. Loss of vegetation around the remaining Moonee Quassia will leave the remaining vegetation (and Moonee Quassia) more susceptible to edge effects such as: increased light, exposure and disturbance, greater susceptibility to weed invasion, and alteration of microclimate.



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The proposed development will result in the loss of two (2) mature Rusty plums for the construction of town-houses and access roads. The majority of the Rusty plums occur within Bushfire Asset Protection Zone (APZ) and will be retained.

Other impacts on flora include:

- Disturbance to the Subject site creates opportunities for weeds to colonise. Weeds may be introduced to the Study site in construction materials or by vehicles. Occupation of the Subject site creates opportunities for weeds to become established. Landscape species may escape to retained areas of vegetation.
- The removal of vegetation from the Subject site represents the loss of organic material from the site.
- Clearance of areas of the Subject site represents a loss of habitat available for dispersal for plants and will reduce visits by pollination and dispersal vectors.
- Visitation to the 7A section of the site may result in creation of walking tracks and disturbance to flora.

Impacts on fauna include:

- The Proposed development will require the clearance of native vegetation. This represents a loss of habitat for a range of native reptiles, birds and mammals and, to a lesser extent, amphibians.
- Loss of sub-mature eucalypts represents a decrease in the future recruitment of hollows.
- Loss of eucalypts decreases the food supply for nectarivores.
- Animals may be killed or injured during the clearance of vegetation.
- Domestic dogs and cats prey on native fauna and may have significant impacts on the populations of native species.
- Development of the Subject site may favour native and introduced disturbance adapted competitors.
- Increased light, noise and activity may cause reclusive species to move away from habitat edges.
- The Proposed development will result in an increase in traffic in the Study area. This increases the likelihood of animals being killed or injured by vehicles.
- Disturbance to fauna in 7A communities may occur from resident visitation.

The proposed development will contribute toward the loss of some secondary Koala habitat in the locality as mapped by CHCC. No Koalas were recorded on the site.

Other impacts associated with the proposed development involve stormwater and effluent disposal on the Subject site. Increased inputs to the creek on the site may compromise water quality and result in siltation or nutrient loading.

Impacts on the connectivity of the site are considered to be relatively insignificant, due to future urban development in the north, while connectivity with habitat in the south will be retained.



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It is recommended that a Vegetation Management Plan be developed as a condition of consent. The Vegetation Management Plan is to contain, a species list and planting layout for the revegetation zones, a weed control plan and a detailed description of the maintenance and monitoring that will be completed.

Other amelioration measures include:

- Retention of mature trees (Brushbox, Blue gum) within grassland areas where possible.
- Six (6) areas of grassland will be converted into revegetation zones and rehabilitated into wet sclerophyll forest;
- A program of bush regeneration will control weed species and complement existing vegetation by allowing natural regeneration on the site. A program of planting will also serve to further extend the existing vegetation on the site and reduce edge effects.
- It is further recommended that weed infestation to the south of the site (Lantana, Winter Senna) be controlled, and this area be regenerated.
- Weeds should be controlled during construction.
- Vegetation removed during construction should be mulched for use on the site. This will prevent the introduction of weeds from seeds in mulch brought in from elsewhere.
- Weeds should be controlled in landscaped areas and areas of retained vegetation.
- Known environmental weeds (e.g. Umbrella tree) should be avoided.
- Landscape plantings should include a majority of species that will provide forage habitat for nectarivorous and frugivorous birds and bats.
- Professional bush regenerators are to be engaged to control weeds and implement the planting program within the revegetation zones.

The most significant flora amelioration issue is the occurrence of the Threatened Moonee Quassia and Rusty plums on the site.

Prior to earthworks/clearing it is recommended that the Moonee quassia and the Rusty plums to be retained are clearly fenced off to minimise the possibility of any damage or removal.

Any Moonee quassias and the Rusty plums that are removed as a result of the proposed development will be replaced within the six (6) rehabilitation areas. Replacement will occur at a ratio of five (5) new plants for every one (1) which is lost.

While vegetation clearance for the proposed development will result in some loss of habitat for fauna utilising the site, this will be relatively minimal, with the best quality habitat on the site being retained.

The following amelioration measures apply:

- Landowners should control dogs and cats. All animals should reside within fenced enclosures and be on a leash when outside of the enclosure.
- Appropriate disposal of rubbish and food scraps reduces opportunities for non-native predators and disturbance adapted competitors.



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- Landscape and landfill materials should be sourced from a supplier where Cane toads do not occur.
- 40 km/hr speed limit to be imposed on internal access roads.

Amelioration measures for the Koala have been based on the need to address the requirements for Secondary Koala Habitat within Coffs Harbour shire. The proposed development will not result in the loss of any of the tree species listed in the KPOM for secondary Koala habitat (Tallowwood, Swamp mahogany, Flooded gum, Forest red gum or Small-fruited grey gum).

It is recommended that:

- Traffic speeds be reduced to 40kph within the development.
- Compensatory Koala habitat trees be planted within road reserves or elsewhere outside the development envelope for any Koala habitat trees removed.
- Dogs should be strictly controlled within the proposed development.
- Swimming pools should be fenced to restrict access by Koalas.

It is unlikely that Koala feed trees will be retained within the development envelope and it is not considered desirable that Koalas be able to access or move through areas of the site. This is particularly so given the limitations of property to the north, and the urban context of the locality.

A Section 5A assessment was completed for two (2) Threatened flora species Moonee Quassia and the Rusty plum.

The assessment concluded that any development of Lot 23 (where the Quassia occur) is likely to have a significant impact on this population, and may result in the extinction of this species from the Study area. Transplanting of recorded specimens into protected habitat (such as that found in the six (6) revegetation zones) will be necessary.

A Section 5A assessment was completed for thirteen (13) Threatened fauna species considered a possible occurrences in the Study area over time.

The assessment concluded that the impacts of the Proposed development would be unlikely to result in the local extinction of any of these flora or fauna species. A Species Impact Statement is not required.

An assessment under the Commonwealth Environment Protection and Biodiversity Conservation Act (1999) concluded that with the implementation of the amelioration measures, the Proposed development will not have a significant impact on any matters of National Environmental Significance. Commonwealth assessment of the proposal is therefore not required.



