APPENDIX I

Ecological Assessment

Ecological Assessment

Clarence River Crossing – Route Selection Stage

prepared for

NSW Roads & Traffic Authority

by

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EXECUTIVE SUMMARY

This report provides an ecological assessment of a proposed additional crossing of the Clarence River at Grafton and was prepared in response to a NSW Road and Traffic Authority (RTA) brief that identified seven localities for assessment.

Searches of the NSW Department of Environment and Conservation (DEC) wildlife atlas database, NSW DEC website, NSW Fisheries website, NSW Fisheries fishfiles, the commonwealth's Environment Australia website, the register of the National estate and other sources of information identified:

- significant flora and fauna species that may occur in or near the study area;
- significant flora and fauna species known to occur in or near the study area;
- an endangered ecological community " lowland rainforest on floodplain" that is considered to occur in the study area;
- key threatening processes that the construction of a second crossing may contribute to; &
- a conservation area identified on the register of the national estate in the study area.

Habitats and vegetation present in the study area were identified initially by stereoscopic aerial photograph interpretation. A field inspection then confirmed the mapped habitat and vegetation.

Important habitat features such as rainforest vegetation remnants and senescent trees with hollows were identified. Fauna observed in the study area during field inspections was recorded. A Grey-headed Flying-Fox (*Pteropus poliocephalus*) colony is known to occupy a permanent camp in Susan Island Nature Reserve on the western end of Susan Island.

The assessment identified potential impacts of the construction of the second crossing for each of the localities and identified localities where it is considered that the construction of the second crossing would have least impact on the study areas flora and fauna. The assessment concluded that the construction of the crossing on the eastern side of the existing bridge would have the least impact on the study area's flora and fauna. Although outside the study area the Grey-headed Flying-Fox (*Pteropus poliocephalus*) camp on the western end of Susan Island is a significant occurrence and it is considered that the construction of the crossing localities on or near the island could impact on the flying-fox colony.

PROJECT TEAM

The project team was

- Keith Kendall who was responsible for undertaking:
    - the terrestrial fauna components of the report;
    - aquatic ecology components of the report;
    - writing the report including background reviews and assessments.
- Greg Clancy who was responsible for undertaking:
    - the terrestrial flora survey component;
    - collation of additional fauna records; &
    - local advice on ecological features;
- Penny Kendall who conducted:
    - aerial photograph interpretation; &
    - computer mapping;
- Greg Elks who provided a peer review of draft report.

GLOSSARY

The tables in this study contain an assessment of the "likelihood of occurrence" of threatened species occurring in the study area.

In the tables:

"Nil" indicates that it is considered that there is no possibility of the occurrence of the species occurring in the study area. This consideration may be based a number of factors including:

- The lack of suitable habitat for the species in the study area;
- The distributional extent (range) of the species;
- The level of confidence of the field survey results, some species are easily identifiable in the field whilst others are more cryptic;
- The lack of records of the species in the locality.

"**Unlikely**" indicates that it is considered that there is an unlikely possibility of the occurrence of the species occurring in the study area. This consideration may be based a number of factors including:

- The presence of marginal habitat for the species in the study area;
- The distributional extent (range) of the species;
- The level of confidence of the field survey results, some species are easily identifiable in the field whilst others are more cryptic; &
- The lack of records of the species in the locality.

"**Possible**" indicates that it is considered that there is a possibility of the occurrence of the species occurring in the study area. This consideration may be based a number of factors including:

- The presence of suitable habitat for the species in the study area; &
- The distributional extent (range) of the species.

"**Likely**" indicates that it is considered that there is a likely possibility of the occurrence of the species occurring in the study area. This consideration may be based a number of factors including:

- The presence of suitable or optimal habitat for the species in the study area;
- The distributional extent (range) of the species; &
- The presence of records of the species in the locality.

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1 INTRODUCTION

1.1 BACKGROUND INFORMATION

The NSW Roads and Traffic Authority (RTA) proposes to provide an additional crossing of the Clarence River in the vicinity of Grafton. A Feasibility Study for the project was completed in February 2003. The project has now progressed to the route selection phase.

Kendall & Kendall Ecological Consultants Pty Ltd were commissioned by the RTA to provide specialist input to ensure that ecological issues are given appropriate consideration in determining a preferred option as part of the "Route Selection Study".

1.2 AIMS & OBJECTIVES

The aims and objectives of this assessment are to:

- Provide a review of previous studies relevant to the study area;
- Provide a description of the known and likely distribution of terrestrial and aquatic flora and fauna species, populations and ecological communities and their habitats with separate and specific references to those listed in schedules 1, 2 & 3 of the *Threatened Species Conservation Act* (TSC) *Act 1995*, *Fisheries Management* (FM) *Act 1994* & *Environmental Protection & Biodiversity Conservation* (EPBC) *Act 1999.* This includes preliminary determinations likely to be finalised prior to 2004. Referral will be made to information available on the relevant websites listed above.
- Identify and classify vegetation communities on a structural and floristic basis, where applicable the classification will be described according to Walker & Hopkins 1990, Groves 1999. Provide a list of all flora species recorded, indicating which species are ROTAPS or threatened species.
- Provide a list of potentially occurring threatened terrestrial and aquatic flora and fauna species based on the known distributions of the species. Provide an assessment of the likelihood of occurrence of a species based on the suitability of available habitat as referred to in the literature.
- Identify and describe the conservation significance of vegetation communities and flora species, fauna habitats, aquatic habitats and aquatic species at a local, regional and state level with reference to their occurrence in the reserve system by citing references such as Briggs and Leigh 1995, Hager and Benson 1994 and/or information available through the Comprehensive Regional Assessment (CRA).
- Describe the existing condition of vegetation communities, fauna habitats and aquatic habitats in relation to the degree and extent of disturbance (weeds, clearing, grazing, industry etc) and the likely impact of this disturbance on flora, fauna and aquatic values.
- Assess the type and degree of impact of each locality on the ecology of the study area, including impacts on threatened species, populations or ecological communities; refer to possible impacts on critical habitat, and consider implications of any relevant threatened species recovery plans, threat abatement plans, regional vegetation plans and other ecological management plans.

- Quantify the area of vegetation and (if applicable) critical habitat, endangered ecological communities and endangered populations to be affected within each of the localities.
- Quantify the number of individuals of endangered populations, threatened fauna or ROTAP species impacted within each locality.
- Assess the potential for each locality to create barriers to the movement of reproductive material between populations of terrestrial and/or aquatic fauna.
- Identify key habitats and corridors (NSW DEC) affected within each locality.
- Assess the contribution of each locality to cumulative impacts on flora and fauna and their habitats in a local regional context, including cumulative impacts on the Clarence River.
- Discuss the relationship of this assessment in regards to the principles of ecologically sustainable development.

1.3 DESCRIPTION OF THE STUDY AREA

The area under investigation is between the eastern end of Susan Island and the western end of Elizabeth Island, and extending north into the Grafton township, and as far south as the Pacific Highway.

The location of the study area is indicated on Map 1 and the study area is defined on Map 2, which also indicates the crossing localities.

1.4 RELEVANT LEGISLATION

The acts and planning policies requiring consideration under this assessment are the *EPBC Act 1999*, the *EP&A Act 1979*, *TSC Act 1995* and the *FM Act 1994*

1.4.1 EPBC Act

The objects of the *EPBC Act* considered relevant to this assessment include:

- to provide for the protection of the environment, especially those aspects of the environment that are matters of national environmental significance;
- to promote ecologically sustainable development through the conservation and ecologically sustainable use of natural resources; and
- to promote the conservation of biodiversity.

1.4.2 TSC Act

The objects of the *TSC Act* considered relevant to this assessment include:

- To conserve biological diversity and promote ecologically sustainable development;
- To prevent the extinction and promote the recovery of threatened species, populations and ecological communities; and
- To ensure the impact of any action affecting threatened species, populations and ecological communities is properly assessed.

1.4.3 FM Act

The objects of the *FM Act* considered relevant to this assessment include:

- To conserve fish stocks and protect key habitat;

- To conserve threatened species, populations and ecological communities of fish and marine vegetation;
- To promote ecologically sustainable development;
- To promote viable commercial fishing; and
- To promote quality recreational fishing opportunities.

