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ENVIRONMENTAL CONSULTANTS



Assessment of Significance (Seven Part Tests)

Lot 211 DP 1044292
Pacific Highway Moonee

JULY 2010

A REPORT PREPARED FOR
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1 INTRODUCTION

1.1 Background

James Warren and Associates have been engaged by Geoff Smyth Consulting to complete a re-application of the Assessment of Significance (seven part tests) for threatened flora and fauna recorded on or likely to occur on Lot 211 DP 1044292 Pacific Highway, Moonee (**FIGURE 1 & 2**). This report has been prepared in response to a request by Coffs Harbour City Council (CHCC).

A Flora and Fauna Assessment was completed by JWA in July 2007. A guide to assist in completing the 7 part test was produced subsequent to the completion of the Flora and Fauna Assessment (DECC 2007; JWA 2007). This report re-applies the seven part tests utilising these guidelines. The re-application considers, in particular, the definition of a 'local population' provided in the guidelines. The updated tests also provide new information on the number of records of threatened species in the local area and the consideration of the Priority Actions for the recovery of each species.

This report should be reviewed in conjunction with the Flora and Fauna Assessment (JWA 2007).

1.2 Definitions

Definitions of key terms used in the Assessment of Significance Guidelines (DECC 2007) as follows:

- **Life cycle:** the series or stages of reproduction, growth, development, ageing and death of an organism.
- **Viable:** the capacity to successfully complete each stage of the life cycle under normal conditions.
- **Local Population:** the population that occurs in the study area. The assessment of the local population may be extended to include individuals beyond the study area if it can be clearly demonstrated that contiguous or interconnecting parts of the population continued beyond the study area, according to the following definitions.
 - The *local population* of a threatened *plant* species comprises those individuals occurring in the study area or cluster of individuals that extend into habitat adjoining and contiguous with the study area that could reasonably be expected to be cross-pollinating with those in the study area.
 - The *local population of resident fauna* species comprises those individuals known or likely to occur in the study area, as well as any individuals occurring in adjoining areas (contiguous or otherwise) that are known or likely to utilise habitats in the study area.
 - The *local population of migratory or nomadic fauna* species comprises those individuals that are likely to occur in the study area from time to time.

In cases where multiple populations occur in the study area, each population should be addressed separately.



- **Risk of extinction:** the likelihood that the local population will become extinct whether in the short-term or in the long-term as a result of direct or indirect impacts on the viability of that population.

1.3 Threatened Flora and Fauna

Flora

Seven (7) Threatened flora species have been recorded within 10kms of the Subject site (**APPENDIX 1**). Of these, two occur on the site as follows:

- Fifteen (15) stems of the Endangered Quassia sp. 'Moonee Creek' (TSC Act 1995; EPBC Act 1999); and
- Twenty one (21) stems of the Vulnerable Rusty plum (*Niemeyera whitei*) (TSC Act 1995).

The locations of these threatened species are shown in **FIGURE 3**.

Fauna

A fauna survey was carried out on the Subject site in June 2004 and again in February 2007 (JWA 2007). No Threatened fauna species were recorded. However, based on the Threatened fauna records within 10kms of the Subject site (**APPENDIX 2**) and a habitat assessment, a number of Threatened fauna species were considered to possibly occur on the site over time. These were as follows:

- Barred cuckoo-shrike
- Brown tree creeper
- Brush-tailed phascogale
- Common blossom bat
- Giant barred frog
- Glossy black cockatoo
- Grey-headed flying fox
- Koala
- Little bent-wing bat
- Square-tailed kite
- Squirrel glider
- Stephens' banded snake
- Yellow-bellied glider

1.4 Proposed Development and Impacts on the Threatened Species

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 4**. The entire southern half of the site consists of the 7a Environmental Protection land which may be acquired by CHCC at a later stage. The western half of the site is to be developed as the Moonee Collector Road designated by CHCC.



The proposed development will result in the loss of approximately 2.9 hectares of vegetation, most of which is comprised of grassland with scattered trees. In addition, ten (10) Moonee quassia and three (3) Rusty plums will also be lost. These plants all occur within the designated Moonee Collector Road Reserve which will be acquired by CHCC. The removal of other vegetation from the subject site may also indirectly impact on the retained Moonee quassias and Rusty plums. These indirect impacts may include increased edge effects, exposure to light, disturbance and weed invasion, and alteration of the microclimate. The impact of the proposed development is show in **FIGURE 5**.

1.5 Mitigation

The proposed development will include the implementation of a Vegetation Management Plan (VMP) and a Translocation Plan (TP) to mitigate the loss native vegetation from the site and the impacts to the Moonee quassia and the Rusty plum.

The VMP will outline strategies to rehabilitate approximately 0.2726 hectares of land (**FIGURE 6**) and cover such areas as weed control, enhancement planting, maintenance and monitoring. Approximately 1200m² of the rehabilitation will occur within an area that is already designated for Environmental Protection (i.e. 7a zoned land) and a further 1500m² will be outside the 7a boundary. The rehabilitated area outside the 7a zone will effectively be incorporated into the conservation area increasing the quality and quantity of native habitat on the Subject site.

The vegetation rehabilitation presents an opportunity to create quality recipient habitat for the Moonee Quassia and the Rusty Plum. The TPs (i.e. for both species) will cover such details as: an updated census of the plants found on site and those to be impacted; the Biology and Ecology of both species; plant and recipient site preparation, the translocation method; post translocation maintenance and monitoring; and replacement planting.



2 THREATENED SPECIES ASSESSMENTS

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 add a focus of consideration of the 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 state-wide 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.

An Assessment of Significance (seven part test) has been undertaken for all listed species recorded on the site, including threatened fauna predicted to occur over time (**SECTION 1.3**). Potential impacts on threatened species, populations or ecological communities, or their habitats was assessed using the *Threatened Species Assessment Guidelines: The Assessment of Significance* (DECC 2007).

2.2 Flora

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 (**FIGURE 3**).
- The vulnerable Rusty plum occurs north of the creek, within two (2) different vegetation communities (**FIGURE 3**).



Moonee Quassia

Factors of assessment

(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

A small population of Moonee quassia has been recorded within the CHCC designated Road Reserve (i.e. Moonee Collector Road, CHCC 2004) on the Subject site. Approximately fifteen (15) individuals were recorded. The local population, for this species, is considered to be all individuals recorded on the Subject site, as well as any individuals within adjoining areas (contiguous or otherwise) that may be potentially cross-pollinating. The NPWS database contained nineteen (19) records within 10 kilometres of the Study area and 158 records within the Coffs Harbour LGA (May 2010; DECCW undated).

Direct and Indirect Impacts on the Life-cycle

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.