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APPENDIX 1

PLANT SPECIES LIST

	Grouping and Family	Botanical Name	Common Name
Ferns and Fern Allies	Adiantaceae	<i>Adiantum aethiopicum</i>	Common maidenhair
Ferns and Fern Allies	Blechnaceae	<i>Blechnum indicum</i>	Swamp water fern
Ferns and Fern Allies	Blechnaceae	<i>Doodia aspera</i>	Prickly rasp fern
Ferns and Fern Allies	Blechnaceae	<i>Doodia media</i>	Common rasp fern
Ferns and Fern Allies	Cyatheaceae	<i>Cyathea</i> spp.	
Ferns and Fern Allies	Dennstaedtiaceae	<i>Pteridium esculentum</i>	Bracken fern
Ferns and Fern Allies	Lindsaeaceae	<i>Lindsaea</i> spp.	
Gymnosperms	Pinaceae	<i>Pinus elliotii</i> *	Slash pine
Monocotyledons		<i>Monstera deliciosa</i>	
Monocotyledons	Arecaceae	<i>Archontophoenix cunninghamiana</i>	Bangalow palm
Monocotyledons	Arecaceae	<i>Cocos nucifera</i>	Cocos palm
Monocotyledons	Asparagaceae	<i>Asparagus</i> sp.	Ground asparagus fern
Monocotyledons	Asteliaceae	<i>Cordyline rubra</i>	Red fruited palm lily
Monocotyledons	Commelinaceae	<i>Commelina cyanea</i>	Native wandering jew
Monocotyledons	Cyperaceae	<i>Gahnia</i> spp.	Saw sedge
Monocotyledons	Dioscoraceae	<i>Dioscorea transversa</i>	Native yam
Monocotyledons	Flagellariaceae	<i>Flagellaria indica</i>	Whip vine
Monocotyledons	Juncaceae	<i>Juncus</i> spp.	
Monocotyledons	Lomandraceae	<i>Lomandra hystrix</i>	Matrush
Monocotyledons	Lomandraceae	<i>Lomandra longifolia</i>	Spiny-headed matrush
Monocotyledons	Lomandraceae	<i>Lomandra obliqua</i>	
Monocotyledons	Luzuriagaceae	<i>Eustrephus latifolius</i>	Wombat berry
Monocotyledons	Luzuriagaceae	<i>Geitonoplesium cymosum</i>	Scrambling lily
Monocotyledons	Phormiaceae	<i>Dianella caerulea</i>	Blue flax lily
Monocotyledons	Phormiaceae	<i>Dianella revoluta</i>	
Monocotyledons	Poaceae	<i>Andropogon virginicus</i> *	Whiskey grass
Monocotyledons	Poaceae	<i>Chloris gayana</i> *	Rhodes grass
Monocotyledons	Poaceae	<i>Echinopogon</i> sp.	
Monocotyledons	Poaceae	<i>Entolasia</i> sp.	
Monocotyledons	Poaceae	<i>Imperata cylindrica</i>	Blady grass



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	Grouping and Family	Botanical Name	Common Name
Monocotyledons	Poaceae	<i>Oplismenus imbecillis</i>	Basket grass
Monocotyledons	Poaceae	<i>Paspalum dilatatum</i>	Broad leaved paspalum
Monocotyledons	Poaceae	<i>Sporobolus africanus</i>	Parramatta grass
Monocotyledons	Ripogonaceae	<i>Ripogonum discolor</i>	Prickly supplejack
Monocotyledons	Ripogonaceae	<i>Ripogonum</i> sp.	Supplejack
Monocotyledons	Smilacaceae	<i>Smilax australis</i>	Austral sarsparilla
Dicotyledons	Apiaceae	<i>Centella asiatica</i>	Pennywort (Gotu kola)
Dicotyledons	Apocynaceae	<i>Melodinus australis</i>	Southern melodinus
Dicotyledons	Apocynaceae	<i>Tabernaemontana pandacaqui</i>	Banana bush
Dicotyledons	Araliaceae	<i>Polyscias elegans</i>	Celerywood
Dicotyledons	Araliaceae	<i>Polyscias murrayi</i>	Pencil cedar
Dicotyledons	Araliaceae	<i>Polyscias sambucifolia</i>	Elderberry panax
Dicotyledons	Araliaceae	<i>Schefflera actinophylla</i> *	Umbrella tree
Dicotyledons	Asclepiadaceae	<i>Araujia sericifera</i> *	Moth vine
Dicotyledons	Asclepiadaceae	<i>Gomphocarpus physocarpus</i> *	Balloon cotton bush
Dicotyledons	Asteraceae	<i>Ageratina adenophora</i> *	Crofton weed
Dicotyledons	Asteraceae	<i>Ageratum houstonianum</i> *	Blue billygoat weed
Dicotyledons	Asteraceae	<i>Ambrosia artemisiifolia</i> *	Annual ragweed
Dicotyledons	Asteraceae	<i>Bidens pilosa</i> *	Cobblers pegs
Dicotyledons	Asteraceae	<i>Onopordum acanthium</i> *	Scotch thistle
Dicotyledons	Asteraceae	<i>Sigesbeckia orientalis</i>	Indian Weed
Dicotyledons	Asteraceae	<i>Taraxacum officinale</i> *	Dandelion
Dicotyledons	Asteraceae	<i>Tithonia</i> spp.	Japanese sunflower
Dicotyledons	Asteraceae	<i>Wedelia trilobata</i> *	Singapore daisy
Dicotyledons	Bignoniaceae	<i>Pandorea baileyana</i>	Large-leaved wonga vine
Dicotyledons	Bignoniaceae	<i>Pandorea jasminoides</i>	Bower vine
Dicotyledons	Caesalpinioidae	<i>Senna coluteoides</i> *	Winter senna
Dicotyledons	Capparaceae	<i>Capparis arborea</i>	Capparis
Dicotyledons	Casuarinaceae	<i>Allocasuarina torulosa</i>	Forest oak
Dicotyledons	Casuarinaceae	<i>Casuarina glauca</i>	Swamp oak
Dicotyledons	Celastraceae	<i>Hedraianthera porphyropetala</i>	Hedraianthera
Dicotyledons	Cunoniaceae	<i>Aphanopetalum resinosum</i>	Gum vine
Dicotyledons	Dilleniaceae	<i>Hibbertia scandens</i>	Climbing guinea flower
Dicotyledons	Elaeocarpaceae	<i>Elaeocarpus obovatus</i>	Hard quandong



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	Grouping and Family	Botanical Name	Common Name
Dicotyledons	Epacridaceae	<i>Trochocarpa laurina</i>	Tree heath
Dicotyledons	Escalloniaceae	<i>Abrophyllum omans</i>	Native hydrangea
Dicotyledons	Euphorbiaceae	<i>Breynia oblongifolia</i>	Coffee bush
Dicotyledons	Euphorbiaceae	<i>Bridelia exaltata</i>	Brush ironbark
Dicotyledons	Euphorbiaceae	<i>Claoxylon australe</i>	Brittlewood
Dicotyledons	Euphorbiaceae	<i>Croton verrauxii</i>	Native carscarilla
Dicotyledons	Euphorbiaceae	<i>Glochidion ferdinandi</i> var. <i>ferdinandi</i>	Cheese tree
Dicotyledons	Fabaceae	<i>Erythrina x sykesii</i> *	Coral tree
Dicotyledons	Flacourtiaceae	<i>Scolopia braunii</i>	Flintwood
Dicotyledons	Lauraceae	<i>Cinnamomum camphora</i> *	Camphor laurel
Dicotyledons	Lauraceae	<i>Cryptocarya erythroxylon</i>	Pigeonberry ash
Dicotyledons	Lauraceae	<i>Cryptocarya glaucescens</i>	Jackwood
Dicotyledons	Lauraceae	<i>Cryptocarya microneura</i>	Murrogun
Dicotyledons	Lauraceae	<i>Cryptocarya obovata</i>	Pepperberry tree
Dicotyledons	Lauraceae	<i>Endiandra muelleri</i>	Green-leaved rose walnut
Dicotyledons	Lauraceae	<i>Neolitsea australiensis</i>	Green bolly gum
Dicotyledons	Lauraceae	<i>Neolitsea dealbata</i>	White bolly gum
Dicotyledons	Lobeliaceae	<i>Pratia purpurascens</i>	Whiteroot
Dicotyledons	Malvaceae	<i>Sida rhombifolia</i> *	Paddy's lucerne
Dicotyledons	Meliaceae	<i>Dysoxylum fraserianum</i>	Rosewood
Dicotyledons	Meliaceae	<i>Dysoxylum mollissimum</i> ssp. <i>Molle</i>	Red bean
Dicotyledons	Meliaceae	<i>Synoum glandulosum</i> subsp. <i>Glandulosum</i>	Scentless rosewood
Dicotyledons	Meliaceae	<i>Toona ciliata</i>	Red cedar
Dicotyledons	Menispermaceae	<i>Stephania aculeata</i>	Prickly snake vine
Dicotyledons	Menispermaceae	<i>Stephania japonica</i>	Snake vine
Dicotyledons	Mimosaceae	<i>Acacia floribunda</i>	Gossamer wattle (White sally)
Dicotyledons	Mimosaceae	<i>Acacia longifolia</i>	Sydney golden wattle
Dicotyledons	Mimosaceae	<i>Acacia melanoxylon</i>	Blackwood wattle
Dicotyledons	Mimosaceae	<i>Acacia obtusifolia</i>	
Dicotyledons	Mimosaceae	<i>Archidendron grandiflorum</i>	Lace flower tree
Dicotyledons	Monimiaceae	<i>Wilkiea austroqueenslandica</i>	Smooth wilkiea
Dicotyledons	Monimiaceae	<i>Wilkiea huegeliana</i>	Veiny wilkiea
Dicotyledons	Moraceae	<i>Ficus coronata</i>	Creek sandpaper fig
Dicotyledons	Moraceae	<i>Ficus watkinsiana</i>	Strangler fig