1.4.4 EP&A Act

The objects of the EP& A Act considered relevant to this assessment include:

- To encourage:
    - The proper management, development and conservation of natural and man-made resources for the purpose of promoting the social and economic welfare of the community and a better environment;
    - The promotion and co-ordination of the orderly and economic use and development of the land;
    - The protection, provision and co-ordination of communication and utility services;
    - The provision of land for public purposes;
    - The provision and co-ordination of community services and facilities; &
    - The protection of the environment;

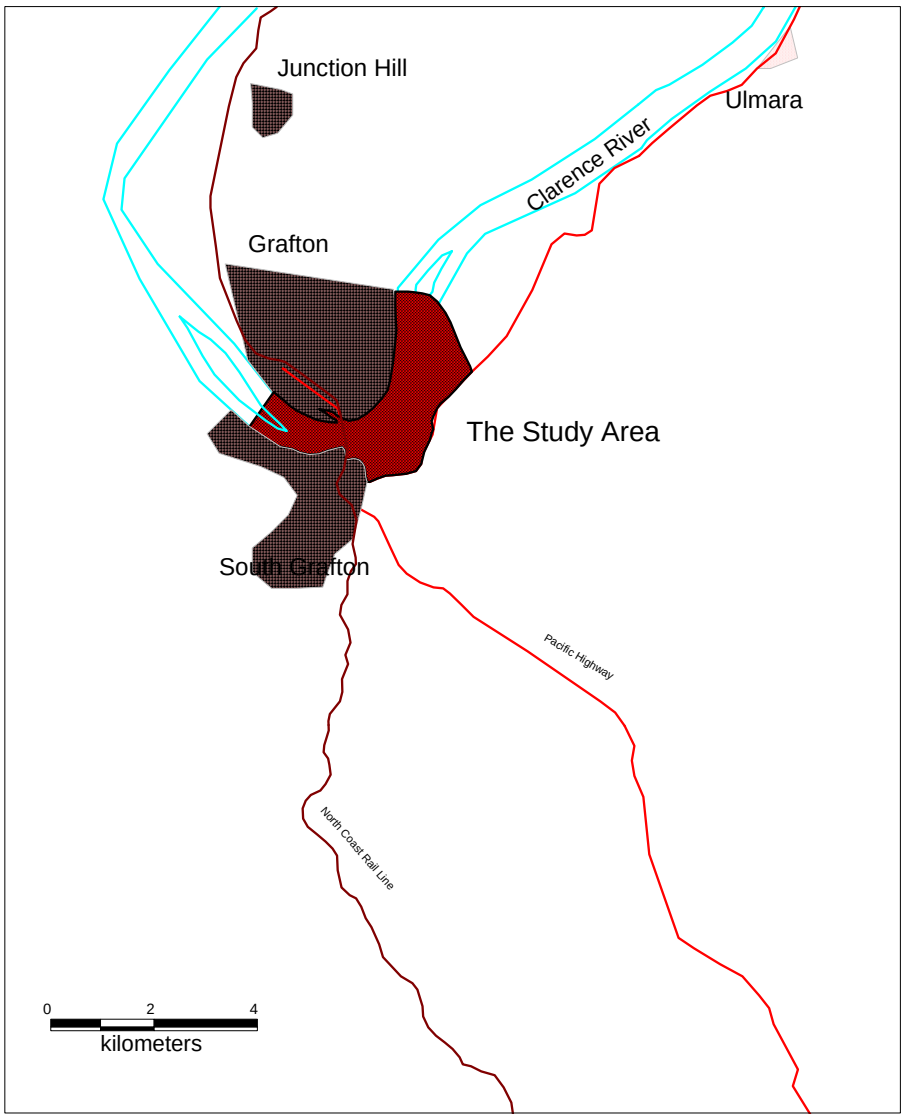
1.4.5 SEPP 44 – Koala Habitat Protection

The main aim of *State Environmental Planning Policy No. 44* (SEPP 44) is to encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas to ensure a permanent free-living population over their present range and reverse the current trend of koala population decline.

1.4.6 SEPP 14 – Wetlands

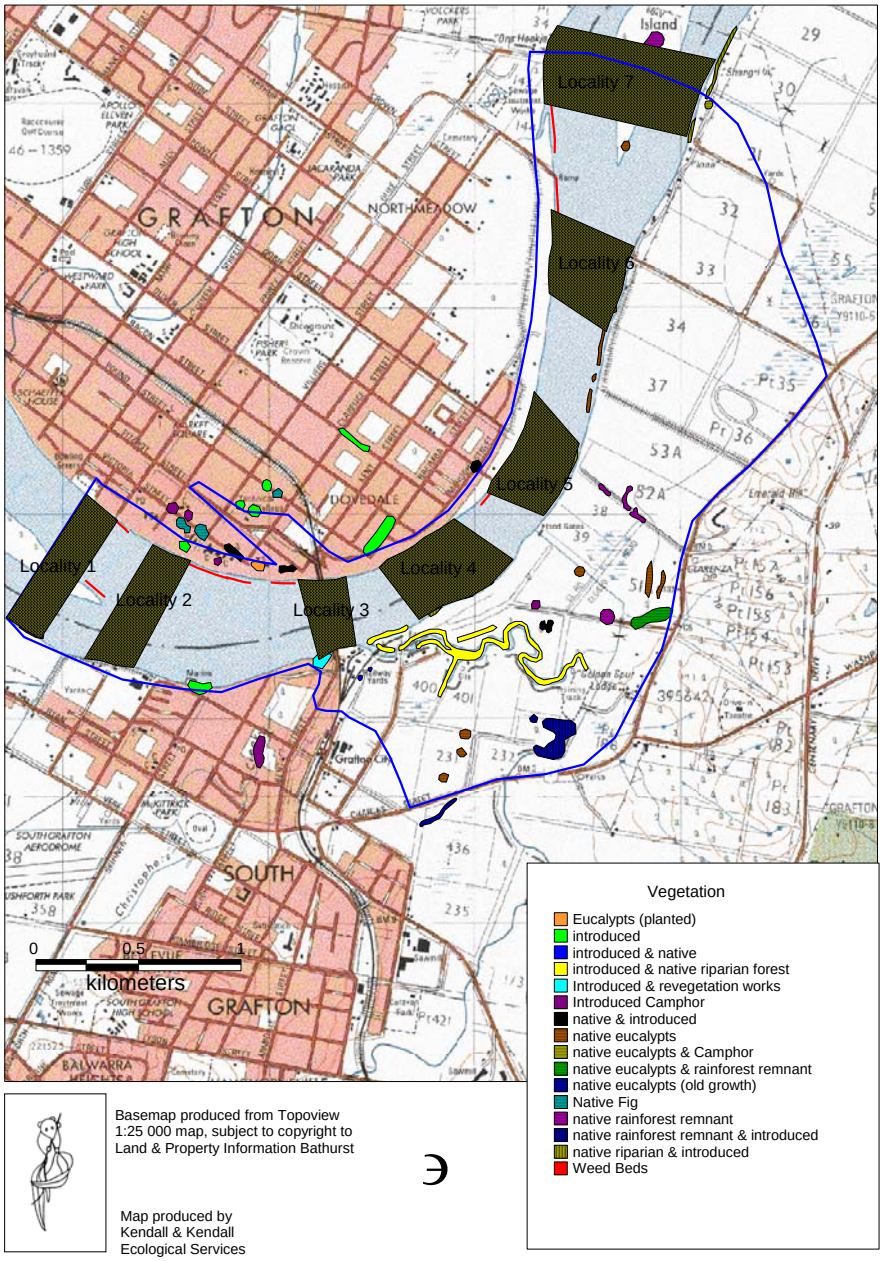
The aim of SEPP 14 is to protect designated wetlands by controlling clearing, levee construction, drainage and filling within the wetlands.

Map 1: Locality Map



Map produced by
Kendall & Kendall
Ecological Services

Map 2: Study Area Boundary, Option Localities & Vegetation



2 METHODS

2.1 DESKTOP LITERATURE REVIEW

A desktop literature review was conducted and included:

- Research and review of existing information on terrestrial and aquatic protected and threatened flora and fauna species, populations, ecological communities and their habitats as listed in the *EPBC Act 1999, TSC Act 1995* and *FM Act 1994*;
    - A review all relevant databases covering the area. Database searches included:
        - The Register of the National Estate;
        - Environment Australia's EPBC database;
        - The NSW NPWS Atlas of NSW Wildlife; and
        - The NSW Fisheries database.
- Review of existing literature from the local Grafton City Council library and the council's state of the environment report, and all other relevant council policies and plans.
- Liaison with the Susan Island Trust secretary whose comments are included in section 6.
- Identification of locations of threatened species, populations or ecological communities within 10 km of the centre of the study area.

2.2 TERRESTRIAL FIELD SURVEYS

2.2.1 Terrestrial Flora Survey Methods

Terrestrial and aquatic flora was initially identified by stereoscopic interpretation of 1:25,000 colour aerial photography, which was flown on 8th September 2002. The photography being:

- photo nos.121 &122 Run 5 Grafton NSW 4740; &
- photo nos.129 &130 Run 6 Grafton NSW 4740.

The flora was mapped onto transparent overlays.

The overlays were taken into the field and vegetation was then located and identified on the ground. A list of all flora species was recorded during random meander survey of the vegetation communities and remnants of the study area. It was intended to classify vegetational communities on a structural basis according to Walker & Hopkins 1990, Groves 1999 however due to the small size and high disturbance impacts to the structure and floristics of the vegetation this was not possible.

2.2.3 Terrestrial Habitat Assessment & Fauna Survey Methods

Draft vegetation maps and the above aerial photography were taken into the field to assist in identifying habitats present in the study area.

No systematic fauna survey was conducted however opportunistic records of fauna species observed were recorded.

2.2.4 Survey Limitations

It was not intended that this assessment be based on a comprehensive field survey, therefore the fauna survey effort was limited to opportunistic survey.

2.3 AQUATIC FIELD SURVEYS

2.3.1 Sampling Sites

No sampling of aquatic fauna was conduced as part of this assessment.

2.3.2 Habitat Assessments

The aquatic habitats present at each of the localities were observed and notes taken to provide a description of the aquatic habitat present in the study area.

2.3.3 Fishes

No systematic fish survey was conducted as part of this assessment.

2.3.4 Limitations of the Aquatic Assessment

Due to the current drought salinity in the Clarence River at Grafton has increased. The increased salinity has caused much of the underwater aquatic freshwater vegetation known to normally occur in the study area to die (Nigel Blake, wetland officer DIPNR pers comm.).

3 FLORA RESULTS

3.1 PLANT SPECIES - CONSERVATION SIGNIFICANCE

3.1.1 Conservation Significance of Plant Species

A list of the plant species recorded on the study area is provided in Appendix A.

No plant species listed as threatened under the:

- Provisions of the EPBC Act 1999, or
- Schedules of the TSC 1995,

have been reported from the study area or were detected during the field assessment.