The Moonee Quassia flowers in November and December and fruits mature between March and April. Flowering appears to occur on plants that access to direct sunlight and/or lateral light across the forest floor. Mature fruit has been observed on very small plants indicating that plants may become reproductively mature at a young age. Plants are also capable of self-pollination. Seed dispersal mechanisms are not known but many populations along water courses indicates rainfall runoff may be important. Selfed seeds from an individual growing at the North Coast Regional Botanic Garden (NCRBG) have been successfully germinated but seedling recruitment in the wild seems to be minimal. Populations often consist of many individuals of a similar age class but it is not known whether this is as a result of the same germination event, or whether the plants have vegetatively reproduced by means of suckers from buried stems or from the root system. The root system is extensive on mature plants which may facilitate vegetative regrowth (DEC 2005).

The National Parks and Wildlife Service have listed the major issues which are threatening the survival of the Moonee quassia (NPWS 2002). These are: the 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; affects of small population sizes e.g. inbreeding.

Ten (10) Moonee quassia plants will be directly impacted by the construction of the CHCC dedicated Moonee Collector Road (**FIGURE 5**). The five (5) remaining plants, which occur within the bushfire asset protection zone, may be indirectly impacted by



understory clearing. Indirect impacts may include: weed invasion, increased light and/or minor changes to the microclimate.

Mitigation

A VMP will be prepared outlining the rehabilitation of approximately 2700m² of land adjacent to and within the 7a zoned land (**FIGURE 6**). The rehabilitation will include the preparation of recipient habitat for the impacted Moonee Quassia plants. These plants will be translocated in accordance to strict guidelines set out in the TP. Additional plantings, at a ratio of five plantings for every one plant translocated, will be completed effectively increasing the population of Quassias on the Subject site. Although it is unlikely that the indirect impacts outlined above will prevent the retained plants from successfully maturing and reproducing, these plants will be carefully maintained and closely monitored.

Likelihood of local extinction

With the adoption of the mitigation outlined above (i.e. the translocation of ten (10) plants and the recruitment of a further fifty (50)), it is highly unlikely that the proposed development will result in the extinction, either in the short- or long-term, of the local population of the Moonee quassia. These measures will effectively increase the population size and the chances of long term survival for the local population of Moonee Quassia.

(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.

There are thirty six (36) endangered populations listed under the TSC Act. 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 will 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 (JWA 2007).

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 and 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 the 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 not considered to be significant.

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

Six (6) Critical habitat areas are currently listed under the Threatened Species Conservation Act (1995). 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 July 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 (JWA 2007), this proposed action is considered to be consistent with the objectives of this recovery plan.

Priority Actions

Additionally, there are a number of Priority Actions identified to help the recovery of this species. Priority Actions, relevant to the proposed development, for the Moonee quassia include:

- Determine need to collect seed for NSW Seedbank. Develop collection program in collaboration with BGT - multiple provenances.
- Investigate seed viability, germination, dormancy and longevity (in natural environment and in storage).
- Develop and implement a broadscale awareness strategy that includes conservation and management of the species and mechanisms and incentives for protection and on-ground management. Target groups are identified in the recovery plan for the species.
- If monitoring shows a decline in population health or numbers, amelioration or control of the threatening processes must be implemented.
- If monitoring shows a decline in population health or numbers, amelioration or control of the threatening processes must be implemented.
- Monitor population structure and health at known locations to detect any variation in population dynamics and the species response to a range of disturbance regimes.

The proposed Vegetation Management and Translocation Plans for the site will incorporate the above actions where relevant.

(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) (**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.

Clearance of native vegetation, on the Subject site, will be for the building envelopes, access and internal roads and the Bushfire Asset Protection Zone. A total of 2.9 hectares will be removed however, most of this is cleared and disturbed grassland with scattered trees. Measures have been recommended to mitigate the loss of the native vegetation (i.e. the implementation of a Vegetation Management Plan).

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

Rusty plum (*Niemeyera whitei*)

(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

Twenty one (21) stems of the Rusty Plum were recorded on the Subject site, include five (5) mature stems (8-12m), one (1) intermediate stem (~2.5m) and an additional fifteen (15) saplings around one of the mature plants. The NPWS database (May 2010) contained 281 records within 10 kilometres of the Study area and 745 records within the Coffs Harbour LGA (DECCW undated). The local population, for this species, is considered to be all individuals recorded on the Subject site, as well as any individuals within adjoining areas (contiguous or otherwise) that may be potentially cross-pollinating.

Direct and Indirect Impacts on the Life-cycle

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.

The Rusty plum flowers in September to October with fruits ripening from September to November (Floyd 1998). The ecology of *Amorphaespermum whitei* has not been extensively studied and data about the life cycle attributes such as pollination and germination are largely unknown. The large fleshy seeds may be dispersed by mammal species.

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: the



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; and effects of small population sizes e.g. inbreeding depression (NPWS 2002).

Three (3) mature Rusty plums will be directly impacted by the construction of the CHCC dedicated Moonee Collector Road (**FIGURE 5**). The remaining plants, which occur within the bushfire asset protection zone, may be indirectly impacted by understory clearing. Indirect impacts may include: weeds invasion, increased light and/or minor changes to the microclimate.

Mitigation

A VMP will be prepared outlining the rehabilitation of approximately 2700m² of land adjacent to and within the 7a zoned land (**FIGURE 6**). The rehabilitation will include the preparation of recipient habitat for the impacted Rusty plums. These plants will be translocated in accordance to strict guidelines set out in the TP. Additional plantings, at a ratio of five plantings for every one plant translocated, will be completed effectively increasing the population of Rusty plums on the Subject site. Although it is unlikely that the indirect impacts outlined above will prevent the retained plants from successfully maturing and reproducing, these plants will be carefully maintained and closely monitored.

Likelihood of local extinction

With the adoption of amelioration measures outlined above, it is highly unlikely that the proposed development will result in the extinction, either in the short- or long-term, of the local population of Rusty plums.

(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.

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.

Priority Actions

There are a number of Priority Actions identified to help the recovery of this species. Priority Actions, relevant to the proposed development, for the Rusty Plum include:

- Involve private landholders in the conservation of this species.
- Provide map of known occurrences to Rural Fire Service and seek inclusion on Bush Fire Risk Management Plan(s), risk register and operation map(s).
- Protect areas of known habitat from timber harvesting and other land clearing.
- Control weeds in known habitat for this species.
- Model habitat to identify sites for further survey. Habitat condition to be assessed at known sites.

The proposed Translocation and Habitat Compensation Plan would involve incorporating the above actions where relevant.

(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) (**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.

Clearance of native vegetation, on the Subject site, will be for the building envelopes, access and internal roads and the Bushfire Asset Protection Zone. A total of 2.9 hectares will be removed however, most of this is cleared and disturbed grassland with scattered trees. Measures have been recommended to mitigate the loss of the native vegetation (i.e. the implementation of a Vegetation Management Plan).

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



2.3 Fauna

No threatened species were recorded from the subject site, however thirteen (13) species were considered a possible occurrence on the Subject site over time. A Section 5A assessment has been undertaken for each of these species.

(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 3**.