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	Grouping and Family	Botanical Name	Common Name
Dicotyledons	Moraceae	<i>Maclura cochinchinensis</i>	Cockspur
Dicotyledons	Moraceae	<i>Trophis scandens</i>	Burney vine
Dicotyledons	Myrsinaceae	<i>Embelia australiana</i>	Embelia
Dicotyledons	Myrsinaceae	<i>Rapanea variabilis</i>	Muttonwood
Dicotyledons	Myrtaceae	<i>Acmena smithii</i>	Lilly pilly
Dicotyledons	Myrtaceae	<i>Callistemon citrinus</i>	Crimson bottlebrush
Dicotyledons	Myrtaceae	<i>Callistemon salignus</i>	Willow bottlebrush
Dicotyledons	Myrtaceae	<i>Corymbia gummifera</i>	Red bloodwood
Dicotyledons	Myrtaceae	<i>Corymbia intermedia</i>	Pink bloodwood
Dicotyledons	Myrtaceae	<i>Eucalyptus saligna</i>	Sydney Blue Gum
Dicotyledons	Myrtaceae	<i>Eucalyptus siderophloia</i>	Northern grey ironbark
Dicotyledons	Myrtaceae	<i>Lophostemon confertus</i>	Brushbox
Dicotyledons	Myrtaceae	<i>Melaleuca bracteata</i>	
Dicotyledons	Myrtaceae	<i>Melaleuca quinquenervia</i>	Broad-leaved paperbark
Dicotyledons	Myrtaceae	<i>Rhodamnia rubescens</i>	Scrub turpentine
Dicotyledons	Myrtaceae	<i>Rhodomyrtus psidiodes</i>	Native guava
Dicotyledons	Myrtaceae	<i>Syzygium luehmannii</i>	Riberry
Dicotyledons	Myrtaceae	<i>Syzygium oleosum</i>	Blue lilly pilly
Dicotyledons	Myrtaceae	<i>Tristanopsis laurina</i>	Water gum
Dicotyledons	Ochnaceae	<i>Ochna serrulata</i>	Mickey-mouse plant
Dicotyledons	Oleaceae	<i>Notelaea longifolia</i>	Large mock olive
Dicotyledons	Oleaceae	<i>Notelaea ovata</i>	
Dicotyledons	Oleaceae	<i>Notelaea venosa</i>	Smooth mock olive
Dicotyledons	Passifloraceae	<i>Passiflora</i> sp.	Wild passionfruit
Dicotyledons	Passifloraceae	<i>Passiflora subpeltata</i>	White passionflower
Dicotyledons	Phytolacaceae	<i>Phytolacca octandra</i> *	Inkweed
Dicotyledons	Pittosporaceae	<i>Pittosporum revolutum</i>	Hairy pittosporum
Dicotyledons	Pittosporaceae	<i>Pittosporum undulatum</i>	Sweet pittosporum
Dicotyledons	Rhamnaceae	<i>Alphitonia excelsa</i>	Red ash
Dicotyledons	Rosaceae	<i>Rubus parvifolius</i>	Native raspberry
Dicotyledons	Rubiaceae	<i>Morinda acutifolia</i>	
Dicotyledons	Rubiaceae	<i>Morinda jasminoides</i>	Morinda
Dicotyledons	Rubiaceae	<i>Psychotria loniceroides</i>	Hairy psychotria
Dicotyledons	Rutaceae	<i>Acronychia oblongifolia</i>	Common acronychia
Dicotyledons	Rutaceae	<i>Flindersia schottiana</i>	Cudgerie
Dicotyledons	Rutaceae	<i>Melicope elleryana</i> (formerly <i>Pink euodia</i>)	Pink-flowered doughwood
Dicotyledons	Rutaceae	<i>Sarcomelicope simplicifolia</i> subsp. <i>Simplicifolia</i>	Big yellow wood



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	Grouping and Family	Botanical Name	Common Name
Dicotyledons	Sapindaceae	<i>Cupaniopsis anacardioides</i>	Tuckeroo
Dicotyledons	Sapotaceae	<i>Niemeyera whitei</i>	Rusty Plum
Dicotyledons	Sapindaceae	<i>Elattostachys nervosa</i>	Green tamarind
Dicotyledons	Sapindaceae	<i>Guioa semiglauc</i>	Guioa
Dicotyledons	Sapindaceae	<i>Jagera pseudorhus</i>	Foambark
Dicotyledons	Sapindaceae	<i>Mischocarpus australis</i>	Red pear fruit
Dicotyledons	Sapindaceae	<i>Sarcopteryx stipitata</i>	Steelwood
Dicotyledons	Simaroubaceae	<i>Quassia</i> sp. 'Moonee Creek'	Moonee Quassia
Dicotyledons	Solanaceae	<i>Duboisia myoporoides</i>	Duboisia
Dicotyledons	Solanaceae	<i>Solanum capsicoides</i>	Devil's apple
Dicotyledons	Solanaceae	<i>Solanum mauritianum</i> *	Wild tobacco tree
Dicotyledons	Solanaceae	<i>Solanum americanum</i> *	Glossy nightshade
Dicotyledons	Solanaceae	<i>Solanum seaforthianum</i> *	Brazilian nightshade
Dicotyledons	Verbenaceae	<i>Clerodendrum floribundum</i>	Smooth clerodendrum
Dicotyledons	Verbenaceae	<i>Lantana camara</i> *	Lantana
Dicotyledons	Violaceae	<i>Viola hederacea</i> subsp. <i>Hederacea</i>	Native violet
Dicotyledons	Vitaceae	<i>Cayratia clematidea</i>	Slender grape
Dicotyledons	Vitaceae	<i>Cissus antarctica</i>	Water vine
Dicotyledons	Vitaceae	<i>Cissus hypoglauca</i>	Five-leaf water vine
Dicotyledons	Vitaceae	<i>Cissus sterculiifolia</i>	