However, the likelihood of occurrence of threatened plant species or populations in the study area is regarded as unlikely, as the vegetation of the study area has been well studied in the past and none have been recorded, has been subjected to a long period of disturbance resulting in severe floristic and structural modification, and the survey conducted as part of this assessment failed to locate any of the species.

The search of the EPBC Act website interactive map indicated that habitat for eight plant species listed under the provisions of the EPBC Act 1999 was predicted to occur within 10 km of the centre of the study area (Table 1). Also included in Table 1 is an indication of their favoured habitat.

Table 1 EPBC Act listed species with modelled habitat within 10 km of the study area

Scientific name	Habitat	Likelihood of occurrence	EPBC Act Status
Angophora robur	Dry sclerophyll forest on sandy or skeletal soils	Nil	Vulnerable
Arthraxon hispidus	Edges of rainforest in wet sclerophyll forest	Unlikely	Vulnerable
Cryptostylis hunteriana	Coastal heath on sand	Nil	Vulnerable
Eucalyptus tetapleura	Dry sclerophyll forest	Nil	Vulnerable
Marsdenia longiloba	Rainforest & wet sclerophyll forest	Unlikely	Vulnerable
Melichrus hirsutus	Dry eucalypt forest on sandy infertile soils with rocky outcrops	Nil	Endangered
Triplarina imbricata	Along water courses in low open forest with Water Gum	Nil	Endangered
Tylophora woollsii	Rainforest & Wet sclerophyll forest	Unlikely	Endangered

Similarly, the NSW DEC wildlife atlas lists three species listed under the schedules of the TSC Act 1995 not known to occur on the study area but recorded on the NSW DEC wildlife atlas database as occurring within 10km of the study area (Table 2). The locations of these records are indicated on Map 4.

Table 2. *TSC Act* listed species and populations known to occur within 10km of the study area

Scientific name	Habitat	Likelihood of occurrence	TSC Act Status
Cryptandra longistaminea,	Red gum open forest near watercourse	Unlikely	Endangered Population
Amorphospermum whitei	Rainforest and adjoining moist open forest	Unlikely	Vulnerable
Eucalyptus tetrapleura	Dry sclerophyll forest	Nil	Vulnerable

3.1.2 Plants and the National Estate

The search of the "Register of the National Estate" lists the "Grafton Conservation Area" which is an area of approximately 400ha comprising the area bounded by a line commencing on the north bank of the Clarence River on the alignment of the western side of Turf Street, then proceeding northerly to the railway line; then easterly via the northern side of the railway line and the eastern side of the railway bridge to the south bank of the Clarence River; then westerly via that bank to the mouth of Christopher Creek; then southerly via the eastern bank of that creek to the intersection of Beatson and Bligh Streets; then southerly via the eastern side of Bligh Street to Vere Street; then westerly via the southern side of that street and its alignment to Hay Street; then northerly via the western side of that street and its alignment to the southern bank of the Clarence River; then directly to the commencement point. The statement of significance describes the architectural and cultural values of the area and also includes reference to magnificent canopies of ficus, jacarandas and camphor laurels. Therefore figs within this area of Grafton are recognised in the National Estate.

Localities 1, 2 & 3 occur in the Grafton Conservation Area.

3.1.3 Local & Regional Conservation Significance of Plant Species

A sample of a rainforest tree was collected on the Alipou Creek TSR (locality 4) during the field flora survey. It was identified as Broad-leaved Brush Wilga *Geijera latifolia*. This species is considered to be very uncommon to rare locally (Greg Clancy pers comm.).

3.2 PLANT COMMUNITIES - CONSERVATION SIGNIFICANCE

3.2.1 Regional & Local Significance

It is considered that all native vegetation within the study area has local significance as the vast majority of the study area has been cleared and only remnant trees or small patches of disturbed communities remain.

It is considered that much of the study area would have been originally covered by a mosaic of:

- Wet open forest (Forest Red Gum – *Eucalyptus tereticornis*);
- Paperbark swamp sclerophyll forest (*Melaleuca* spp.);

- Lowland floodplain rainforest;
- Sedgelands and open wetlands; &
- Riparian vegetation.

Grafton City Council Planning Department indicated that there are no designated SEPP 14 wetlands within the study area.

3.2.2 National & State Significance

The search of the EPBC Act interactive map website indicates that there are no threatened ecological communities listed under the provisions of the EPBC Act that are considered as possible occurrences within 10 km of the study area.

The search of the DEC website and wildlife atlas indicated that no threatened flora populations or communities occur on the study area

However, "Lowland Rainforest on Floodplain in the New South Wales North Coast Bioregion" is listed as an endangered ecological community on Part 3 of Schedule 1 of the TSC Act. The determination identifies this community as existing on a part of Susan Island that is outside of the study area. The community comprises the majority of the forested area that occurs on the north-west section of Susan island.

The field survey indicated that isolated rainforest trees, that may have been part of a larger stand of this community, also exist in locations within the study area, and it could be argued that these isolated trees form part of this community.

3.3 KEY THREATENING PROCESSES

It is considered that clearing stands of remnant native vegetation within any of the localities could be considered a "key threatening process" listed under both the EPBC Act 1999 and the TSC Act 1995:

- The EPBC Act 1999 lists "Land clearance" involving the removal of areas of vegetation where native species constitute at least 70% of the species present as a key threatening process; &
- The TSC Act 1995 "Clearing of native vegetation" involving the loss of ecological integrity of stands of vegetation as a key threatening process.

However it is considered that there is the opportunity to lower the extent of the impact or avoid the impact of the above key threatening process in accordance with the hierarchy of "avoid, minimise, mitigate" outlined in RTA's *Policy and Guidelines, Road Development and Impacts on Habitat (Amelioration Measures), Draft 6.*

The proposal will not contribute to any preliminary key threatening process currently being assessed by the NSW scientific committee for inclusion on schedule 3 of the TSC Act 1995, or being considered by Environment Australia for inclusion under the provisions of the EPBC Act 1999.

4 TERRESTRIAL FAUNA RESULTS

4.1 FAUNA HABITATS

Terrestrial fauna habitats within the study area and within areas adjoining the study area are restricted to isolated trees and remnant vegetation. Perhaps the most important of these are:

- The lowland rainforest on floodplain on the western end of Susan Island just outside the study area and other small stands of rainforest in the study area as indicated on map 2; &
- The tree hollows of the senescent forest red gum (*Eucalyptus tereticornis*) trees, most of the eucalypts throughout the study area are mature or senescent and many of the forest red gums (*Eucalyptus tereticornis*) would contain hollows. Also senescent forest red gums (*Eucalyptus tereticornis*) occur as emergents in the rainforest. A small stand of old growth eucalypts occurs to the south of the study area. The localities of eucalypts and rainforest stands are indicated on Map 2.

4.1.1 Habitats within the Study Area

The terrestrial fauna habitat of the study area has been severely compromised by clearing, drainage and other disturbances associated with rural and urban development. Map 2 indicates that remaining vegetation within the study area consists of isolated trees and small remnant patches.

Nevertheless it is considered that these trees and remnants provide habitat for a range of threatened fauna species that are either known to occur in the study area or are considered as potential occurrences in the study area. Important habitat resources provided include foraging habitat and tree hollows.

Foraging habitat is provided by trees such as:

- Figs – which provide fruit for species such as the threatened Barred Cuckoo-shrike, rainforest pigeons, and the three species of flying-foxes recorded in the locality; &
- Forest Red Gums (*Eucalyptus tereticornis*)– which are mature or senescent, and when flowering provide a nectar and flower resource for species such as the three species of flying-foxes recorded in the locality, and insects, which are an important foraging resource for a variety of threatened and protected fauna species including threatened microbats.

Within the study area the remnant vegetation and isolated trees provide connectivity for mobile wildlife species capable of moving between isolated habitat resources. Therefore all remnant vegetation and isolated trees have value at a local level.

4.1.2 Habitats Adjoining the Study Area

Inspection of the 1:25,000 colour aerial photography flown on 8/9/1992 indicates that the habitat surrounding the study area contains isolated trees and small remnant patches similar to that occurring in the study area.

