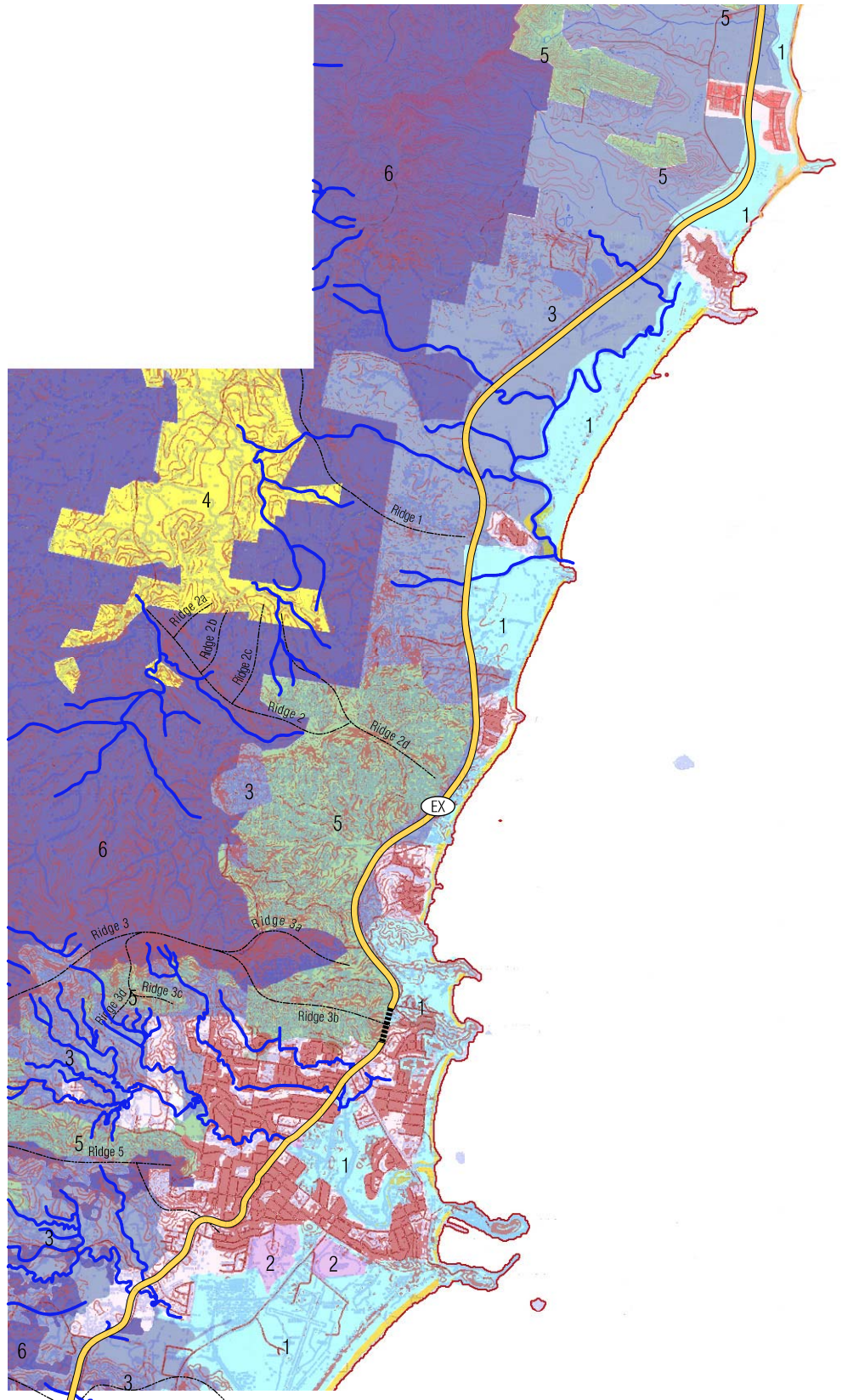


4.1 Upgrade of Existing Highway

The concept for an “ultimate” upgrade of the existing highway through Coffs Harbour has been developed to provide a dual-carriageway facility with grade-separated interchanges at key locations for east-west movements as shown in Figure 4.1 over page. These would be complemented by the provision of service roads or adjustments to existing local roads for access to properties and businesses along the existing corridor.