Barred cuckoo-shrike (*Coracina lineate*)

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, and six (6) sightings in the Coffs Harbour LGA (May 2010; DECCW undated). The local population for this species is considered to comprise of all individuals that are likely to occur on the Subject site, as well as any individuals within contiguous habitat, to the south, and the Moonee Nature Reserve, that could reasonably be expected to be mating with individuals on the Subject site.

Direct and Indirect Impacts on the Life-cycle

The Barred Cuckoo-Shrike is a medium-sized bird to 25 cm long. It is dark grey above and under the chin, with a front barred with strong horizontal stripes of white and very dark grey. A darker stripe runs from the base of the bill through the pale yellow eye. It inhabits rainforest, eucalypt forests and woodlands, clearings in secondary growth, swamp woodlands and timber along watercourses. They are usually found in low elevation subtropical and littoral rainforest and coastal wet sclerophyll close to fruiting figs with the preferred habitat being a mature canopy. They also feed on large insects including cicadas and phasmids. They are active birds, usually seen in pairs or small flocks foraging among foliage of trees (DEC 2005a).

Threats to the survival of this species include: reduction of habitat, particularly rainforest, due to clearing for agriculture, development and timber harvesting (DEC 2005a). Vegetation clearance for the residential development in the north of the site is not considered to have a significant direct impact on this species (**FIGURE 5**). Indirect impacts, to this species, may include an increase in noise and light disturbance from the proposed development.

The impacts outlined above are unlikely to prevent individuals of this species from successfully maturing and reproducing.

Mitigation

A VMP will be prepared outlining the rehabilitation of approximately 2700m² of land adjacent to and within the 7a zoned land (**FIGURE 6**). The rehabilitation will result in an improvement of potential habitat for this species. Enhancement planting will



include suitable fruiting species and the overall improvement to the quality of forested vegetation will improve the area as forage habitat for this species.

Likelihood of local extinction

Suitable habitat for the Barred cuckoo-shrike will be retained and improved within the 7a zone so it is highly unlikely that the proposed development will result in the extinction, either in the short- or long-term, of the local population of this species.

Brown treecreeper

Extent of the local population

The NPWS database contained one (1) record of this species within 10 kilometres of the Study area and five (5) sightings in the Coffs Harbour LGA. There is also one (1) sighting within the Moonee Beach Nature Reserve (May 2010; DECCW undated). The local population for this species is considered to comprise of all individuals that are likely to occur on the Subject site as well as any individuals within contiguous habitat, to the south, and the Moonee Nature Reserve, that could reasonably be expected to be mating with individuals on the Subject site.

Direct and Indirect Impacts on the Life-cycle

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. Individuals are active, noisy and conspicuous, and give a loud 'pink' call, often repeated in contact, and sometimes given in a series of 5 - 10 descending notes. They are considered a sedentary species, resident in many locations throughout its range and present in all seasons. Some birds may disperse locally after breeding. They are gregarious and usually observed in pairs or small groups of eight to 12 birds; terrestrial and arboreal in about equal proportions; active, noisy and conspicuous while foraging on trunks and branches of trees and amongst fallen timber; spend much more time foraging on the ground and fallen logs than other treecreepers. They are primarily insectivorous but also forage for small reptiles, nectar and sap. They nest in hollows in standing dead or live trees and tree stumps. The species breeds from July to February either in pairs or co-operatively in territories of around 4 - 5 hectares (DEC 2005a).

Threats to the survival of this species include: reduction of habitat, due to clearing for agriculture, development and timber harvesting (DEC 2005a). The proposed development will result in the loss of 2.9 hectares of vegetation, consisting of mostly grassland with scattered trees (**FIGURE 5**). Much of this habitat is considered sub-optimal for this species, with superior habitat occurring to the south and west of the site. Indirect impacts, to this species, may include an increase in noise and light disturbance from the proposed development.

The impacts outlined above are unlikely to prevent individuals of this species from successfully maturing and reproducing.



Mitigation

A VMP will be prepared outlining the rehabilitation of approximately 2700m² of land adjacent to and within the 7a zoned land (**FIGURE 6**). The rehabilitation will result in an improvement of potential habitat for this species. The overall improvement to the quality of forested vegetation will improve the area as forage habitat for this species.

Likelihood of local extinction

Suitable habitat for the Brown treecreeper will be retained and improved within the 7a zone so it is highly unlikely that the proposed development will result in the extinction, either in the short- or long-term, of the local population of this species.

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 and fifteen (15) sightings in the Coffs Harbour LGA (May 2010; DECCW undated). The local population for this species is considered to comprise of all individuals that are likely to occur on the Subject site as well as any individuals within contiguous habitat, to the south, and the Moonee Nature Reserve, that could reasonably be expected to be mating with individuals on the Subject site.

Direct and Indirect Impacts on the Life-cycle

The Brush-tailed phascogale prefers dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter. They also inhabit heath, swamps, rainforest and wet sclerophyll forest. They are agile climbers, foraging preferentially in rough barked trees of 25 cm DBH or greater, and feed mostly on arthropods, but will also eat other invertebrates, nectar and sometimes small vertebrates.

Females have exclusive territories of approximately 20 - 60 ha, while males have overlapping territories of up to 100 ha. They nest and shelter in tree hollows with entrances 2.5 - 4 cm wide and use many different hollows over a short time span. Mating occurs May - July and males die soon after the mating season whereas females can live for up to three years but generally only produce one litter.

Threats to the survival of this species include: reduction of habitat including loss and fragmentation; loss of hollow bearing trees; predation by foxes and cats; and competition for nesting hollow with the introduced honey bee (DEC 2005a). The proposed development will result in the loss of 2.9 hectares of vegetation, consisting of mostly grassland with scattered trees (**FIGURE 5**). Much of this habitat is considered sub-optimal for this species, with superior habitat occurring to the south and west of the site. Indirect impacts, to this species, may include an increase in noise and light disturbance; and disturbance from domestic animals.

The impacts outlined above are unlikely to prevent individuals of this species from successfully maturing and reproducing.



Mitigation

A VMP will be prepared outlining the rehabilitation of approximately 2700m² of land adjacent to and within the 7a zoned land (**FIGURE 6**). Hollow-bearing trees will be retained where possible and consideration should be given to the placement of artificial nest sites. This will ensure suitable nest locations are retained on the subject site. The rehabilitation will result in an improvement of potential habitat for this species. The overall improvement to the quality of forested vegetation will improve the area as forage habitat for this species.

Likelihood of local extinction

Suitable habitat for the Brush-tailed phascogale will be retained and improved within the 7a zone so it is highly unlikely that the proposed development will result in the extinction, either in the short- or long-term, of the local population of this species.

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 and seventeen (17) sightings in the Coffs Harbour LGA. There are also three (3) sightings within the Moonee Beach Nature Reserve (May 2010; DECCW undated). The local population for this species is considered to comprise of all individuals that are likely to occur on the Subject site as well as any individuals within contiguous habitat, to the south, and the Moonee Nature Reserve, that could reasonably be expected to be mating with individuals on the Subject site.

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.