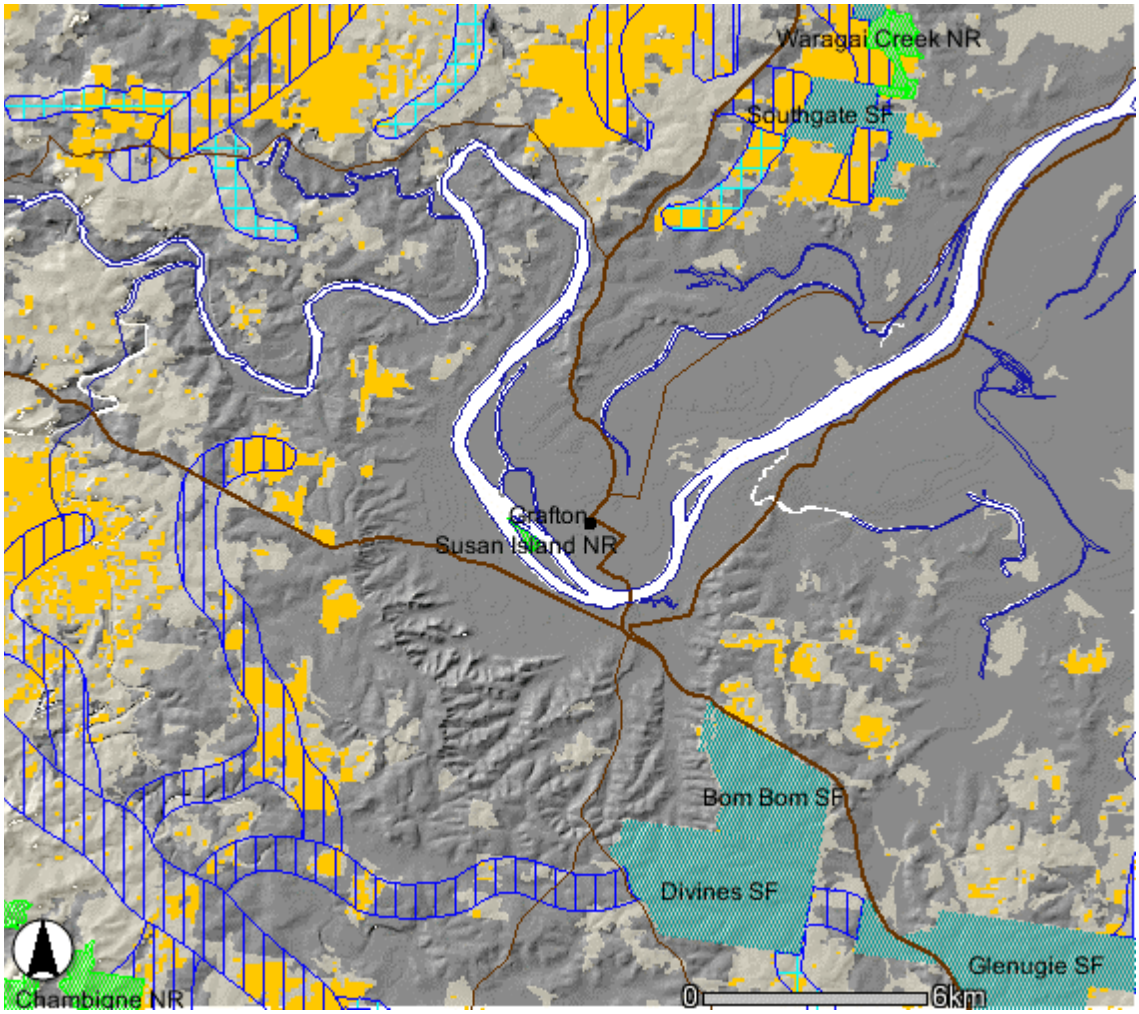
Key habitats and corridors for forest fauna have been identified in northeast NSW (Scotts 2003). The closest identified regional wildlife corridors are the:

- Picnic Creek Regional Corridor, approximately 5 kms to the west of the study area between Eldon Creek and Orara River; &
- Bushy Park Regional Corridor, approximately 6 km to the south of the study area between Shannon creek and the north coast railway.

The locations of these corridors are indicated in blue on map 3, courtesy CANRI website. This map confirms that the study area does not contribute to the recognised regional or subregional corridors in northeast NSW.

Map 3 also identifies Susan Island Nature Reserve on the western end of Susan Island. The lowland floodplain rainforest in the nature reserve provides important habitat for a permanent colony of the Grey-headed Flying fox (*Pteropus poliocephalus*) (listed as threatened under *EPBC Act* and *TSC Act*).

Map 3 – Key habitat and corridors



4.2 FAUNA SPECIES - CONSERVATION SIGNIFICANCE

4.2.1 Federally Listed Threatened and Migratory Species

Threatened and migratory species covered by the provisions of the *EPBC Act* and with predicted habitat within 10km of the study area were obtained from the EPBC Act interactive website (Table 3).

The search provided a category indicating the type of presence and the status fauna species listed under the provisions of the EPBC Act. A description of the preferred habitat of each species has been provided in Table 3 that also contains an indication of the likelihood of occurrence of each species. Appendix D provides a more detailed discussion on their habitat requirements and likelihood of occurrence. Note that previous disturbance to habitat in the study area has greatly reduced the likelihood of occurrence of many of the species listed below. Habitat for some of the species such as the Brush-tailed Rock Wallaby (*Petrogale penicillata*) has never occurred in the study area, and habitat for other species is at best marginal.

Table 3 *EPBC Act* listed species with predicted habitat within 10km of the study area

Common name	*Scientific name*	Habitat	Habitat function	Likelihood of occurrence	*Status
Black-breasted Button-quail	*Turnix melanogaster*	Rain-forest	general	Nil	2
Latham's Snipe	*Gallinago hardwickii*	Wetlands	general	Unlikely	4
Painted Snipe	*Rostratula benghalensis*	Wetlands	general	Unlikely	4
Australian Painted Snipe	*Rostratula australis*	Wetlands	general	Unlikely	2
White-bellied Sea-eagle	*Haliaeetus leucogaster*	Variety of forest types	general	Known	3
Swift Parrot	*Lathamus discolor*	Variety of forest types	general	Possible	1
White-throated Needletail	*Hirundapus caudacutus*	Aerial over variety of vegetation types	general	Known	3
Rufous Fantail	*Rhipidura rufifrons*	Wet sclerophyll forest/rainforest	Breeding	Possible	3
Satin Flycatcher	*Myiagra cyanoleuca*	Variety of forest types	Breeding	Possible	3
Black-faced Monarch	*Monarcha melanopsis*	Wet sclerophyll forest/rainforest	Breeding	Known (Susan Island)	3
Spectacled Monarch	*Monarcha trivirgatus*	Wet sclerophyll forest/rainforest	Breeding	Known (Susan Iskand)	3
Regent Honeyeater	*Xanthomyza phrygia*	Variety of forest types	general	Possible	1 & 3
Spotted-tailed Quoll	*Dasyurus maculatus*	Variety of forest types	general	Known (Sth Grafton)	2
Long-nosed Potoroo	*Potorous tridactylus*	Variety of forest types	general	Nil	2

Brush-tailed Rock-wallaby	*Petrogale penicillata*	North facing rocky slopes and cliffs	general	Nil	2
Grey-headed Flying Fox	*Pteropus poliocephalus*	Variety of forest types	general	Known	2
Large Pied Bat	*Chalinolobus dwyeri*	Variety of forest types	general	Possible	2
Three-toed Snake-tooth Skink	*Coeranoscincus reticulatus*	Rain-forest	general	Known (Susan Island)	2
Stuttering Frog	*Mixophyes balbus*	Creeklines in moist forest	general	Nil	2
Giant Barred Frog	*Mixophyes iteratus*	Creeklines in moist forest	general	Nil	1

*Status: 1 = Threatened Species listed as endangered under the provisions of the EPBC Act
2 = Threatened Species listed as vulnerable under the provisions of the EPBC Act
3 = Terrestrial species covered by migratory provisions of the EPBC Act
4 = Wetland species covered by migratory provisions of the EPBC Act

At this stage of development of the Environment Australia website a search of the "interactive map" is not necessarily comprehensive and it may not include all species listed under the provisions of the *EPBC Act 1999*. The search failed to identify the possible occurrence of a number of species listed under international migratory agreements known to have been recorded in the study area:

- Chamba
- Jamba

Listed migratory species additional to those predicted to occur on the *EPBC Act* website have also have been recorded in the study area. Table 4 contains a list of these bird species either recently recorded in the study area (Clancy 2001) or historically records of these species in the study area attributed to a survey conducted by Wilcox in 1870 (Clancy 2001)

Table 4 – Additional migratory species known to occur in or near the study area (EPBC Act)

Common Name	*Scientific Name*	Record Type
Whiskered Tern	*Chlidonias hybridus*	R
Ruddy Turnstone	*Arenaria interpres*	H
Whimbrel	*Numenius phaeopus*	H
Bar-tailed Godwit	*Limosa lapponica*	H
Common Greenshank	*Tringa nebularia*	H
Terek Sandpiper	*Xenus cinereus*	H
Sharp-tailed Sandpiper	*Calidris acuminata*	H
Latham's Snipe	*Gallinago hardwickii*	H
Great Egret	*Ardea alba*	R
White-bellied Sea-eagle	*Haliaeetus leucogaster*	R
Rainbow Bee-eater	*Merops ornatus*	R
White-throated Needletail	*Hirundapus caudacutus*	R
Cattle Egret	*Ardea ibis*	R

*Record type: R = Records by Clancy of species covered by CAMBA and/or JAMBA
H = Records of species recorded on Susan Island attributed to Wilcox 1870 (Clancy 2001)

4.2.2. NSW Listed Threatened Species

Table 5 contains a list of *TSC Act* threatened fauna species reported by the NSW DEC Wildlife Atlas as occurring within 10km of the study area. A description of the preferred habitat of each species has been provided in Table 5 that also contains an indication of the likelihood of occurrence of each species. Appendix D provides a more detailed discussion on their habitat requirements and likelihood of occurrence).