* Introduced Species

Threatened species area shown in bold



APPENDIX 2

FAUNA DISTRIBUTION TABLES



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Name	Barred Cuckoo shrike (<i>Coracina lineata</i>)	
Status	Vulnerable - Schedule 2 TSC Act 1995.	
Geographical Distribution	This species occurs from Cape York Peninsula in Queensland to the Manning River district in NSW (Schodde and Tidemann 1986).	
Description	Medium sized (26-28cm) songbird, face is dark with black lores and yellow eyes. It is dark grey above with darker wings, breast to abdomen is white, strongly barred with black (Simpson and Day 1996).	
Habitat	Blakers et al (1984) note that this species inhabits rainforests and eucalypt forests including margins and regrowth, where it feeds on fruits and insects. A major habitat component is the presence of fruiting trees, particularly figs (<i>Ficus</i> sp.).	
Life Cycle Requirements	Forage	The Barred cuckoo shrike flies freely from one feeding tree to another but once settled the birds tend to be quiet and undemonstrative. Aside from rainforest fruits, this species has been reported also to feed on beetles, insect larvae and dragonflies (Shields 1993). Roosting is communal.
	Nesting	Nesting is between October and January, with a small nest of dry twigs and foliage usually built high in a tree (Shields 1993).
	Movements	The bird is often encountered alone or in pairs, but it also congregates in flocks at temporarily abundant food sources.
Conservation Reserves	Border Ranges, Mt. Warning, Nightcap National Parks. Iluka, Limeburners, Sea Acres Nature Reserves.	
Threatening Processes	This is mainly a tropical and subtropical species of lowland rainforest. This habitat has been subject to extensive clearing for residential and agricultural purposes.	
References	Blakers, M.; Davies, S.J.J.F.; and Reilly, P.N. (1984). <u>The Atlas of Australian birds</u>. RAOU and Melbourne University Press: Melbourne. Schodde, R. and Tidemann, S. (Eds) (1986) <u>Readers Digest Complete Book of Australian Birds</u>. Second Edition. Readers Digest Services, Sydney. Shields, J.M. (1993) <u>Yellow-eyed cuckoo shrike <i>Coracina lineata</i></u>. In: Strahan, R (Ed). <u>Cuckoos, Kingfisher and Nightbirds of Australia</u>. Angus and Robertson, Sydney. Simpson, K. & Day, N (1996). <u>Field Guide to the Birds of Australia</u>. Viking: Penguin Books, Sydney.	



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Name	Brush-tailed phascogale (<i>Phascogale tapoatafa</i>)	
Status	Endangered- Schedule 1 TSC Act (1995)	
Geographical Distribution	The species prefers open forest with sparse ground cover. The species was formerly distributed throughout the dry sclerophyll forest and woodlands of temperate and tropical Australia.	
Description	Head and body length is 181mm (approximately) for males. Uniform grizzled grey above, cream to white below. Large naked ears. Conspicuous black bottle-brush tail with hairs up to 55mm long.	
Habitat	The preferred habitat of this species is reported to be dry open forest and woodland containing box, stringybark and ironbark trees (Cuttle 1982, Trail and Coates 1993) but it has also been recorded from coastal forest in NE NSW containing Blackbutt and red bloodwood (Quin, cited in AMBS 1995).	
Life Cycle Requirements	Breeding	The requirement for hollow-bearing trees for nesting sites indicates that this species will require some component of old-growth within its habitat and therefore is likely to be sensitive to removal of this habitat component. This species occurs patchily and in low densities throughout its entire range.
	Foraging	This species is known to forage over the trunks and major limbs of trees, taking arthropods from the bark surface and in shallow bark crevices, and it is thought that they may also forage on logs (Trail and Coates 1993). Foraging takes place throughout the home range of this species rather than at particular sites (Soderquist 1995). The <i>Phascogale</i> forages as it travels, and all parts of the home range therefore represent forage habitat.
	Dispersal	Recent studies by Soderquist (1995) in Victoria have shown that both females and males occupy large home ranges (41ha and 106ha respectively). The home range of males was found to expand during the breeding season to an average length of 2.7km.
Conservation Reserves	Barrington Tops NP, Bundjalung NP, Dorrigo NP, Limeburners Ck. NR, Mt. Warning NP, New England NP, Washpool NP, Werrikimbe NP, Yuraygir NP.	
Threatening Processes	<i>P. tapoatafa</i> is sensitive to the loss of critical nest, shelter and feeding habitat such as tree hollows and suitable foraging substrate (especially fallen logs), and predation by feral carnivores such as foxes and cats (CHUMA - Supporting Document 4, 1995). Little is known about this species ecology but an overly frequent fire regime in drier forests is likely to be detrimental to the species through reduction in cover and increased exposure to predation (Smith <i>et al.</i> , 1994).	
References	Australian Museum Business Services (1995). <u>Urbenville Management Area - Fauna Impact Statement Vol. D</u>. State Forests of N.S.W., Pennant Hills. Cuttle, P (1982) <u>Life history of the dasyurid marsupial <i>Phascogale tapoatafa</i></u> pp13-22. In <u>Carnivorous Marsupials</u> Ed by M. Archer, Royal Zoological Society of NSW, Sydney. Soderquist, T.R. (1995) Spatial organisation of the arboreal carnivorous marsupial <i>Phascogale tapoatafa</i>. <u>Journal of Zoology</u>, 237 pp 385-398. Traill, B.J. and Coates, T.D. (1993). <u>Field Observations on the Brush-tailed Phascogale (<i>Phascogale tapoatafa</i>) Marsupalia: Dasyuridae</u>. <u>Australian Mammalogy</u>, 16: 61-65.	



Flora and Fauna Assessment

Name	Common blossom bat (<i>Syconycteris australis</i>)	
Status	Vulnerable -Schedule 2 TSC Act (1995).	
Geographical Distribution	This species occurs in eastern Queensland from Cape York south, with disjunct populations occurring south to the mid north coast of NSW around Taree. The southern limit distribution of the Common blossom bat in NSW is latitude 32°19'S at Booti Booti National Park, and may be a deterrent of climatic factors (Law 1994a).	
Description	The Common blossom bat is one of the smallest pteropids, about the size of a mouse. It has fawn to reddish fur that is very soft. The nostrils are raised above the surface of the muzzle and it has a long brush-like tongue (Strahan 1995).	
Habitat	The Queensland blossom bat is a nectarivore and takes nectar from species such as Banksia and Melaleuca in autumn and winter and from coastal Eucalypts in summer. The Bat prefers to roost in coastal Rainforest or other communities containing broad-leaved species where the canopy provides good protection from rain and wind (B Law, pers. comm).	
Life Cycle Requirements	Foraging	Foraging resources for the Common blossom bat species are produced in a number of habitats throughout coastal NSW and include heaths, paperbark swamps, coastal Eucalypt forest and sub-tropical rainforest. An essential requirement for the occurrence of the Queensland Blossom Bat is a diversity of habitats proximate to rainforest roost sites, so as to ensure a year round supply of nectar and pollen through sequential flowering of different species.
	Roosting	Individuals tend to roost solitarily, shifting roost sites within rainforest habitat depending on prevailing weather conditions.
	Movements	Commuting distances from these roosts to foraging areas are greater in spring and autumn (mean 1.4km) than in winter (mean 0.8km). Adults often change roosts each day, moving approximately 100m, while juveniles re-use roosts over longer periods (Law 1993).
Conservation Reserves	Broadwater, Broken Head, Bundjalung, Mt. Warning, Yuraygir National Parks. Iluka, Limeburners Creek Nature Reserves.	
Threatening Processes	The dominant threat to the critical habitat of this species in NSW is the extensive development of the coastal zone which disrupts the proximity of food supplies and roost sites.	
References	Law, B.S. (1993) "Roosting and Foraging Ecology of the Queensland Blossom Bat (<i>Syconycteris australis</i>) in north-eastern New South Wales: Flexibility in response to seasonal variation". Wildlife Research, 20: 419-431. Law, B.S. (1994a) "Climatic limitations of the southern distribution of the Common blossom bat (<i>Syconycteris australis</i>) in New South Wales." Aust. J. Ecology 19:366-374. Strahan R. (1995) "The Mammals of Australia". Reed Books, Chatswood.	