Threats to the survival of this species include: habitat loss and fragmentation; management burns and wildfire; increasing predation and decreasing food availability; apiary; weed invasion; drainage of swamps; sand mining; logging of coastal sclerophyll forests with Banksia understorey; aerial spraying of bitou bush; sand dune disturbance from recreational 4WDs; barbed wire fences; introduced predators (DEC 2005a).

There will be no direct impacts to this species. The proposed development will result in the loss of 2.9 hectares of vegetation, consisting of mostly grassland with scattered trees (**FIGURE 5**) but this is not considered habitat for the Common blossom bat. Suitable habitat occurs to the south and west of the site. Indirect impacts, to this species, may include an increase in noise and light disturbance; and disturbance from domestic animals.



The impacts outlined above are unlikely to prevent individuals of this species from successfully maturing and reproducing.

Likelihood of local extinction

Suitable habitat for the Common blossom bat will be retained and improved within the 7a zone so it is highly unlikely that the proposed development will result in the extinction, either in the short- or long-term, of the local population of this species.

Giant barred frog

Extent of the local population

The NPWS database contained fifty-seven (57) records of this species within 10 kilometres of the Study area and 217 sightings in the Coffs Harbour LGA (May 2010; DECCW undated). The local population for this species is considered to comprise of all individuals that are likely to occur on the Subject site as well as any individuals within contiguous habitat, to the south, and the Moonee Nature Reserve, that could reasonably be expected to be mating with individuals on the Subject site.

Direct and Indirect Impacts on the Life-cycle

Giant barred frogs forage in deep, damp leaf-litter in rainforests, moist eucalypt forest and adjacent dry eucalypt forest slopes. They breed around shallow, flowing rocky streams from late spring to summer. However, when not breeding, this species may disperse several hundred metres from water sources (DEC 2005a).

Threats to the species include: 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; and herbicide use near streams.

There will be no direct threats to this species from the proposed development however, indirect impacts include an increase in stormwater volume flowing to the drainage line on site.

The impacts outlined above are unlikely to prevent individuals of this species from successfully maturing and reproducing.

Mitigation

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.

Likelihood of local extinction

Overall, impacts on this species are not considered to be significant, therefore it is highly unlikely that the proposed development will result in the extinction, either in the short- or long-term, of the local population of this species.



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 and 379 sightings within the Coffs Harbour LGA (May 2010; DECCW undated). The local population for this species is considered to comprise of all individuals that are likely to occur on the Subject site as well as any individuals within contiguous habitat, to the south, and the Moonee Nature Reserve, that could reasonably be expected to be mating with individuals on the Subject site.

Direct and Indirect Impacts on the Life-cycle

The glossy black-cockatoo inhabits mountain forests, coastal woodlands, open forest, riparian vegetation and partially cleared areas from sea level to 1000 metres. This distribution of this species is strongly linked to the occurrence of their primary food source, the seeds of *Allocasuarina torulosa*, *A. verticillata* and *A. littoralis*. Breeding occurs from March to August with the main breeding season from April to June. The species requires a large a large cavities for nesting and breeding which is often found in a hollow trees limb.

Threats to the survival of this species include: reduction of habitat including loss and fragmentation; Grazing and associated burning; urban development; logging that reduces age classes of eucalypts and *Allocasuarina*; cats climbing into nests; and firewood collection (DEC 2005a).

The proposed development will result in the loss of 2.9 hectares of vegetation, consisting of mostly grassland with scattered trees (**FIGURE 5**). 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 and may also result in higher levels of disturbance via indirect impacts (i.e. light, noise, domestic animals).

The impacts outlined above are unlikely to prevent individuals of this species from successfully maturing and reproducing.

Mitigation

A VMP will be prepared outlining the rehabilitation of approximately 2700m² of land adjacent to and within the 7a zoned land (**FIGURE 6**). Suitable feed trees will be included in the replacement species list. The rehabilitation will result in an improvement of potential habitat for this species.

Likelihood of local extinction

Suitable habitat for the Glossy black cockatoo will be retained and improved within the 7a zone so it is highly unlikely that the proposed development will result in the extinction, either in the short- or long-term, of the local population of this species.



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 and 224 sightings in the Coffs Harbour LGA. There are also four (4) sightings within the Moonee Beach Nature Reserve (May 2010; DECCW undated). The local population for this species is considered to comprise of all individuals that are likely to occur on the Subject site as well as any individuals within contiguous habitat, to the south, and the Moonee Nature Reserve, that could reasonably be expected to be mating with individuals on the Subject site.

Direct and Indirect Impacts on the Life-cycle

Grey-headed flying-foxes occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Individual camps may have tens of thousands of animals and are used for mating, birth and the rearing of young. Annual mating commences in January and a single young is born each October or November. Site fidelity to camps is high with some camps being used for over a century.

Grey-headed flying-foxes may travel up to 50 km to forage on the nectar and pollen of native trees, in particular Eucalyptus, Melaleuca and Banksia, and fruits of rainforest trees and vines. They also forage in cultivated gardens and fruit crops and can inflict severe crop damage.

Threats to the survival of this species include: habitat loss and fragmentation; direct disturbance to camps; drainage of swamps; powerlines; logging of Sclerophyll forests; management burns and wildfires; shooting; disease - lyssavirus; apiary; barbed wire fences; weed invasion; and climate change (DEC 2005a). Although the proposed development will result in the loss of 2.9 hectares of vegetation, this is not considered to be quality habitat for the Grey-headed flying fox. The proposed development may result in indirect impacts to this species such as higher levels of disturbance (i.e. light, noise, domestic animals).

The impacts outlined above are unlikely to prevent individuals of this species from successfully maturing and reproducing.

Mitigation

A VMP will be prepared outlining the rehabilitation of approximately 2700m² of land adjacent to and within the 7a zoned land (**FIGURE 6**). The overall improvement to the quality of forested vegetation will result in an improvement in forage habitat for this species.

Likelihood of local extinction

Suitable habitat for the Grey-headed flying-fox will be retained and improved within the 7a zone so it is highly unlikely that the proposed development will result in the extinction, either in the short- or long-term, of the local population of this species.



Koala

Extent of the local population

The NPWS database contained 138 records of this species within 10 kilometres of the Study area and 1393 sightings in the Coffs Harbour LGA (May 2010; DECCW undated). There was no evidence of Koalas occurring on the Subject site but there are three (3) sightings within the Moonee Beach Nature Reserve (May 2010; DECCW undated). Therefore, it is possible that dispersing Koalas move through the site occasionally. The local population for this species is considered to comprise of all individuals that are likely to occur on the Subject site, as well as any individuals within contiguous habitat to the south and the Moonee Nature Reserve, that could reasonably be expected to be mating with individuals on the Subject site.

Direct and Indirect Impacts on the Life-cycle

The Koala inhabits eucalypt woodlands and forests where it feeds on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species. Koalas also utilise isolated paddock trees. The quality of forest and woodland communities as habitat for koalas is influenced by a range of factors, such as: species and size of trees present; structural diversity of the vegetation; soil nutrients; climate and rainfall; and size and disturbance history of the habitat patch.