Table 5 –TSC Act threatened species records within 10 km of the study area

Common Name	Scientific Name	Legal Status TSC Act 1995	Habitat	No. of records within 10km of the study area
Sooty Tern	*Sterna fuscata*	V	Tropical seas	3
Pied Oystercatcher	*Haematopus longirostris*	V	Open beaches, intertidal flats, sand banks & occasionally headlands	1
Comb-crested Jacana	*Irediparra gallinacea*	V	Permanent water with floating vegetation	95
Bush Stone-curlew	*Burhinus grallarius*	E	Woodlands with sparse ground cover	2
Black-necked Stork	*Ephippiorhynchus asiaticus*	E	Wetlands	70
Magpie Goose	*Anseranas semipalmata*	V	Wetlands	39
Freckled Duck	*Stictonetta naevosa*	V	Terrestrial wetlands usually west of the Great Dividing Range	9
Red Goshawk	*Erythrotriorchis radiatus*	E	Swamp forest & woodlands on coastal plain near watercourses	2
Square-tailed Kite	*Lophoictinia isura*	V	Dry woodland and open forest	69
Osprey	*Pandion haliaetus*	V	Forages for fish in rivers lakes and estuaries	9
Powerful Owl	*Ninox strenua*	V	Variety of forest types	1
Masked Owl	*Tyto novaehollandiae*	V	Variety of forest types	1

Common Name	Scientific Name	Legal Status TSC Act 1995	Habitat	No. of records within 10km of the study area
Grey-crowned Babbler (eastern subsp.)	*Pomatostomus temporalis temporalis*	V	Variety of woodlands with an intact ground cover of grasses and forbs	1
Speckled Warbler	*Pyrrholaemus sagittatus*	V	Woodlands with a grassy understorey	4
Brown Treecreeper	*Climacteris picumnus*	V	Eucalypt woodlands lacking a dense understorey	5
Black-chinned Honeyeater (eastern subsp.)	*Melithreptus gularis gularis*	V	Woodlands containing box-ironbark associations and river red gums	22
Diamond Firetail	*Stagonopleura guttata*	V	Eucalypt woodlands & forest with a grassy understorey	1
White Tern	*Gygis alba*	V	Tropical Islands and seas	1
Spotted-tailed Quoll	*Dasyurus maculatus*	V	Variety of forest types w	1
Brush-tailed Phascogale	*Phascogale tapoatafa*	V	Variety of forest types	7
Common Planigale	*Planigale maculata*	V	Variety of forest types where there is surface cover usually close to water	1
Squirrel Glider	*Petaurus norfolcensis*	V	Dry eucalypt forest and woodland	1
Koala	*Phascolarctos cinereus*	V	Variety of forest types	6
Rufous Bettong	*Aepyprymnus rufescens*	V	Variety of forest types with a tussock grass understorey	4
Grey-headed Flying-fox	*Pteropus poliocephalus*	V	Roost in camps in rainforest & swamp forest	8
Black Flying-fox	*Pteropus alecto*	V	Roosts in camps in rainforest & swamp forest	1
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	V	Variety of forest types	3
Common Bentwing-bat	*Miniopterus schreibersii*	V	Variety of forest types	2

Common Name	Scientific Name	Legal Status TSC Act 1995	Habitat	No. of records within 10km of the study area
Little Bentwing-bat	*Miniopterus australis*	V	Variety of forest types	3
Hoary Wattled Bat	*Chalinolobus nigrogriseus*	V	Dry eucalypt forest	1
Three-toed Snake-tooth Skink	*Coeranoscincus reticulatus*	V	Rainforest and occasionally moist sclerophyll forest on sandy soils	4
White-crowned Snake	*Canopies harriettae*	V	Dry eucalypt forest & woodland	1
Pale-headed Snake	*Hoplocephalus bitorquatus*	V	Variety of forest types	1

E = Endangered i.e. listed on schedule 1 of the *TSC Act*
V= Vulnerable i.e. listed on schedule 2 of the *TSC Act*

Of particular significance is the local population of Grey-headed Flying Foxes on Susan Island just to the west of the study area (Clancy 2001). The species has been observed camped in the rainforest throughout the year however numbers may decrease to a few hundred or even to zero during the winter months. Dependant young are observed during November-February. Small numbers forage over most of the Island in blossoming and fruiting trees when these are available, but mostly animals disperse from Susan Island in the direction of available food, which is mostly nectar and pollen of eucalypts and other tree species. The Grey-headed Flying Fox colony on Susan Island is one of the largest in NSW although numbers are variable with peak numbers occurring in summer and late summer (Mark Williams Dept of Environment and Conservation pers comm..). The maternity colony on Susan Island is regarded as an important maternity camp with numbers reaching 200,000 although these numbers also include Little Red Flying-foxes (*Pteropus scapulatus*) and Black Flying-foxes (*Pteropus alecto*) (Jeff Thomas NPWS pers comm.).

4.3 KEY THREATENING PROCESSES

It is considered that clearing stands of remnant native vegetation within any of the localities could be considered a “key threatening process” listed under both the EPBC Act 1999 and the TSC Act 1995:

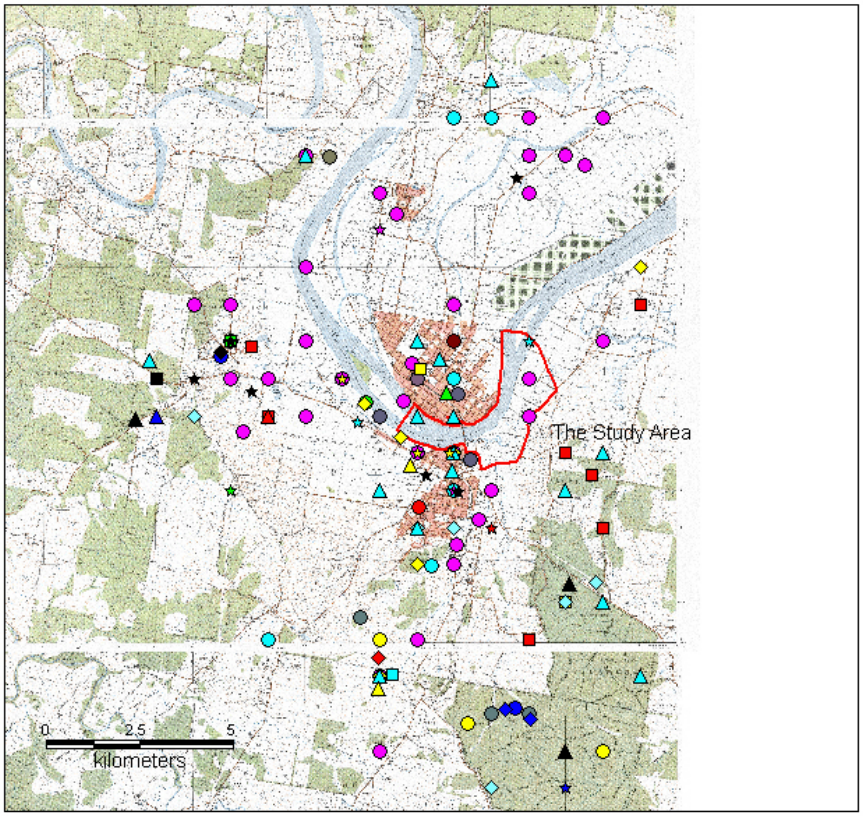
- The EPBC Act 1999 lists “Land clearance” involving the removal of areas of vegetation where native species constitute at least 70% of the species present as a key threatening process; &

- The TSC Act 1995 “Clearing of native vegetation” involving the loss of ecological integrity of stands of vegetation as a key threatening process.

However it is considered that there is the opportunity to lower the extent of the impact or avoid the impact of the above key threatening process on fauna in accordance with the hierarchy of “avoid, minimise, mitigate” outlined in RTA’s *Policy and Guidelines, Road Development and Impacts on Habitat (Amelioration Measures), Draft 6.*

The proposal will not contribute to any preliminary key threatening process currently being assessed by the NSW scientific committee for inclusion on schedule 3 of the TSC Act 1995, or being considered by Environment Australia for inclusion under the provisions of the EPBC Act 1999.

Map 4: Locations of Threatened Species (NSW NPWS Wildlife Atlas) Within 10 km of Study Area



TSC Species Common_Name

- Amorphospermum whitei
- Black Flying-fox
- Black-chinned Honeyeater (eastern subsp.)
- Black-necked Stork
- Brown Treecreeper
- Brush-tailed Phascogale
- Bush Stone-curlew
- Comb-crested Jacana
- Common Bentwing-bat
- Common Planigale
- Cryptandra longistaminea
- Diamond Firetail
- Eucalyptus tetrapleura
- Freckled Duck
- Grey-crowned Babbler (eastern subsp.)
- Grey-headed Flying-fox
- Hoary Wattled Bat
- Koala
- Little Bentwing-bat
- Magpie Goose
- Masked Owl
- Osprey
- Pale-headed Snake
- Pied Oystercatcher
- Powerful Owl
- Red Goshawk
- Rufous Bettong
- Sooty Tern
- Speckled Warbler
- Spotted-tailed Quoll
- Square-tailed Kite
- Squirrel Glider
- Three-toed Snake-tooth Skink
- White Tern
- White-crowned Snake
- Yellow-bellied Sheathtail-bat

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5 AQUATIC RESULTS

5.1 AQUATIC HABITAT

The Clarence River at Grafton is a major river, at its widest point in the study area it is approximately 650 metres wide and at its narrowest point in the study area, the river is approximately 300 metres wide. At Grafton the river flows around a large U bend, on the inside curve (north bank) the banks are not steep and sandy substrate slopes gently into the river. On the outer edge of the bend (south bank) the banks are steep and the substrate is rockier, and slopes more sharply into the river. A local resident and fisher reported that the river depth on the southern side is approximately 6 metres deep near the bank.

At most times in the study area fresh water dominates the river system, allowing aquatic vegetation more typical of freshwater rivers to occur. The predominance of freshwater in the study area has restricted the establishment of communities typical of tidal estuaries such as mangroves, saltmarshes and seagrass beds.

Freshwater weed beds usually present in Clarence River at Grafton in the study area would provide shelter for fish fingerlings and usually consist of ribbon weed *Vallisneria gigantea* in the shallow areas and dense waterweed *Egeria densa* in deeper locations. Weed beds are more vigorous in open unshaded areas and do not occur under the existing bridge. (Nigel Blake, wetlands officer, DIPNR pers. comm.).