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Name	Giant barred frog (<i>Mixophyes iteratus</i>)	
Status	Endangered (Schedule 1 TSC Act (1995))	
Geographical Distribution	The Giant barred frog occurs from the Bunya Mountains in Queensland extending south to about Narooma in south-eastern NSW (Cogger 1994).	
Description	Dark olive to black above, broad lateral band of dark spots or mottling dividing dark dorsal from white ventral surface. Limbs with dark cross-bars which are as wide as the light interspaces. Hind side of thighs black with a few large yellow spots. Outer metacarpal tubercle flat, poorly developed; inner metatarsal tubercle well developed, but only half as long as first toe (Cogger 1994).	
Habitat	Terrestrial inhabitants of rainforest, Antarctic beech forests and Wet sclerophyll forests (Cogger 1994). Barker and Grigg (1977) list this species as an inhabitant of coastal riverine rainforest.	
Life Cycle Requirements	Breeding	Eggs are deposited over water on overhangs about 20 cm above the water level in heavily shaded sections of creeks. When the eggs hatch, they drop into the water below. Barker and Grigg (1977) reported that egg deposition occurred in damp depressions alongside creeks and eggs would be washed into the creeks during heavy rain.
	Foraging	This species is known to call from damp leaf litter along the banks of water courses. Diet is mainly insects and smaller frogs. Development and growth of the tadpoles varies greatly when food is scarce and some individuals have been observed to take more than two years before metamorphosing to adult frogs (Tanton 1996).
Conservation Reserves	Dorrigo, Gibraltar Range, Washpool and Werrikimbe National Parks (Ehmann 1997).	
Threatening Processes	The major threat to this species is the loss of suitable habitat, in particular riverine rainforest habitat where the water is flowing and of high quality (Ehmann 1997).	
References	Ehmann, H. (1997) Threatened Frogs of New South Wales - Habitats, Status and Conservation. Pub. By Frog and Tadpole Study Group of NSW, Sydney. Tanton, M (1996). Fauna Appendix. Environmental Impact Statement for proposed forestry operations in the Murwillumbah District of State Forests NSW. Cogger H. G. (1994). <i>Reptiles and Amphibians of Australia</i> (Rev. ed) Reed, Sydney. Barker, J. and Grigg, G (1977). A field guide to Australian frogs. Rigby Limited, Adelaide.	



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Name	Glossy black cockatoo (<i>Calyptorhynchus lathami</i>)	
Status	Vulnerable - Schedule 2 TSC Act (1995)	
Geographical Distribution	This species occurs from about the Clarke Range in Queensland to Gippsland and the Central Highlands of Victoria along the eastern seaboard. It occurs as far west as the Riverina and Pilliga Scrub (Blakers <i>et al</i> 1984).	
Description	This is the smallest of the Black cockatoos with a body length of about 48cm. Plumage I brownish black, with two panels in the tail: these panels are bright red in males, barred and shot with yellow in females. The bill is more bulbous than that of the Red-tailed black cockatoo (Simpson and Day 1996).	
Habitat	Found in coastal forests and open inland woodland in eastern Australia. The Glossy black-cockatoos distribution is limited to habitat which contains sufficient seed reserves of their three favoured species of food trees: <i>Allocasuarina littoralis</i> , <i>Allocasuarina torulosa</i> and <i>A. verticillata</i> (Forshaw, 1981) and suitable large hollow bearing trees for nesting.	
Life Cycle Requirements	Foraging	It is noticeable that birds appear to favour a certain tree, perhaps when seeds are at correct maturity and sweeter, or perhaps the tree is easily accessible (Clout 1989).
	Breeding	The cockatoos require large hollows in tall mature Eucalyptus for nesting (Forshaw 1981). Successful breeding of this species is dependent on cones having high seed-fill rates (% of viable seed per cone). Higher seed fill rate, often in excess of 80% appears to be influenced by geology, soil and moisture (Garnett 1997 <i>in press</i>).
	Movements	This cockatoo is mainly sedentary with pairs isolating themselves from groups to breed and then rejoin the main group with their young (Joseph, 1989). This species live in loose groups of 2 to 20 birds (Blakers <i>et al</i> 1984). Groups may disperse over wider areas during times of reduced she-oak seed occurrence within their normal range. There are no known barriers to the movement of this species.
Conservation Reserves	Barrington Tops, Border Ranges, Bundjalung, Dorriggo, Gibraltar Range, Guy Fawkes River, Hat Head, New England, Nymboida, Washpool, Werrikimbe, Woko and Yuraygir National Parks.	
Threatening Processes	The Glossy black cockatoo is threatened by any action that significantly reduces the quantity, quality or availability of the seed crop of the preferred <i>Allocasuarina</i> species, and/or results in the removal or destruction of potential nest sites.	
References	Blakers, M. Davies, S.J.J.F.; and Reilly, P.N. (1984). <u>The Atlas of Australian birds</u>. RAOU and Melbourne University Press: Melbourne. Clout, M.N. (1989). <u>Foraging behaviour of Glossy Black Cockatoos</u>. Aust Wild. Res. 16, 467-473. Forshaw, J.M (1981). <u>Australian Parrots</u>. Second (revised) Edition. Lansdowne Press, Melbourne. Joseph, L. (1989). <u>The Glossy Black-Cockatoo in the South Mount Lofty Ranges</u>. South Australian Ornithologists, 30: 202-204. Simpson, K. & Day, N (1996). <u>Field Guide to the Birds of Australia</u>. Viking: Penguin Books, Sydney.	



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Name	Grey-headed Flying Fox (<i>Pteropus poliocephalus</i>)	
Status	Vulnerable (Schedule 2 TSC Act (1995); Tidemann <i>et al.</i> , 1999)	
Recovery Plan	Under the <i>Threatened Species Conservation Act</i> 1995, a Recovery Plan for the Grey-headed Flying Fox is required to be prepared by 2006.	
Geographical Distribution	Occurs along the east coast from Bundaberg in Queensland to Melbourne in Victoria (Eby, 2000a). The distribution of this species has contracted south, formerly ranging north to Rockhampton (Eby, 2000a). This species may range to the western slopes of the Great Dividing Range in northern NSW (Eby, 1991). At any one time the majority of animals only occupy a small proportion of this entire range.	
Description	The Grey-headed Flying Fox has dark grey fur on the body, lighter grey fur on the head and a russet collar encircling the neck. This species can be distinguished from other flying-fox species by leg fur which extends to the ankle. Wing membranes are black and the wingspan can be up to one metre with a head and body length 23-30cm and weight of 600-1000g. (Tidemann, 1995 and Eby, 1995)	
Habitat	The Grey-headed Flying Fox inhabits “sub - tropical and temperate rainforests, tall sclerophyll forest and woodlands, heaths and swamps” (Eby, 1995). Urban gardens and cultivated fruit crops also provide habitat for this species.	
Life Cycle Requirements	Breeding/ nesting	Mating occurs annually with mating commencing in January, the majority to a single young.
	Foraging	The nectar and pollen of native trees, in particular <i>Eucalyptus</i> , <i>Melaleuca</i> and <i>Banksia</i> (Eby, 2000a), and fruits of rainforest trees and vines. This species is an important pollinator and seed-disperser of native trees.
	Movements	The Grey-headed Flying Fox migrate in response to food availability, sometimes travelling hundreds of kilometres. In addition, during periods when native food is limited, during periods when native food is limited, they disperse from colonial roosts, often foraging in cultivated gardens and fruit crops. This species occasionally inflicts severe crop damage during periods of native food shortage. (Ratcliffe, 1932; Eby, 1991; Parry-Jones & Augee, 1992). This results in large fluctuations of the numbers of this species in NSW from as few as 20% of the total population in winter up to around 75% of the total population in summer (Eby, 2000a).
Conservation Reserves	In NSW, Grey-headed Flying Fox have been recorded in numerous conservation reserves along the east coast, and the tablelands and eastern slopes of the Great Dividing Range.	
Threatening Processes	Destruction and fragmentation of roosting and foraging habitat pose significant threats to this species in NSW. Unregulated shooting, electrocution on power lines, persecution due to poor understanding of diseases they may carry and competition and hybridisation with the Black Flying-fox (<i>Pteropus alecto</i>).	