The main physical features of the Highway Upgrade Option are:

- A total of 9 grade separated interchanges at
 - Englands Road / Stadium Drive
 - North Boambee Road / Cook Drive
 - Thompsons Road / Halls Road
 - Combine Street / Albany Street
 - north of Coffs Creek near Beryl Street
 - Bray Street / Orlando Street
 - Arthur Street/Mastrocolas Road (existing)
 - Bruxner Park Road/James Small Drive South; and
 - Old Coast Road/James Small Drive North;
- Rationalisation and connection of industrial area access roads on the southern outskirts between Englands Road and Thompsons Road
- Horizontal alignment improvements (larger radii) and widening between Thompsons Road and Albany Street
- Lowering of the highway (in an open slot arrangement) through the CBD area between Park Avenue and Coff Street, with widening on the western side
- Provision of a service road on the eastern side of the highway over the same length
- Additional east / west overbridges at Park Avenue / Moonee Street and High Street / Harbour Drive
- A 500 metre long tunnel through Macauleys Headland, with local traffic remaining on the existing highway.



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FIGURE 4.1 - Existing Highway

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Existing Highway



Proposed Tunnel

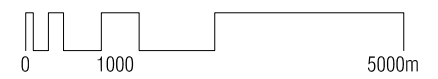


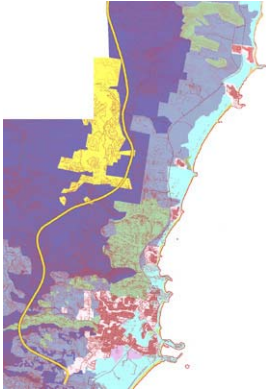
Ridges



Drainage Corridors