Koalas are inactive for most of the day, feeding and moving mostly at night. They spend most of their time in trees, but will descend and traverse open ground to move between trees.

Home range size varies with quality of habitat, ranging from less than 2 ha to several hundred hectares in size. They are generally solitary animals, but have complex social hierarchies based on a dominant male with a territory overlapping several females and sub-ordinate males on the periphery. Females breed at two years of age and produce one young per year.

Threats to the survival of this species include: Habitat clearing; Introduced predators - foxes and dogs; 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.; Wildfire; Road kills; Disease (DEC 2005a).

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 (**FIGURE 5**). No primary food tree species occur on the site. Blue gum in the 7a area will be retained. 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 result in higher levels of disturbance on rare vagrant Koalas via indirect impacts (i.e. light and noise).

The impacts outlined above are unlikely to prevent individuals of this species from successfully maturing and reproducing.



Mitigation

A VMP will be prepared outlining the rehabilitation of approximately 2700m² of land adjacent to and within the 7a zoned land which will include the planting of koala food species (**FIGURE 6**). The overall improvement to the quality of forested vegetation will improve the area as potential forage habitat for this species.

Likelihood of local extinction

Overall, impacts on this species are not considered to be significant, therefore it is highly unlikely that the proposed development will result in the extinction, either in the short- or long-term, of the local population of this species.

Little bent-wing bat

Extent of the local population

The NPWS database contained twenty-eight (28) records of this species within 10 kilometres of the Study area and 143 sightings in the Coffs Harbour LGA. There was also one (1) sighting within the Moonee Beach Nature Reserve (May 2010; DECCW undated). The local population for this species is considered to comprise of all individuals that are likely to occur on the Subject site as well as any individuals within contiguous habitat, to the south, and the Moonee Nature Reserve, that could reasonably be expected to be mating with individuals on the Subject site.

Direct and Indirect Impacts on the Life-cycle

The Little bent-wing bat shows a preference for well timbered areas including rainforest, wet and dry sclerophyll forest, *Melaleuca* swamps and dense coastal banksia scrub. They roost in caves, tunnels and sometimes tree hollows during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats. They often share roosting sites with the Common bent-wing bat (*M. schreibersii*) and, in winter, the two species may form mixed clusters.

In NSW the largest maternity colony is in close association with a large maternity colony of Common bent-wing bats and appears to depend on the large colony to provide the high temperatures needed to rear its young.

Threats to the survival of this species include: Clearing - habitat loss; Disturbance to camps/caves by limestone mining (cave collapse, altered air flow, noise, dust etc) and recreational activities; Clearing - fragmentation; Logging - loss of foraging habitat; Frequent burning; Altered hydrology/microclimate - old growth-regrowth; Grazing; Wildfire; Pesticides; Introduced predators; (DEC 2005a).

Loss of forage habitat for this species as a result of the proposed development is considered to be relatively minor, considering the availability of other suitable forage resources in the area. The proposed development will result in the loss of 2.9 hectares of vegetation, consisting of mostly grassland with scattered trees. This loss does include some flowering eucalypt species suitable as forage habitat for this species (**FIGURE 5**). Indirect impacts, to this species, may include an increase in noise and light disturbance; and disturbance from domestic animals.



The impacts outlined above are unlikely to prevent individuals of this species from successfully maturing and reproducing.

Mitigation

A VMP will be prepared outlining the rehabilitation of approximately 2700m² of land adjacent to and within the 7a zoned land (**FIGURE 6**). The rehabilitation will result in an improvement of potential habitat for this species. The overall improvement to the quality of forested vegetation will improve the area as forage habitat for this species.

Likelihood of local extinction

Suitable habitat for the Little bent-wing bat will be retained and improved within the 7a zone so it is highly unlikely that the proposed development will result in the extinction, either in the short- or long-term, of the local population of this species.

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 and thirty (30) sightings of this species in the Coffs Harbour LGA. There was also one (1) sighting within the Moonee Beach Nature Reserve (May 2010; DECCW undated). The local population for this species is considered to comprise of all individuals that are likely to occur on the Subject site as well as any individuals within contiguous habitat, to the south, and the Moonee Nature Reserve, that could reasonably be expected to be mating with individuals on the Subject site.

Direct and Indirect Impacts on the Life-cycle

The Square-tailed kite is found in a variety of timbered habitats including dry woodlands and open forests, and shows a particular preference for timbered watercourses. In arid north-western NSW the species has been observed in stony country with a ground cover of chenopods and grasses, open acacia scrub and patches of low open eucalypt woodland.

It is a specialist hunter of passerines, especially honeyeaters, and most particularly nestlings, and insects in the tree canopy, picking most prey items from the outer foliage. It appears to occupy large hunting ranges of more than 100km².

Breeding is from July to February, with nest sites generally located along or near watercourses, in a fork or on large horizontal limbs.

Threats to the survival of this species include: clearing for agriculture; grazing and associated burning; logging which increases the structural density through reducing age classes, decreased nectar production; intensive horticulture; nest site loss; urban development; and egg collecting (DEC 2005a).

Loss of forage habitat for this species as a result of the proposed development is considered to be relatively minor, considering the availability of other suitable forage resources in the area. The proposed development will result in the loss of 2.9 hectares of vegetation, consisting of mostly grassland with scattered trees. No suitable nest



trees occur but this species may forage for prey on the site but this loss does include some flowering species that is likely to attract the Square-tailed kite's preferred prey (**FIGURE 5**). Indirect impacts, to this species, may include an increase in noise and light disturbance; and disturbance from domestic animals.

The impacts outlined above are unlikely to prevent individuals of this species from successfully maturing and reproducing.

Mitigation

A VMP will be prepared outlining the rehabilitation of approximately 2700m² of land adjacent to and within the 7a zoned land (**FIGURE 6**). The rehabilitation will result in an improvement of potential habitat for this species. The overall improvement to the quality of forested vegetation will improve the area as forage habitat for this species.

Likelihood of local extinction

Loss of this forage habitat is considered to be relatively minor, considering the availability of other suitable forage resources in the area therefore it is highly unlikely that the proposed development will result in the extinction, either in the short- or long-term, of the local population of this species.

Squirrel glider

Extent of the local population

The NPWS database contained three (3) records of this species within 10 kilometres of the Study area and forty-four (44) sightings in the Coffs Harbour LGA. There was also one (1) sighting within the Moonee Beach Nature Reserve (May 2010; DECCW undated). The local population for this species is considered to comprise of all individuals that are likely to occur on the Subject site as well as any individuals within contiguous habitat, to the south, and the Moonee Nature Reserve, that could reasonably be expected to be mating with individuals on the Subject site.

Direct and Indirect Impacts on the Life-cycle

The Squirrel glider inhabits dry sclerophyll forest and woodland and is generally absent from rainforest and closed forest. It is generally recorded from mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. In NSW the species has also been recorded from Blackbutt, Forest red gum and Red bloodwood forests, Coastal banksia heathland and Grey gum/Spotted gum/Grey ironbark dry hardwood forests. Within a suitable vegetation community at least one flora species should flower heavily in winter and one or more of the eucalypts should be smooth-barked. A shrub or Acacia midstorey is also preferred.