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References	Eby, P. 1991. Seasonal movements of Grey-headed Flying-foxes, <i>Pteropus poliocephalus</i> (Chiroptera: Pteropodidae). From two maternity camps in northern New South Wales. <i>Wildlife Research</i> 18:547-559. Eby, P. 1995. The biology and management of flying-foxes in NSW; Species management report number 18 Llewellyn, L. (ed). NPWS, Hurstville. Eby, P. 2000a. The results of four synchronous assessments of relative distribution and abundance of Grey-headed Flying-fox <i>Pteropus poliocephalus</i>. In <i>Proceedings of a Workshop to Assess the Status of the Grey-headed Flying-fox in New South Wales</i>. Richards, G. (ed). http://batcall.csu.edu.au/abs/ghff/ghffproceedings.pdf Eby, P. 2000b. A case for listing Grey-headed Flying-fox <i>Pteropus poliocephalus</i> as threatened in NSW under IUCN creiterion A2. In <i>Proceedings of a Workshop to Assess the Status of the Grey-headed Flying-fox in New South Wales</i>. Richards, G. (ed). http://batcall.csu.edu.au/abs/ghff/ghffproceedings.pdf Parry-Jones, K.A. and Augee, ML. 1992. Movements of Grey-headed Flying Foxes (<i>Pteropus poliocephalus</i>) to and from a colony site on the central coast of New South Wales. <i>Wildlife Research</i> 19:331-340. Ratcliffe, F.N. 1932. Notes on the fruit bats (<i>Pteropus spp.</i>) of Australia. <i>Journal of Animal Ecology</i> 1:32-57. Tidemann, C.R., Eby P., Parry-Jones, K.A. and Vardon, M. 1999. Grey-headed Flying-fox. In <i>The Action Plan for Australian Bats</i>. Duncan, A., Baker, G.B. and Montgomery, N. (eds.). Environment Australia, Canberra.
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Flora and Fauna Assessment

Name	Koala (<i>Phascolarctos cinereus</i>)	
Status	Vulnerable - Schedule 2 TSC Act (1995)	
Geographical Distribution	The Koala has a broad distribution in eastern Australia, extending from South Australia through to north Queensland (Lee and Martin 1988). Reed <i>et al</i> (1990) noted that the distribution of the Koala in NSW was sparse on the south coast but there was a concentration of sightings on the north coast, northern tablelands and western slopes.	
Description	The Koala is an arboreal marsupial with woolly, pale to dark grey fur on the back, lighter on the underside. The tail is vestigial. Animals from the northern part of the range are smaller than those from the south (Martin and Handasyde 1995)	
Habitat	Koalas primarily inhabit Eucalypt woodlands and open forest and occasionally grazing lands and residential developments, although the latter obviously do not constitute optimal habitat. Home ranges can vary from 1ha to 67ha depending on the resource availability (MKES 1994).	
Life Cycle Requirements	Breeding	Breeding occurs in summer. Females become sexually active at two years and produce one young each year after a gestation period of about 35 days. Weaning occurs at 12 months and at 18 months dispersal may occur. Females breed to more than 14 years of age (Martin and Handasyde 1995)
	Foraging	Schedule 2 of State Environmental Planning Policy No. 44 (SEPP 44) - Koala Habitat Protection, supplies a list of ten (10) Koala Feed Tree Species, noting that "almost all occurrences of Koalas in NSW have been associated with the presence of one or more of these species." The nominated species are; Forest red gum (<i>Eucalyptus tereticornis</i>), Tallowwood (<i>E. microcorys</i>), Grey gum (<i>E. punctata</i>), Ribbon gum (<i>E. viminalis</i>), River red gum (<i>E. camaldulensis</i>), Broad - leaved scribbly gum (<i>E. haemastoma</i>), Scribbly gum (<i>E. signata</i>), White box (<i>E. albens</i>), Bimple box (<i>E. populnea</i>) and Swamp mahogany (<i>E. robusta</i>). Department of Planning: 1995).
	Movements	The Koala is solitary. Home range size is related to the density of occurrence of large trees, preferred feed trees and population density. Home range can vary from several hectares to 15ha in area (Mitchell 1990).
Conservation Reserves	Billinudgel NR, Bongil Bongil NP, Border Ranges NP, Broadwater NP, Broken Head NR, Brunswick Heads NR, Bundjalung NP, Chaelundi NR, Cudgen NR, Dorrigo NP, Iluka NR, Koreelah NP, Mallanganee NP, Mebbin NP, Mt. Warning NP, Nightcap NP, Richmond Range NP, Stotts Island NR, Toloom NP, Toonumbar NP, Ukerebagh NR and Wilson NR. In NSW, Koalas have been recorded in numerous conservation reserves along the east coast and the slopes and tablelands of the Great Dividing Range (NPWS 1999).	
Threatening Processes	The most serious threat to the koala is the removal of food trees (Braithwaite 1993). The optimal habitat of this species has been mainly cleared for agriculture and forestry activities.	