The river at Grafton lies in the upper part of the estuary where the fresh water current from upstream usually overrides the tidal saltwater from the lower sections of the estuary, although the influence of the tides still occurs within the study area. At Grafton the river is usually predominantly fresh water overlying a prism of salt water. At present because of drought the water is more salty with conductivity measurements of 20ppm in February and recent sightings of dolphins and sharks (Nigel Blake pers. comm.).

The salt water has killed off weed beds in the river (Nigel Blake pers. comm), and during the field inspection no weed beds were located in areas where they had been mapped from aerial photograph interpretation. The locations of the weed beds mapped from the aerial photographs taken in September 2002 are indicated on Map 2.

5.2 MACROINVERTEBRATES

No survey of macroinvertebrates was conducted as part of the assessment. It is expected that a range of macroinvertebrates would be present and include classes such as crustaceans, molluscs, insects, annelids and arachnids.

A search of the “Fish files” on the CANNRI website did not list any macroinvertebrates as occurring in the Clarence River near Grafton, and either the river does not contain suitable habitat or is not in the distribution range of threatened macroinvertebrate species listed on the schedules of the FM Act 1994.

5.3 FISH

Fish species occurring in the river at Grafton are usually estuarine species; the water is generally too salty for freshwater fish although fish such as bass and estuary perch are found during their annual migrations (Nigel Blake pers comm.). During the field inspection a fisher was observed catching a bream species. A local fisher also reported catching jewfish, mullet, bream, catfish and eels within the study area.

Australian Bass *Macquaria novemaculeara* habitat includes lakes, rivers in upland and coastal plain areas, and brackish estuaries. It favours the cover provided by aquatic vegetation in rocky or gravel-bottomed pools. Only females dwell upstream; males tend to stay in the lower estuarine reaches of rivers. Flood events between May and August trigger a downstream spawning migration to estuaries (Allen et al 2002).

Estuary Perch *Macquaria colonorum* habitat includes lakes and rivers close to the coast, and is most common in estuaries and lower tidal reaches of rivers, where it tends to swim near the bottom in deeper water. Diet consists of small fishes, molluscs, shrimps and other crustaceans. During winter (July and August) they move to the mouth of estuaries to breed.

The search of the NSW Fisheries "Fish Files" on the CANNRI website indicated numerous freshwater fish as occurring in the Clarence River catchment with Grafton as the closest town, however all of these except the Long-finned Eel were recorded in the Orara River well upstream from the study area.

5.4 CONSERVATION SIGNIFICANCE

5.5.1 State Threatened Species

The NSW Fisheries website provides a description of the habitat and distribution of species listed as threatened under the FM Act 1994. It is considered that only two species have remotely possible occurrences in the study area, these being the:

- Eastern Cod (*Maccullochella ikei*); and
- Green Sawfish (*Pristis zijsron*).

The Eastern Cod was once distributed throughout the freshwater areas of the Clarence River but has retracted to pristine areas of the upper catchment. Its decline is attributed to over fishing and water quality deterioration. These disturbance factors make the occurrence of the Eastern Cod unlikely in the study area.

The Green Sawfish is rarely recorded; its habitat includes the upper reaches of estuaries in NSW. Due to its rarity it is considered an unlikely occurrence in the study area.

5.5.2 National Threatened Species

The Eastern Cod is also listed as a nationally threatened species.

5.5.3 Key Threatening Processes

It is considered that the proposal could constitute could be considered as contributing to "key threatening processes" listed under the FM act 1994, these being:

- The removal of large woody debris, although no large woody debris was observed during the field inspection there may be submerged large woody debris;
- The degradation of native riparian vegetation along NSW water courses; &
- The installation and operation of instream structures and other mechanisms that alter the natural flow regimes of rivers and streams

However it is considered that there is the opportunity to lower the extent of the impact or avoid the impact of the above key threatening process on the aquatic environment in accordance with the hierarchy of "avoid, minimise, mitigate" outlined in RTA's *Policy and Guidelines, Road Development and Impacts on Habitat (Amelioration Measures), Draft 6.*

The proposal will not contribute to any preliminary key threatening process currently being assessed by the NSW Fisheries scientific committee for inclusion on schedule 6 of the FM Act 1994. , or being considered by Environment Australia for inclusion under the provisions of the EPBC Act 1999.

6 POTENTIAL IMPACTS

6.1 HABITAT REMOVAL

The potential impacts of an additional crossing of the Clarence River at Grafton on the type and area of habitats in the study area are summarised below.

Table 6 Summary of habitat that would be possibly removed by an additional crossing in the 7 localities within the study area

Locality	Description of possible habitat removal
Locality 1	Little potential removal of habitat
Locality 2	Removal of large fig in Villiers Street - part of the Grafton Conservation Area (National Estate Register)
Locality 3	Possible removal of riparian and revegetated area
Locality 4	Possible removal of native rainforest remnants and native eucalypt
Locality 5	Possible removal of part of native eucalypt & rainforest remnant
Locality 6	Possible removal of river weed bed habitat
Locality 7	Possible removal of native rainforest remnant

There are also potential impacts on habitats from fragmentation, barrier formation and disruption of habitat linkages.

Habitat removal could include the loss of forest red gums (*Eucalyptus tereticornis*) many of which in the study area contain tree hollows an important nesting and sheltering resource for a number of threatened fauna species considered possible occurrences in the study area. The forest red gums (*Eucalyptus tereticornis*) would also be an important source of nectar a foraging resource for a variety of threatened fauna species considered as possible occurrences in the study area or the prey of those species.

Rainforest remnants on the study area would also be expected to be an important foraging and sheltering resource for a number of threatened fauna species considered as likely occurrences on the study area and their loss would be considered an impact.

6.1.1 Fragmentation

The existing habitat in the study area has been severely fragmented. Further fragmentation of remnants would further compromise their remaining habitat values. The construction of an additional crossing in any of the localities would impact on wildlife movement to some degree but those that would fragment existing remnants would be considered to have the greater impact.

Localities 4, 5 & 7 have the greatest potential to fragment existing remnants.

6.1.2 Disruption of Local Habitat Linkages

As described above, use of habitat linkages is likely to be restricted to local movements of wildlife, as the study area does not contribute to the regional and sub-regional wildlife corridor system.

6.1.3 Barrier Formation

Localities 1 & 2, being elevated and on or near Susan Island, could create a barrier to the movement of Grey-headed Flying-Foxes as they leave and return to their camp on Susan Island.

6.2 HABITAT MODIFICATION

Localities 4, 5 and 7 would potentially pass close and or bisect remnant vegetation patches on the approaches connecting to the Pacific Highway. Therefore they have the potential not only to directly impact on the patches through habitat removal, but also to modify the value of the remaining habitat as a result of edge effects such as:

- Change in the solar regime, shading and exposure to additional sunlight;
- Increased exposure to wind; and
- Increased noise levels.

Locality 6 has the potential to modify river weed-bed habitat by shading.

6.3 WILDLIFE MORTALITY AS A RESULT OF ROAD STRIKE

6.3.1 Impacts on Fauna Groups and Assessment of Corridor Options

Locality 1 being on Susan Island and Locality 2 being close to Susan island have the potential to create road strike mortality on aerial animals including the threatened Grey-headed Flying-Fox and Osprey, both of which species roost and nest on Susan Island.

Localities 4 & 5 would require the construction of a new approach road to the Pacific Highway of approximately 1 kilometre in length lying close to remnant rainforest and eucalypt with rainforest patches. Therefore there is potential wildlife mortality as a result of road strike to all groups of fauna that may use these remnant areas. These groups would include flying and terrestrial animals.

Although the approach to the bridge on locality 7 does not lie close to remnant vegetation patches it is the longest connection to the Pacific Highway. It lies between two patches of native rainforest remnants. Therefore there is potential wildlife mortality as a result of road strike to all groups of fauna that may use cleared areas or travel between rainforest patches. These groups would include flying and terrestrial animals.

The approach from the Pacific Highway to locality 6 would not lie close to remnant vegetation patches but is also relatively long and therefore there is potential wildlife mortality as a result of road strike to all groups of fauna that may use cleared areas.

The advantage of locality 3 is that this option would not lie close to remnant vegetation and the selection of this option would confine the locality of potential road strike to the one existing locality instead of creating an additional potential road strike area in another locality.

6.4 HABITAT MODIFICATION

6.4.1 Potential Impacts

Locality 6 has the potential to shade river weed-bed habitat.

Localities 4, 5 and 7 would pass close to and/or bisect remnant vegetation patches. Therefore they have the potential not only to directly impact on the patches through habitat removal, they also would be expected to modify the value of the remaining habitat that is left after construction of the road and bridge.

This modification would be created by edge effects which would include a:

- Change in the solar regime, shading and exposure to additional sunlight;
- Increased Exposure to wind; &
- Increased Noise levels etc.

Localities 4 & 5 are considered to have the largest potential modification on habitat, followed by locality 7.

6.5 OTHER IMPACTS IDENTIFIED BY INTEREST GROUPS

A discussion with Mr Scott Flynn, the secretary of the Susan Island Trust, a number of the impacts discussed above but also identified impacts including:

- Potential access to the islands, i.e. locality 1 & 7, of pest species both during construction period and after completion of the bridge. Mr Flynn expressed concern in regard to possible weed invasion through operational plant being on the islands and dependant upon the design of the bridge the possible access to the islands by feral pests such as foxes, cats and dogs; &
- Loss of integrity of the islands, Mr Flynn expressed concern in regard to the construction of a bridge on either Susan Island or Elizabeth Island would compromise their value as discreet islands.

7 CONCLUSIONS

This report assesses seven localities for an additional crossing of the Clarence River at Grafton. A summary of the assessment is included in Table 7.

Threatened fauna species are either known to occur or are considered possible occurrences in the study area.