Squirrel gliders live in family groups of between 2 and 10 animals, generally comprising of one male, at least 2 females and juveniles. They require abundant tree hollows for refuge and nest sites. Squirrel Gliders are agile climbers and can glide for more than 50m in one movement. Nightly movements are estimated as between 300 and 500m. Home-ranges have been estimated as between 0.65 and 8.55ha and movements tend to be greater for males than females.



The species feeds on nectar, pollen, flowers, acacia gum and insects, particularly caterpillars. Squirrel Glider's forage in the upper and lower forest canopies and in the shrub understorey. During winter when other food resources are scarce the Squirrel glider may obtain its energy from the winter flowers of the Coastal banksia, Red ironbark, River red gum, Grey ironbark, Spotted gum, Forest red gum and, in some areas, Blackbutt. Xanthorrhoea and mature acacias may also provide a valuable food source.

Threats to the survival of this species include: Habitat clearing; High frequency burning; 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; Apiary - competition for hollows; Introduced predator - foxes, dogs and cats.

The impacts outlined above are unlikely to prevent individuals of this species from successfully maturing and reproducing.

Mitigation

A VMP will be prepared outlining the rehabilitation of approximately 2700m² of land adjacent to and within the 7a zoned land (**FIGURE 6**). The rehabilitation will result in an improvement of potential habitat for this species. The overall improvement to the quality of forested vegetation will improve the area as forage habitat for this species.

Likelihood of local extinction

The proposed development will result in the loss and fragmentation of 2.9 hectares of sub-optimal habitat for this species (**FIGURE 5**). Superior habitat occurs to the south and west of the site. Suitable (but marginal) habitat in the 7a area will be retained and rehabilitated (**FIGURE 6**). It is considered that the proposed development will have relatively little impact on this species and therefore it is highly unlikely that the proposed development will result in the extinction, either in the short- or long-term, of the local population of this species.

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 and twenty (20) sightings in the Coffs Harbour LGA (May 2010; DECCW undated). The local population for this species is considered to comprise of all individuals that are likely to occur on the Subject site as well as any individuals within contiguous habitat, to the south, and the Moonee Nature Reserve, that could reasonably be expected to be mating with individuals on the Subject site.

Direct and Indirect Impacts on the Life-cycle

Stephens' Banded Snake is a medium-sized partly tree-dwelling snake approximately one metre long. It is brown or yellow-brown above, with a series of irregular, broad, dark crossbands. The head is black with a brown crown and a brown or cream patch on



either side of the nape and the lips are barred with black and cream (DEC 2005a). It can be found in rainforest and eucalypt forests and rocky areas up to 950 m in altitude. Stephens' Banded Snake is nocturnal, and shelters between loose bark and tree trunks, amongst vines, or in hollow trunks limbs, rock crevices or under slabs during the day. At night it hunts frogs, lizards, birds and small mammals. This species breeding and shelters in 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) (DEC 2005a).

Threats to the survival of this species include: Clearing and fragmentation of habitat; Forestry practices which result in loss of old or dead trees; frequent burning for fuel reduction or grazing management which destroys old and dead trees and removes understorey vegetation; and Illegal collection of snakes from the wild (DEC 2005a).

The proposed development will result in the loss of 2.9 hectares of vegetation, consisting of mostly grassland with scattered trees (**FIGURE 5**). Much of the habitat to be lost is considered sub-optimal for this species, with superior habitat occurring to the south and west of the site. Indirect impacts, to this species, may include an increase disturbance from domestic animals.

The impacts outlined above are unlikely to prevent individuals of this species from successfully maturing and reproducing.

Mitigation

A VMP will be prepared outlining the rehabilitation of approximately 2700m² of land adjacent to and within the 7a zoned land (**FIGURE 6**). The rehabilitation will result in an improvement of potential habitat for this species. The overall improvement to the quality of forested vegetation will improve the area as forage habitat for this species.

Likelihood of local extinction

The proposed development will have little impact on this species. Suitable habitat within the 7a area will be retained and rehabilitated (**FIGURE 6**). While the proposed development may result in higher levels of disturbance via indirect impacts (i.e. light and noise) it is highly unlikely that the proposed development will result in the extinction, either in the short- or long-term, of the local population of this species.

Yellow-bellied glider

Extent of the local population

The NPWS database contained 44 records of this species within 10 kilometres of the Study area and 225 sightings in the Coffs Harbour LGA (May 2010; DECCW undated). The local population for this species is considered to comprise of all individuals that are likely to occur on the Subject site as well as any individuals within contiguous habitat, to the south, and the Moonee Nature Reserve, that could reasonably be expected to be mating with individuals on the Subject site.



Direct and Indirect Impacts on the Life-cycle

The Yellow-bellied Glider is a large, active, sociable and vocal glider. The very mobile species occupies a large home range of between 20 to 85 hectares. It has a large gliding membrane that extends from the wrist to the ankle. It has a loud, distinctive call, beginning with a high-pitched shriek and subsiding into a throaty rattle. The Yellow-bellied glider feeds primarily on plant and insect exudates, extracts sap or biting into the trunks and branches of favoured food trees, often leaving a distinctive 'V'-shaped scar. The species is found in tall mature eucalypt forest in areas of high rainfall and nutrient rich soils on the coast and the drier escarpment forests. They live in small family groups of two - six individuals and are nocturnal. Their dens are found in the hollows of large trees (DEC 2005a).

Threats to the survival of this species include: 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; habitat clearing; and high frequency burning (DEC 2005a).

The proposed development will result in the loss of 2.9 hectares of vegetation, consisting of mostly grassland with scattered trees (**FIGURE 5**). Much of this habitat is considered sub-optimal for this species, with superior habitat occurring to the south and west of the site. Indirect impacts, to this species, may include an increase in noise and light disturbance; and disturbance from domestic animals.

The impacts outlined above are unlikely to prevent individuals of this species from successfully maturing and reproducing.

Mitigation

A VMP will be prepared outlining the rehabilitation of approximately 2700m² of land adjacent to and within the 7a zoned land (**FIGURE 6**). The rehabilitation will result in an improvement of potential habitat for this species. The overall improvement to the quality of forested vegetation will improve the area as forage habitat for this species.

Likelihood of local extinction

Overall, impacts on this species are not considered to be significant, therefore it is highly unlikely that the proposed development will result in the extinction, either in the short- or long-term, of the local population 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.

There are thirty six (36) endangered populations listed under the TSC Act. 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, of 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
- Brush-tailed phascogale
- Common blossom bat
- 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).

Six (6) Critical habitat areas are currently listed under the Threatened Species Conservation Act (1995). 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.