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References	Lee A.K. and Martin R.W. 1988. The Koala a Natural History. New South Wales University Press, Kensington. Reed P.C., Lunney D. and Walker P. 1990. A 1986-1987 survey of the koala <i>Phascolarctos cinereus</i> (Goldfuss) in New South Wales and an ecological interpretation of its distribution, in A.K. Lee, K.A. Handasyde and G.D. Sanson (Eds). Biology of the Koala. pp 55-74. Surrey Beatty and Sons, Sydney. Martin R.W. and Handasyde K.A. 1995. Koala <i>Phascolarctos cinereus</i> (Goldfuss, 1817), in R. Strahan (Ed). The Mammals of Australia. pp 195-198. Reed Books, Chatswood. Mitchell P. 1990. The home ranges and social activity of koalas - a quantitative analysis, in A.K. Lee, K.A. Handasyde and G.D. Sanson (Eds). Biology of the Koala. pp 171-187. Surrey Beatty & Sons, Sydney.
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Name	Little bent-wing bat (<i>Miniopterus australis</i>)	
Status	Vulnerable -Schedule 2 TSC Act (1995).	
Geographical Distribution	Regionally, this species is widely distributed with records from coastal districts to the Great dividing range. This species becomes increasingly coastal in the southern part of its range in eastern Australia. In north eastern NSW it occurs from the Macleay River watershed to the Hunter River. Nationally this species occurs along the coastal plains and adjacent ranges from Cape York to north east NSW and around the Hunter Valley (Strahan 1992).	
Description	This bat is chocolate brown on the upper surface, with paler fur on the underside. It is similar to <i>M. schreibersii</i> but tends to have lighter and more subtle shades of colour and can be distinguished by smaller size and lighter weight (Dwyer 1995b).	
Habitat	The Little bentwing bat is generally found in forested areas, particularly well timbered habitats, where it forages below and above the tree canopy (Dwyer 1995b).	
Life Cycle Requirements	Foraging	Dwyer (1991) identifies this species as a sub-canopy forager, however Strahan (1992) notes that the Little Bent-wing Bat feeds above the forest canopy in wet and dry open forest, catching insects on the wing.
	Roosting	This species roosts in caves, old mines, stormwater channels and buildings. Roost sites tend to be located adjacent to large areas of dense vegetation.
	Movements	It is known to migrate over large distances to maternity sites, apparently using different roosts for different seasonal needs (Dwyer 1991).
Conservation Reserves	Border Ranges, Broadwater, Broken Head, Bundjalung, New England, Mt. Warning, Yuraygir National Parks, Iluka and Tyagarah Nature Reserves.	
Threatening Processes	State wide threats to this species include disturbance of maternity and winter roost sites from human visitation, destruction of roost sites in caves and mine tunnels, toxic accumulation of agricultural chemicals (such as pesticides and herbicides) in body fat used during winter torpor (Dunsmore <i>et al</i> 1974), predation at roost sites from foxes (Dwyer 1964), and destruction and modification of foraging habitat, which is assumed to be forested areas and wetlands.	
References	Dunsmore, J.D., Hall, L.S. & Kottek, K.H. (1974). DDT in the Bent-winged Bat in Australia. Search 5: 110-111. Dwyer, P.D. (1995b) Little bent-wing bat (<i>Miniopterus australis</i>). In The Australian Museum Complete book of Australian Mammals. R. Strahan (ed). Surrey Beatty and Sons, Sydney. Dwyer, P.D (1991b) Little bent-wing bat (<i>Miniopterus australis</i>). In The Australian Museum Complete book of Australian Mammals. R. Strahan (ed). Angus and Robertson, Sydney. Pp. 338-339. Dwyer, P.D. (1964). Fox Predation on Cave Bats. Australian Journal of Science 26: 397-98. Strahan R. (1992) Encyclopedia of Australian Animals: Mammals. Angus and Robertson Publishers, Sydney.	



Flora and Fauna Assessment

Name	Square-tailed kite (<i>Lophoictinia isura</i>)	
Status	Vulnerable - Schedule 2 TSC Act (1995)	
Geographical Distribution	This species is widespread in its distribution throughout Australia but is uncommon in the arid shrublands and grasslands of central Australia (Debus and Czechura 1989).	
Description	The Square-tailed kite closely resembles several other hawks in appearance. The tail is long and broad with angular corners and shadowy grey and black bars below. At rest the wingtips extend past the tail. Other features include: pale, dark streaked head, slight crest, rufous dark-streaked body, blackish back, fawn mark on shoulder.	
Habitat	Habitat utilised is open forests and woodlands, particularly those on fertile soils and with abundant passerines. This species may range into open habitats nearby but not extensive treeless regions (Marchant and Higgins 1993).	
Life Cycle Requirements	Forage	The Square-tailed kite predaes mainly on the fledglings and nestlings of passerines, lizards and insects. Kites usually forage singly among forests and woodlands at or just above the canopy.
	Nesting	Breeding occurs in Spring. Nests are built high in trees, typically on a large horizontal bough of a Eucalypt and 12 to 26m from the ground. Two or three eggs are laid, these hatch in 37 to 42 days and fledging takes 8 to 10 weeks (Marchant and Higgins 1993).
	Movements	The species is migratory through much of it's range and it is a spring/summer breeding migrant in the south-east, east and south-west of Australia (Marchant and Higgins 1993).
Conservation Reserves	Bundjalung and Gibraltar Range National Parks.	
Threatening Processes	Habitat destruction is the main threat to the survival of the Square-tailed kite, as at least half of the area of open dry eucalypt forest and woodland in southern and eastern Australia has been cleared for settlement or agriculture.	
References	Debus, S.J.S and Czechura, G.V. (1988). <u>The Square-tailed Kite <i>Lophoictinia isura</i>: a review</u> . Australian Birdwatcher, 13, 81-97. Marchant, S. and Higgins, P.J. (eds) (1993) <u>Handbook of Australian, New Zealand and Antarctic birds. Vol. 2 Raptors to Lapwings</u> . Oxford University Press, Melbourne.	



Flora and Fauna Assessment

Name	Squirrel glider (<i>Petaurus norfolcensis</i>)	
Status	Vulnerable -Schedule 2 TSC Act (1995).	
Geographical Distribution	The range of the Squirrel glider has, in the past, been considered to lie to west of the Great Dividing Range and extend from western Victoria to northern Queensland (Strahan 1995). However recent records would tend to suggest that the Squirrel glider is also present in suitable habitat on the coastal lowlands of NSW and Queensland.	
Description	The Squirrel glider is similar to the Sugar glider but has a longer and more pointed face, longer and narrower ears and bushier tail and the facial markings often more distinct (Suckling 1995)..	
Habitat	The Squirrel glider occupies wet and dry sclerophyll forests (Smith & Winter 1984) with open dry sclerophyll forests regarded as optimum habitat (Tyndale-Biscoe & Calaby 1975). Although Davey (1984) has found Squirrel gliders in rainforest, it is unlikely that they occur extensively in this habitat type.	
Life Cycle Requirements	Foraging	Critical habitat consists of mixed stands of Eucalypts which invariably include gum barked species and high proportion of winter nectar producing trees. Mixed species Eucalypt forests may provide a more reliable year round food resource than do less diverse forests. This may attribute to the greater availability of microhabitats for invertebrates and to the availability of nectar for a greater part of the year.
	Nesting	Dens or hollows in trees are another critical habitat component and Squirrel gliders require several hollow trees within a home range. Dens are communal and are occupied by 2-9 adults (Quin 1993).
	Movements	In Victoria (Traill & Coates 1993) have estimated the home range of the Squirrel glider to be 13 hectares with an average density of 0.4 individuals/hectare. The Squirrel glider generally has a higher density than the Sugar glider and as a result where the two occur together the Squirrel glider is usually the more common (Suckling 1984).
Conservation Reserves	Border Ranges, Bundjalung, Mt. Warning, new England, Washpool, Werrikimbe, Yuraygir National Parks. Limeburners Creek Nature Reserve.	
Threatening Processes	Threats to Squirrel glider populations are likely to include: clearing of habitat <i>which</i> provides critical habitat components, particularly older Eucalypt stands which provide a large number of hollow bearing trees. Domestic animals, particularly cats are a major threat. Squirrel glider kills have been observed where motor vehicles pass through or near habitat (based on AKF 1995).	
References	Davey, S.M. (1984). <u>Habitat preferences of arboreal marsupials within coastal forests in Southern NSW</u>. In: Smith, A.P. and Hume, I.D. (Eds.) <i>Possums and Gliders</i>. Surrey Beatty and Sons, Chipping Norton, Sydney, pp. 509-516 Tyndale-Biscoe, C,H and Calaby, J.H. (1975) <u>Eucalypt forests as refuges for wildlife</u>. Australian Forestry 38, 117-133. Quin, D.G. (1993). <u>Socio-ecology of the Squirrel Glider and the Sugar Glider</u>. PhD Thesis, University of New England, Armidale. Strahan R. (1995). <u>The Mammals of Australia</u>. Reed Books, Chatswood. Suckling, G.C. (1984). <u>Population ecology of the sugar glider, <i>Petaurus breviceps</i>, in a system of fragmented habitats</u>. Aust. Wild. Res. 11: 49-75. Traill, B.J. and Coates, T.D. (1993). <u>Field Observations on the Brush-tailed Phascogale (<i>Phascogale tapoatafa</i>)</u> Marsupalia: Dasyuridae. Australian Mammalogy, 16: 61-65.	