An additional crossing in locality 1 would directly impact on Susan Island where a number of threatened species have been recorded and where a stand of lowland rainforest adjoins the study area. Lowland Rainforest on Floodplain in the New South Wales North Coast Bioregion is listed as an endangered ecological community on Part 3 of Schedule 1 of the Act. The field survey indicated that isolated rainforest trees in the study area might have been part of a larger stand of this community.

An additional crossing within locality 2 has the potential to impact upon a large fig tree in the Grafton township at the western end of Villiers Street, an area identified on the "Register of the National Estate".

From an ecological perspective it is concluded that an additional crossing within the localities of 3 and 6 would have the least ecological impacts and effects. . An additional crossing in all the remaining localities would impact on remnants of lowland rainforest or on fauna movement near Susan Island. It is considered that an additional crossing within locality 1 would have the greatest ecological effects due to its potential impacts on Susan Island and associated flora and fauna.

Table 7. Summary Assessment Table

Locality	IMPACTS:					COMMENTS
	Habitat type	Possible Habitat Area (ha)	Habitat fragmentation	Habitat modification	Potential road strike on:	
1	nil	nil	no	no	flying animals	Potential impact on movement on Grey-headed Flying Foxes
2	large fig	0.4	no	no	flying animals	Potential impact on movement on Grey-headed Flying Foxes although less impact than Option 1
3 (west)	nil	nil	no	no	no	This option confines any potential impact to the same locality as the impact created by the existing bridge
3 (east)	nil	nil	no	no	no	This option confines any potential impact to the same locality as the impact created by the existing bridge
4	part of rainforest /eucalypt remnant	1.0	yes	edge effects	flying & terrestrial forest fauna	Potential impact on local corridors between areas of remnant vegetation
5	part of rainforest /eucalypt remnant	0.3	yes	edge effects	flying & terrestrial forest fauna	Potential impact on local corridors between areas of remnant vegetation
6	aquatic weed-bed	0.02	no	shading	flying & terrestrial cleared area fauna	Limited impact on wildlife movement
7	edge of rainforest remnant	0.02	in part	edge effects	flying & terrestrial cleared area fauna	Potential impact on movement of wildlife between native rainforest remnants on Elizabeth Island

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APPENDIX A

Vascular plants recorded in the study area during field surveys

Family	*Species*	Common	Notes
Apocynaceae	*Alstonia constricta*	Quinine Bush	
Araucariaceae	*Araucaria cunninghamii*	Hoop Pine	
Bignoniaceae	*Jacaranda mimosaefolia*	Jacaranda	intro
Casuarinaceae	*Casuarina cunninghamiana*	River Oak	
	Casuarina glauca	Swamp Oak	
Elaeocarpaceae	*Elaeocarpus obovatus*	Hard Quandong	
Euphorbiaceae	*Bridelia exaltata*	Brush Ironbark	
	Mallotus philippensis	Red Kamala	
	Ricinus communis	Castor Oil Plant	intro
Fabaceae	*Castanospermum australe*	Black Bean	
Lauraceae	*Cinnamomum camphora*	Camphor Laurel	Intro
Meliaceae	*Melia azedarach var australasica*	White Cedar	
Mimosoideae	*Pararchidendron pruinosum*	Snow Wood	
Moraceae	*Ficus macrophylla*	Moreton Bay Fig	
	Ficus microcarpa	Weeping Fig	intro
	Ficus rubiginosa	Rusty Fig	
	Maclura cochinchinensis	Cockspur	
	Morus alba	White Mulberry	intro
	Streblus brunonianus	Whalebone tree	
Myrtaceae	*Angophora subvelutina*	Rough-barked Apple	
	Callistemon viminalis	Weeping Bottlebrush	
	Eucalyptus siderophloia	Northern Grey Ironbark	
	Eucalyptus tereticornis	Forest Red Gum	
	Lophostemon suaveolens	Swamp Box	
	Melaleuca alternifolia	Paperbark	
	Syzygium australe	Bush Cherry	
Oleaceae	*Ligustrum sinense*	Small-leaved Privet	Intro
Proteaceae	*Grevillea robusta*	Silky-oak	
Rhamnaceae	*Alphitonia excelsa*	Red Ash	
Sapindaceae	*Cupaniopsis parvifolia*	Small-leaved Tuckeroo	
	Harpullia pendula	Tulipwood	
Sterculiaceae	*Brachychiton discolor*	Lacebark	
Ulmaceae	*Aphananthe philippinensis*	Rough-leaved Elm	
?	*Platanus X acerifolia*	London Plane	intro

APPENDIX B

Aquatic plants recorded in the study area (Nigel Blake pers comm.)

Scientific Name	Common Name
Azolla sp	Azolla
Bolboschoenus fluviatilis	Marsh club rush
Ceratophyllum demsum	Hornwort
Lemna sp	Duck weed
Eichhornia crassipes	Water hyacinth
Elocharis sphacelata	Tall spikerush
Juncus sp	Common rush
Ludwigia peploides	Water primrose
Myriophyllum aquaticum	Parrots feather
Nymphaea gigantea	Giant waterlily
Nymphea caerulea ssp zanzibarensis	Cape waterlily
Nymphoides indica	Water snowflake
Egeria densa	Dense waterweed
Persicaria sp	Knot weed
Phragmites australis	Common reed
Potamegeton perfoliatus	Clasped pondweed
Potamogeton crispus	Curly pondweed
Salvinia molesta	Salvinia
Triglochin sp	Water ribbons
Typha orientalis	Bull rush
Valisinaria gigantea	Ribbon weed

APPENDIX C Vertebrate fauna species recorded in the study area during habitat assessment surveys.

Common Name	Scientific name
Brown Quail	*Coturnix ypsilophora*
Australian Wood Duck	*Chenonetta jubata*
Pacific Black Duck	*Anas superciliosa*
Hardhead	*Aythya australis*
Pied Cormorant	*Phalacrocorax varius*
Little Black Cormorant	*Phalacrocorax sulcirostris*
Great Cormorant	*Phalacrocorax carbo*
Australian Pelican	*Pelecanus conspicillatus*
Cattle Egret	*Ardea ibis*
Straw-necked Ibis	*Threskiornis spinicollis*
Osprey	*Pandion haliaetus*
Black-shouldered Kite	*Elanus axillaris*
Whistling Kite	*Haliastur sphenurus*
Brahminy Kite	*Haliastur indus*
Nankeen Kestrel	*Falco cenchroides*
Dusky Moorhen	*Gallinula tenebrosa*
Masked Lapwing	*Vanellus miles*
Silver Gull	*Larus novaehollandiae*
Crested Tern	*Sterna bergii*
Crested Pigeon	*Ocyphaps lophotes*
Galah	*Cacatua roseicapilla*
Sulphur-crested Cockatoo	*Cacatua galerita*
Rainbow Lorikeet	*Trichoglossus haematodus*
Eastern Rosella	*Platycercus eximius*
Laughing Kookaburra	*Dacelo novaeguineae*
Sacred Kingfisher	*Todiramphus sanctus*
Rainbow Bee-eater	*Merops ornatus*
Superb Fairy-wren	*Malurus cyaneus*
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*
Brown Honeyeater	*Lichmera indistincta*
Scarlet Honeyeater	*Myzomela sanguinolenta*
Magpie-lark	*Grallina cyanoleuca*
Grey Fantail	*Rhipidura fuliginosa*
Willie Wagtail	*Rhipidura leucophrys*
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*
Figbird	*Sphecotheres viridis*
Grey Butcherbird	*Cracticus torquatus*
Pied Butcherbird	*Cracticus nigrogularis*
Australian Magpie	*Gymnorhina tibicen*
Torresian Crow	*Corvus orru*
Richard's Pipit	*Anthus novaeseelandiae*
House Sparrow	**Passer domesticus*
Welcome Swallow	*Hirundo neoxena*
Tree Martin	*Hirundo nigricans*
Fairy Martin	*Hirundo ariel*
Silvereye	*Zosterops lateralis*
Common Starling	**Sturnus vulgaris*
Common Myna	**Acridotheres tristis*

APPENDIX D Habitat requirements and likelihood of occurrence of threatened flora and fauna species recorded in the study area and/or the locality (within 10km of the study area).