NB: Recovery plans are no longer required to be produced and have as such been replaced by 'Priority Actions'

Barred cuckoo-shrike

No recovery plan has been gazetted for the Barred cuckoo-shrike however, there are two Priority Actions identified to help the recovery of this species as follows:

- Retain areas of native forest particularly along roads and watercourses on private land, state forests and local government areas.
- Initiate and support rainforest regeneration, specifically retain individual native fruit-bearing trees as feed trees and plant feed trees, including figs and other rainforest fruit trees.

The proposed development will retain some good quality vegetation in the south of the site. This area will also be subject to rehabilitation and will be conserved. Fruit-bearing trees including figs and other rainforest fruit trees should be included in the planting



species list. The proposed development and the planned rehabilitation are consistent with the Priority Actions stated above.

Brown tree creeper

No recovery plan has been gazetted for the Brown tree creeper however, there are a number of Priority Actions identified to help the recovery of this species. One is relevant to the proposed development as follows:

- Implement sympathetic habitat management in conservation reserves, council reserves and crown reserves where the species occurs.

The proposed development will retain some good quality vegetation in the south of the site. This area will also be subject to rehabilitation and will be conserved. The proposed development and the planned rehabilitation and conservation are consistent with the priority action stated above.

Brush-tailed phascogale

No recovery plan has been gazetted for the Brush-tailed phascogale however, there are a number of Priority Actions identified to help the recovery of this species. One is relevant to the proposed development as follows:

- Undertake a targeted community education program that raises awareness about threats such as predation from cats.

The control of dogs and cats is identified as an amelioration strategy, outlined in Section 4.2.3.2 of the Ecological Assessment (JWA 2007). The proposed development will also retain some good quality vegetation in the south of the site. This area will also be subject to rehabilitation. The proposed development, the planned rehabilitation and the plan to educate landowners about the need to control cats and dogs is consistent with the Priority Actions stated above.

Common blossom bat

No recovery plan has been gazetted for the Common blossom bat however, there are a number of Priority Actions identified to help the recovery of this species. Three of these are relevant to the proposed development as follows:

- Ensure a mosaic of nectar-producing trees and shrubs, esp. in coastal heath paperbark swamp as well as rainforest roost habitat. Give high priority in PVP assessments, or other assessment tools.
- Control coastal weed species e.g. Bitou Bush, but avoid aerial spraying during the flowering season of important heath species as herbicides can directly collect in flowers that are fed upon at night.
- Initiate and support rainforest and heath regeneration projects where coastal habitat has been cleared and fragmented.

The proposed development will retain some good quality vegetation in the south of the site. This area will also be subject to rehabilitation and will be conserved. Nectar-producing trees and shrubs should be included in the planting species list. Weed control will also be included the rehabilitation plan. The proposed development and the



planned rehabilitation and conservation are consistent with the priority action stated above.

Giant barred frog

No recovery plan has been gazetted for the Giant barred frog however, there are a number of Priority Actions identified to help the recovery of this species of which one is relevant to the proposed development as follows:

- Ensure species is considered in Plans of Management, environmental planning instruments and environmental impact assessment.

The proposed development will retain some good quality vegetation in the south of the site. This area will also be subject to rehabilitation and will be conserved. The proposed development and the planned rehabilitation and conservation are consistent with the priority action stated above.

Glossy black cockatoo

No recovery plan has been gazetted for the Glossy black cockatoo however, there are a number of Priority Actions identified to help the recovery of this species, of which two are relevant to the proposed development as follows:

- Increase landholder and public awareness and interest in Glossy Black Cockatoo conservation and habitat management.
- Encourage the restoration of foraging habitat that has been cleared or degraded by previous impacts.

The proposed development will retain some good quality vegetation in the south of the site. This area will also be subject to rehabilitation and will be conserved. *Allocasuarina torulosa* (Forest She-oak) is found on the site and should be included in the planting list for the rehabilitation area. The proposed development and the planned rehabilitation and conservation are consistent with the Priority Actions stated above.

Grey Headed flying fox

No recovery plan has been gazetted for the Grey headed flying fox however, there are a number of Priority Actions identified to help the recovery of this species, of which two are relevant to the proposed development as follows:

- Protect and enhance priority foraging habitat for Grey-headed Flying-foxes, for example through management plans, local environmental plans and development assessments, and through volunteer conservation programs for privately owned land.
- Increase the extent and viability of foraging habitat for Grey-headed Flying-foxes that is productive during winter and spring (generally times of food shortage), including habitat restoration/rehabilitation works.

The proposed development will retain some good quality vegetation in the south of the site. This area will also be subject to rehabilitation and will be conserved. The proposed development and the planned rehabilitation and conservation are consistent with the Priority Actions stated above.



Koala

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. However, the mapped Secondary Koala habitat is more extensive than the ground truthed vegetation mapping produced (JWA 2007). It appears that there will be a loss of Secondary Koala habitat, as mapped under the CHCC KPoM, when in fact the communities mapped as Koala habitat are grassland and sparse forest dominated by Brushbox with few Koala food trees. Suitable habitat will be retained on the site and Koala food trees should be considered in the planting species list. There is also the potential for 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 including the control of dogs and vehicle speed limits. It is considered that the proposed development is consistent with the objectives and actions of the Recovery Plan for the Koala.

There are also a number of Priority Actions identified to help the recovery of this species, however all of these are initiatives for DECCW and/or other government and Non-government bodies.

Little bentwing bat

No recovery plan has been gazetted for the Little bentwing bat however, there are a number of Priority Actions identified to help the recovery of this species. One is relevant to the proposed development as follows:

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

The proposed development will retain some good quality vegetation in the south of the site. This area will also be subject to rehabilitation and will be conserved. No hollow bearing trees will be removed, and dogs and cats will be controlled within the proposed development site. The proposed development and the planned rehabilitation are consistent with the Priority Actions stated above.



Square tailed kite

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.

There are also a number of Priority Actions identified to help the recovery of this species however none are relevant to the proposed development. The proposed development will retain some good quality vegetation in the south of the site and this area will rehabilitated and conserved providing potential habitat for the Square tailed kite.

Squirrel glider

No recovery plan has been gazetted for the Squirrel glider however, there are a number of Priority Actions identified to help the recovery of this species including:

- Ensure the largest hollow bearing trees (including dead trees) are given highest priority for retention in PVP assessments and other environmental planning instruments, or other land assessment tools.

The proposed development will retain some good quality vegetation in the south of the site. This area will also be subject to rehabilitation. Dead trees should be left in situ and consideration should be given to placing hollow bearing logs within the rehabilitation site. The proposed development and the planned rehabilitation are consistent with the Priority Actions stated above.

Stephens' banded snake

No recovery plan has been gazetted for the Stephens' banded snake however, there are a number of Priority Actions identified to help the recovery of this species including:

- Develop management strategies that protect, retain and perhaps augment stands of native vegetation, connectivity between stands and retain stags or hollow bearing trees.

The proposed development will retain some good quality vegetation in the south of the site. This area will also be subject to rehabilitation which will increase the habitat potential of the area. Additionally, consideration should be given to placing habitat



logs within the rehabilitation area. The proposed development and the planned rehabilitation are consistent with the Priority Actions stated above.