Flora and Fauna Assessment

Name	Stephens' banded snake (<i>Hoplocephalus stephensii</i>)	
Status	Vulnerable - Schedule 2 TSC Act (1995)	
Geographical Distribution	On the coast and Great Dividing Range from Gosford in NSW to Kroombit Tops in southern Queensland (Wilson and Knowles 1988).	
Description	A medium sized (65cm) nocturnal semi-arboreal snake. The dorsal surface is usually brownish to yellowish and can have the colour pattern of broad dark cross bands, but it may lack this pattern entirely. The head is black with a brown or creamy patch either side of the nape. The lips are barred with black and cream (Cogger 1994).	
Habitat	Stephens' banded snake inhabits dry and moist hardwood forest and rainforest in coastal and near coastal areas (Cogger 1992; Wilson and Knowles 1988). It also occurs in rocky outcrops, particularly those comprising exfoliated granite (Wilson and Knowles 1988; Ehmann 1992) and occasionally sandstone in the southern parts of its range (Wells <i>et al</i> 1988). The key elements of the preferred habitat for Stephens' banded snake are a dense understorey and canopy structure which are required for foraging and movement.	
Life Cycle Requirements	Forage	Hollows, tree scars and loose bark in mature or senescent trees, and to a lesser extent large hollow logs, are required for foraging. It feeds in the canopy as well as on the ground. Prey is lizards and small mammals, including bats, that occur in the tree canopy or in its roost site in trees (Ehmann 1992).
	Breeding	Breeding habitat is analogous with sheltering habitat. Females appear to reproduce every two years, producing a litter of 3 to 8 young in December to February.
	Shelter	Hollows, tree scars and loose bark in mature or senescent trees, and to a lesser extent large hollow logs, are required for sheltering sites.
	Dispersal	Not known.
Conservation Reserves	Mt. Warning, Dorrig, Nymboida, Gibraltar Range and Border Ranges National Parks	
Threatening Processes	Stephens' banded snake is threatened by habitat loss brought about by logging and Clearing Rainforest, Dry hardwood forest and Moist hardwood forest.	
References	Cogger, H. (1992). <u>Reptiles and Amphibians of Australia</u>. Reed International Books. Cogger, H. (1994) <u>Reptiles and Amphibians of Australia</u>. Reed International Books. Ehmann H., (1992). <u>Encyclopaedia of Australian Animals. Reptiles</u>. Angus and Robertson 495pp. Wells, R.W., Wellington, C.R. & Williams D.J (1988) <u>Notes on Stephens' Banded Snake <i>Hoplocephalus stephensii</i> Krefft, 1869</u>. The Australian Herpetologist No. 512. Wilson, S.K. and Knowles, D.G. (1988) <u>Australia's reptiles: A photographic Guide to the terrestrial Reptiles of Australia</u>. Collins, Sydney.	



Flora and Fauna Assessment

Name	Yellow-bellied glider (<i>Petaurus australis</i>)	
Status	Vulnerable - Schedule 2 TSC Act (1995)	
Geographical Distribution	The Yellow-bellied glider has a patchy distribution along the east coast and adjacent ranges of Australia from south-eastern South Australia to North Queensland. The southern subspecies <i>P. australis australis</i> occurs along the east coast of Australia to central Queensland and the northern subspecies <i>P.a. reginae</i> occurs in two small populations in North Queensland (Russell 1995).	
Description	Grey fur above, whitish to orange fur underneath and large bare ears. Individuals have a gliding membrane that extends from the wrists to the ankles. The head and body is much longer than that of the Sugar or Squirrel glider but shorter than in the Greater glider. Tail is fluffy and about one and a half times the length of its body and relatively much longer than in other gliders. Males and females are similar in appearance.	
Habitat	Preferred habitats are productive, tall open sclerophyll forests where mature trees provide shelter and nesting hollows and yearround food resources are available from a mixture of eucalypt species (Goldingay & Kavanagh 1991; Tanton 1994; Craig 1985).	
Life Cycle Requirements	Breeding	A single young is born between May and September, with the variation likely to reflect the abundance of food resources (Goldingay & Kavanagh 1991). The young remains in the pouch for up to 100 days after which time it is left in the nest while the mother forages. After leaving the pouch, the young is suckled for up to 60 days (Russell 1995).
	Foraging	Primarily made up of eucalypt nectar, eucalypt sap, honeydew, manna and invertebrates found under decortivating bark and pollen (Goldingay & Kavanagh 1991). Incises the bark of eucalypts to obtain sugar-rich sap.
	Dispersal	Homerange between 30 and 65 ha (Goldingay & Kavanagh 1991) usually occurs in densities of 0.05-0.14 individuals per ha (Russell 1995). This is a gregarious species and lives in family groups of between 3 (in southern parts of its range) and 6 (in the north).
Conservation Reserves	Yellow-bellied glider occurs in various conservation reserves along the east coast and adjacent inland areas in NSW (NPWS 1999).	
Threatening Processes	The loss and fragmentation of habitat through clearing and the activities associated with clearing is a threat as the logging of oldgrowth elements removes the number of hollow bearing trees available for nesting. Inappropriate fires regimes reduces the availability of food resources and isolates populations making them vulnerable. Predation by feral carnivores such as foxes and cats is also a threat.	
References	Craig, S.A. 1985. Social organization, reproduction and feeding behaviour of a population of Yellow-bellied Glider <i>Petaurus australis</i> (Marsupalia: Petauridae). <i>Australian Wildlife Research</i> 12:1-18. Goldingay, R.L. and Kavanagh, R.P. 1991. The Yellow-bellied Glider: a review of its ecology, and management considerations, in D. Lunney (Ed.) <i>Conservation of Australia's Forest Fauna</i>. Royal Zoological Society of NSW, Mosman. Russell, R. 1995. Yellow-bellied Glider <i>Petaurus australis</i> Shaw 1791.	



APPENDIX 3 - KEY THREATENED PROCESS

Key Threatening Processes (Listed under Schedule 3 of the Threatened Species Conservation Act 1995):

- Invasion of native plant communities by Lantana (*Lantana camara*)
- Invasion of native plant communities by Exotic vines and scramblers;
- Introduction of the Cane toad, *Bufo marinus*;
- Invasion of the yellow crazy ant;
- Feral pigs;
- Competition and habitat destruction by feral goats;
- Entanglement in, or digestion of anthropogenic debris in marine and estuarine environments;
- Introduction of the large earth Bumble bee, *Bombus terrestris*;
- Removal of dead wood and dead trees;
- Death or injury to marine species following capture in shark control programs on ocean beaches;
- Invasion of native plant communities by exotic perennial grasses;
- Infection of frogs by amphibian chytrid, causing the disease chytridiomycosis
- Competition from feral honeybees;
- Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands;
- Clearing of native vegetation;
- Bushrock removal;
- Ecological consequences of high frequency fires;
- Human-caused climate change;
- Invasion of native plant communities by Bitou Bush and Boneseed;
- Loss and/or degradation of sites used for hilltopping by butterflies;
- Predation by the European red fox;
- Predation by feral cats;
- Predation by the ship rat on Lord Howe Island;
- Predation by the Plague minnow (*Gambusia holbrooki*);
- Infection of native plants by *Phytophthora cinnamomi*;
- Infection by Psittacine circoviral (beak and feather) disease affecting endangered psittacine species and populations;
- Importation of red imported fire ants into NSW; and
- Competition and grazing by the feral European rabbit.