Common Name	Scientific Name	Legal Status TSC Act 1995 / EPBC Act 1999	Habitat	Likelihood of occurrence in study area
FLORA				
	Angophora robur	2	Dry open forest in sandy or skeletal soils	Nil
	Arthraxon hispidus	2	Edges of rainforest in wet sclerophyll forest	Unlikely
	Cryptostylis hunteriana	2	Coastal heath on sand	Nil
Snowflower Bush	*Cryptandra longistaminea*	3	Occurs in open forest, at Sth Grafton it occurs near an intermittent watercourse under forest red gum and other eucalypts (NPWS 2002)	Unlikely as not recorded previously or during survey on study area
Rusty Plum	*Amorphospermum whitei*	4	Rainforest and adjacent understorey of moist eucalypt forest (NPWS 2002)	Unlikely as not recorded previously or during survey on study area

Common Name	Scientific Name	Legal Status TSC Act 1995 / EPBC Act 1999	Habitat	Likelihood of occurrence in study area
Square-fruited Ironbark	*Eucalyptus tetrapleura*	2 , 4	Dry or moist eucalypt often in low areas with poor drainage (NPWS 2002)	Unlikely as not recorded previously or during survey on study area during survey on study area
	Marsdenia longiloba	2	Rainforest & wet sclerophyll forest	Unlikely
	Melichrus hirsutus	1	wet sclerophyll forest	Nil
	Triplarina imbricata	1	Dry eucalypt forest on sandy infertile soils with rocky outcrops	Nil
	Tylophora woollsii	1	Along water courses in low open forest with Water Gum	Unlikely
FAUNA				
Black-breasted Button-quail	*Turnix melanogaster*	2	Dry rainforest & viney scrub (NPWS 2002b)	Nil, study area well south of distributional range
Sooty Tern	*Sterna fuscata*	4	Tropical seas (Higgins & Davies 1996)	Very unlikely, records within 10 km of study area possible vagrants due to bad weather

Common Name	Scientific Name	Legal Status TSC Act 1995 / EPBC Act 1999	Habitat	Likelihood of occurrence in study area
Pied Oystercatcher	*Haematopus longirostris*	4	Open beaches, intertidal flats, sand banks & occasionally headlands (NPWS 2002b)	Possible (occasional)
Latham's Snipe	*Gallinago hardwickii*	6	Open freshwater permanent & temporary wetlands also fresh meadowsand edges of rivers (Higgins & Davies 1996)	Known
Painted Snipe	*Rostratula benghalensis*	6	Shallow freshwater occassionally brackish wetlands (Marchant & Higgins 1993)	Possible
Australian Painted Snipe	*Rostratula australis*	2	Wetlands	Possible
Comb-crested Jacana	*Irediparra gallinacea*	4	Permanent water with floating vegetation (Kendall pers obs)	Unlikely
Bush Stone-curlew	*Burhinus grallarius*	3	Woodlands with sparse ground cover (Gilmore & Parnaby 1994)	Very unlikely

Common Name	Scientific Name	Legal Status TSC Act 1995 / EPBC Act 1999	Habitat	Likelihood of occurrence in study area
Black-necked Stork	*Ephippiorhynchus asiaticus*	3	Swamps, mangroves, mudflats, dry floodplains & irrigated land (NPWS 2002b)	Likely
Magpie Goose	*Anseranas semipalmata*	4	Shallow wetlands (NPWS 2002b)	Possible
Freckled Duck	*Stictonetta naevosa*	4	Terrestial wetlands ususually west of the Great Dividing Range but seek drought relief on coasts (Marchant & Higgins 1990)	Possible
Red Goshawk	*Erythrotriorchis radiatus*	3	Swamp forest & woodlands on coastal plain near watercourses (NPWS 2002b)	Unlikely
White-bellied Sea-eagle	*Haliaeetus leucogaster*	5	Maritime habitats andterrestrial wetlands and large rivers (Marchant & Higgins 1993)	Known
Square-tailed Kite	*Lophoictinia isura*	4	Dry woodland and open forest (NPWS 2002b)	Likely

Common Name	Scientific Name	Legal Status TSC Act 1995 / EPBC Act 1999	Habitat	Likelihood of occurrence in study area
Osprey	*Pandion haliaetus*	4	Forages for fish in rivers lakes and estuaries (NPWS 2002b)	Known, nests on Susan Island
Powerful Owl	*Ninox strenua*	4	Variety of forest types (Gilmore & Parnaby 1994)	Unlikely
Masked Owl	*Tyto novaehollandiae*	4	Variety of forest types (Gilmore & Parnaby 1994)	Possible
Swift Parrot	*Lathamus discolor*	1	Dry eucalypt eucalypt forest (Higgins 1999)	Possible
White-throated Needletail	*Hirundapus caudacutus*	5	Aerial (Blakers et al 1984)	Known
Rufous Fantail	*Rhipidura rufifrons*	5	Wet forests (Simpson & day 1993)	Known
Satin Flycatcher	*Myiagra cyanoleuca*	5	Tall & medium open forests (Simpson & Day 1993)	Possible
Black-faced Monarch	*Monarcha melanopsis*	5	Variety of forests (Simpson & Day 1993)	Likely
Spectacled Monarch	*Monarcha trivirgatus*	5	Wet forests (Simpson & Day 1993)	Known

Common Name	Scientific Name	Legal Status TSC Act 1995 / EPBC Act 1999	Habitat	Likelihood of occurrence in study area
Grey-crowned Babbler (eastern subsp.)	*Pomatostomus temporalis temporalis*	4	Variety of woodlands with an intact ground cover of grasses and forbs (NSW scientific committee 2001)	Unlikely
Speckled Warbler	*Pyrrholaemus sagittatus*	4	Woodlands with a grassy understorey (NSW scientific committee 2001)	Unlikely
Brown Treecreeper	*Climacteris picumnus*	4	Eucalypt woodlands lacking a dense understorey (NSW scientific committee 2001)	Unlikey in study area due to small size of remnant vegetation ptaches
Black-chinned Honeyeater (eastern subsp.)	*Melithreptus gularis gularis*	4	Mainly in woodlands containing box-ironbark associations and river red gums (NSW scientific committee 2001)	Unlikey in study area due to small size of remnant vegetation ptaches
Regent Honeyeater	*Xanthomyza phrygia*	1, 3 & 5	Terrestrial wetlands usually west of the Great Dividing Range	Possible occurring in study area when inland areas affected by drought
Diamond Firetail	*Stagonopleura guttata*	4	Eucalypt woodlands & forest with a grassy understorey (NSW scientific committee 2001)	Unlikely

Common Name	Scientific Name	Legal Status TSC Act 1995 / EPBC Act 1999	Habitat	Likelihood of occurrence in study area
White Tern	*Gygis alba*	4	Tropical Islands and seas (Higgins & Davies 1996)	Very unlikely, record within 10 km of study area possible vagrant due to bad weather
Spotted-tailed Quoll	*Dasyurus maculatus*	2 & 4	Variety of forest types which provide a prey base (NPWS 2002b)	Unlikely
Brush-tailed Phascogale	*Phascogale tapoatafa*	4	Variety of forest types which provide a prey base (NPWS 2002b)	Unlikey in study area due to small size of remnant vegetation ptaches
Common Planigale	*Planigale maculata*	4	Variety of forest types where there is surface cover usually close to water (NPWS 2002b)	Unlikely
Squirrel Glider	*Petaurus norfolcensis*	4	Dry eucalypt forest and woodland (NPWS 2002b)	Unlikely
Koala	*Phascolarctos cinereus*	4	Variety of forest types, a favoured food tree species is forest red gum (Gilmore & Parnaby 1994)	Unlikely

Common Name	Scientific Name	Legal Status TSC Act 1995 / EPBC Act 1999	Habitat	Likelihood of occurrence in study area
Long-nosed Potoroo	*Potorous tridactylus*	2	Variety of forest types with a dense lower strata of grasses,ferns, graminoids or shrubs (Gilmore & Parnaby 1994)	Unlikely
Rufous Bettong	*Aepyprymnus rufescens*	4	Variety of forest types with a tussock grass understorey (NPWS 2002b)	Unlikely
Brush-tailed Rock-wallaby	*Petrogale penicillata*	2	Rocky steep north and north-east facing slopes	Nil
Grey-headed Flying-fox	*Pteropus poliocephalus*	4	Roost in camps in rainforest & swamp forest, known to roost on Susan Island feed in a variety of forest types (NPWS 2002b)	Known
Black Flying-fox	*Pteropus alecto*	4	Roost in camps in rainforest & swamp forest, known to roost on Susan Island feed in a variety of forest types (NPWS 2002b)	Known
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	4	Variety of forest types, nest in hollows (NPWS 2002b)	Possible

Common Name	Scientific Name	Legal Status TSC Act 1995 / EPBC Act 1999	Habitat	Likelihood of occurrence in study area
Common Bentwing-bat	*Miniopterus schreibersii*	4	Variety of forest types (Parnaby & Gilmore 1994)	Possible
Little Bentwing-bat	*Miniopterus australis*	4	Variety of forest types, generally roost in caves, tunnels etc (NPWS 2002b) but recorded roosting in tree hollows (Shultz 1997)	Possible
Large Pied Bat	*Chalinolobus dwyeri*	2	Most commonly recorded in dry sclerophyll forest (Churchill 1998)	Unlikely
Hoary Wattled Bat	*Chalinolobus nigrogriseus*	4	Dry eucalypt eucalypt (NPWS 2002b)	Possible
Three-toed Snake-tooth Skink	*Coeranoscincus reticulatus*	2 & 4	Rainforest and occasionally moist sclerophyll forest on sandy soils (NPWS 2002b)	Possible
White-crowned Snake	*Cacophis harriettae*	4	Dry eucalypt forest & woodland with well developed leaf litter layer (NPWS 2002b)	Unlikely

Common Name	Scientific Name	Legal Status TSC Act 1995 / EPBC Act 1999	Habitat	Likelihood of occurrence in study area
Pale-headed Snake	*Hoplocephalus bitorquatus*	4	Dry eucalypt forest & woodland occasionally in rainforest or moist sclerophyll forest especially near watercourses, shelters in tree hollows (NPWS 2002b) Variety	Unlikely
Stuttering Frog	*Mixophyes balbus*	2	Generally at higher elevation in rainforest (Panaby & Gilmore 1994) generally close to permanent streams	Nil
Giant Barred Frog	*Mixophyes iteratus*	1	In rainforest (Panaby & Gilmore 1994) generally close to permanent streams	Nil

1= species listed as endangered under the provisions of the EPBC Act 1999
2= species listed as vulnerable under the provisions of the EPBC Act 1999
3= species listed as endangered under the schedules of the TSC Act 1995
4= species listed as vulnerable under the schedules of the TSC Act 1995
5= terrestrial species listed under the migratory provisions of the EPBC Act 1999
6= wetland species listed under the migratory provisions of the EPBC Act 1999

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TOPOGRAPHIC BASE MAP

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