Yellow-bellied glider

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.

There are also a number of Priority Actions identified to help the recovery of this species including:

- Integrate Recovery Actions where appropriate with those of other threatened species, populations and ecological communities.
- Consider species in reserve management and planning to protect and enhance habitat and connection corridors.

The proposed development will retain some good quality vegetation in the south of the site. This area will also be subject to rehabilitation and conservation. The Yellow bellied glider will be considered within the rehabilitation plan by providing quality potential habitat. The proposed development and the planned rehabilitation are consistent with the Priority Actions stated above.

Threat Abatement Plans

There are three approved Threat Abatement Plans for the following:

- Predation by the Plague Minnow
- Predation by the Red fox
- Invasion by Bitou bush

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. No Bitou bush was 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) (**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.



REFERENCES

- DEC (2005) Approved NSW & National Recovery Plan *Quassia* sp. Mooney Creek (Moonee Quassia). Department of Environment and Conservation. New South Wales Parks and Wildlife Service. July 2005.
- DECC (2005a) Threatened species, population and Ecological communities of NSW. View species by scientific name. Located at http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/browse_scientificname.aspx and viewed on the 15th June 2010.
- DECC (2007) Threatened species assessment guidelines. The assessment of significance. The Department of Environment and Climate Change NSW
- DECCW (undated) NSW National Parks & Wildlife Service - Atlas of NSW Wildlife. Department of Environment Conservation, Climate Change and Water. Located at <http://wildlifeatlas.nationalparks.nsw.gov.au/wildlifeatlas/watlas.jsp> Accessed on 14th May 2010.
- Floyd, A.G., (1989) Rainforest Trees of Mainland South-eastern Australia, Inkata Press



APPENDIX 1

Threatened Flora Known from the Area



A search of the NPWS Database (DECCW undated) 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>Sarcochilus 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'



APPENDIX 2

**Threatened Fauna Known from the Area
and
Threatened Fauna Considered a Possible Occurrence on the Subject Site**



A search of the NPWS Database (DECCW undated) revealed forty-one (41) Threatened Fauna species within 10km of the Subject site. These species are shown in TABLE 2.

TABLE 2
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>Calyptrorhynchus banksii</i>	Red-tailed Black-Cockatoo
<i>Calyptrorhynchus lathamii</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



Based on an 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. Threatened fauna considered a possible occurrence on the Subject site are shown in TABLE 3.

TABLE 3
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.
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.



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Species	Likelihood of occurrence in the Study area	Notes
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.
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.



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Species	Likelihood of occurrence in the Study area	Notes
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.
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.



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Species	Likelihood of occurrence in the Study area	Notes
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.



APPENDIX 3

Threatened Fauna Profiles



7 Part Tests - Lot 211 Moonee

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.	



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, Dorrig 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. State Forests of N.S.W., Pennant Hills.</u> Cuttle, P (1982) Life history of the dasyurid marsupial <i>Phascogale tapoatafa</i> 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. Trall, B.J. and Coates, T.D. (1993). <u>Field Observations on the Brush-tailed Phascogale (<i>Phascogale tapoatafa</i>) Marsupalia: Dasyuridae. <i>Australian Mammalogy</i>, 16: 61-65.</u>	



7 Part Tests - Lot 211 Moonee

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.	



7 Part Tests - Lot 211 Moonee

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). <u>Reptiles and Amphibians of Australia</u> (Rev. ed) Reed, Sydney. Barker, J. and Grigg, G (1977). A field guide to Australian frogs. Rigby Limited, Adelaide.	



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, Dorrigo, 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.	



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 & Augée, 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>).	



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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7 Part Tests - Lot 211 Moonee

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.	
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.	



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. <i>Search</i> 5: 110-111. Dwyer, P.D. (1995b) Little bent-wing bat (<i>Miniopterus australis</i>). In <i>The Australian Museum Complete book of Australian Mammals</i>. R. Strahan (ed). Surrey Beatty and Sons, Sydney. Dwyer, P.D (1991b) Little bent-wing bat (<i>Miniopterus australis</i>). In <i>The Australian Museum Complete book of Australian Mammals</i>. R. Strahan (ed). Angus and Robertson, Sydney. Pp. 338-339. Dwyer, P.D. (1964). Fox Predation on Cave Bats. <i>Australian Journal of Science</i> 26: 397-98. Strahan R. (1992) <i>Encyclopedia of Australian Animals: Mammals</i>. Angus and Robertson Publishers, Sydney.	



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 predares 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.	



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> <u>Marsupalia: Dasyuridae</u>. Australian Mammalogy, 16: 61-65.	



7 Part Tests - Lot 211 Moonee

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, Dorrigo, 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.	



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 decorticating 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 4

KEY THREATENING PROCESSES



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

- Alteration of habitat following subsidence due to longwall mining
- Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands
- Anthropogenic climate change
- Bushrock removal
- Clearing of native vegetation
- Competition and grazing by the feral European rabbit (*Oryctolagus cuniculus*)
- Competition and habitat degradation by feral goats (*Capra hircus*)
- Competition from feral honey bees (*Apis mellifera*)
- Death or injury to marine species following capture in shark control programs on ocean beaches
- Entanglement in or ingestion of anthropogenic debris in marine and estuarine environments
- Forest Eucalypt dieback associated with over-abundant psyllids and bell miners
- High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition
- Herbivory and environmental degradation caused by feral deer
- Importation of red imported fire ants (*Solenopsis invicta*)
- Infection by *Psittacine circoviral* (beak and feather) disease affecting endangered psittacine species and populations
- Infection of frogs by amphibian chytrid causing the disease *Chytridiomycosis*
- Infection of native plants by *Phytophthora cinnamomi*
- Introduction of the large earth bumblebee (*Bombus terrestris*)
- Invasion and establishment of exotic vines and scramblers
- Invasion and establishment of Scotch broom (*Cytisus scoparius*)
- Invasion and establishment of the cane toad (*Bufo marinus*)
- Invasion, establishment and spread of *Lantana camara*
- Invasion of native plant communities by *Chrysanthemoides monilifera* (bitou bush and boneseed)
- Invasion of native plant communities by exotic perennial grasses
- Invasion of the yellow crazy ant (*Anoplolepis gracilipes* (Fr. Smith)) into NSW
- Loss of hollow-bearing trees
- Loss or degradation (or both) of sites used for hill-topping by butterflies
- Predation and hybridisation of feral dogs (*Canis lupus familiaris*)
- Predation by the European red fox (*Vulpes vulpes*)
- Predation by the feral cat (*Felis catus*)
- Predation by *Gambusia holbrooki* Girard, 1859 (plague minnow or mosquito fish)
- Predation by the ship rat (*Rattus rattus*) on Lord Howe Island
- Predation, habitat degradation, competition and disease transmission by feral pigs (*Sus scrofa*)
- Removal of dead wood and dead trees