1	Coastal wetland	4	Cleared Land (pastoral)
2	Cleared Land (Recreational)	5	Cleared Land (crops)
3	Woodland	6	Forest





4.2 Coastal Ridge Way

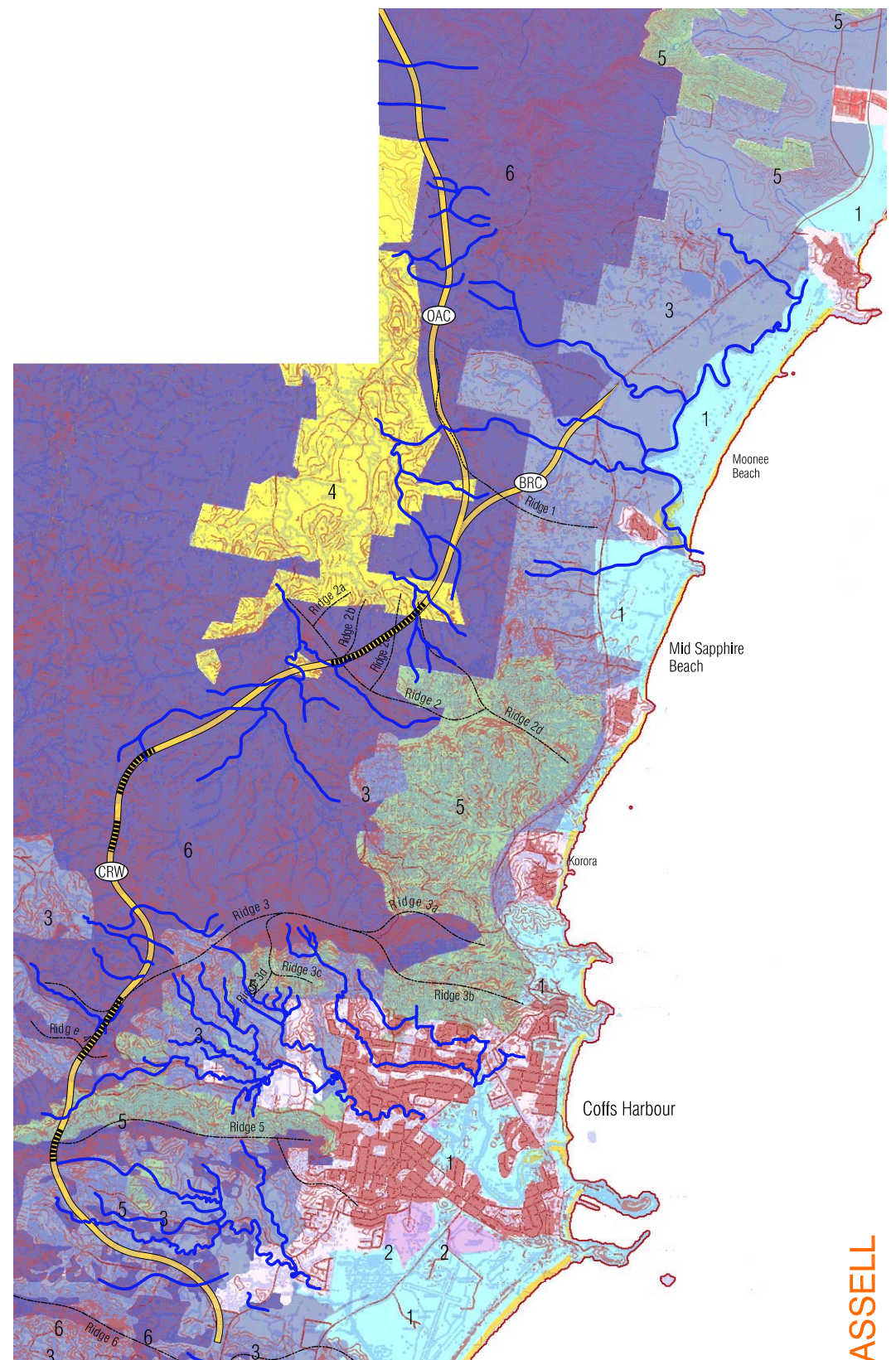
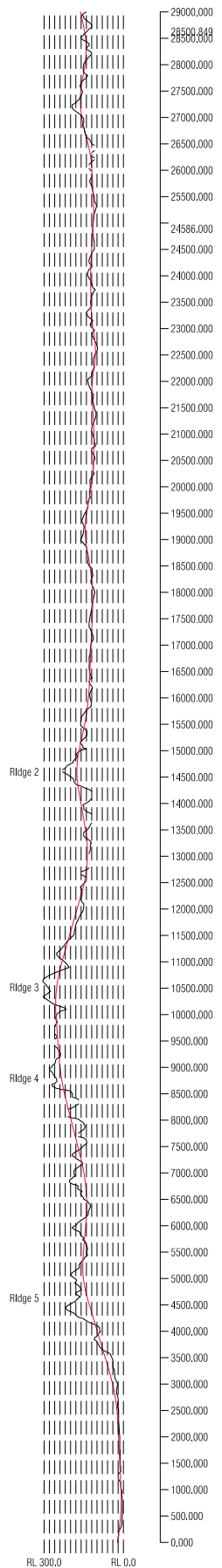
The Coastal Ridge Way option is approximately 22km in length and generally traverses to the west of Coffs Harbour, passing through very rugged terrain between the Coffs Harbour basin and the Orara Valley, as shown in figure 4.2 over page. There is flexibility at the northern end of the Coastal Ridge Way alignment in that it could connect to Option A of the Sapphire to Woolgoolga section of the Strategy or rejoin the existing highway at Bucca Road north of Moonee.





The route would bypass approximately 18km of the existing highway between Englands Road near North Boambee and Bucca Road near Moonee Beach. The Coastal Ridge Way option is a four lane / dual carriageway formation with grade separation (bridges) at all intersecting local and access roads. Interchanges are provided at Englands Road, Coramba Road and at Bucca Road.



The alignment for the Coastal Ridge Way veers west from the existing Pacific Highway at Englands Road and passes through the North Boambee Valley, crossing the southern Coffs Harbour ridgeline at Red Hill. From there it would traverse generally north through the Orara East State Forest, crossing numerous ridges and passing to the west of the Ulidarra National Park.

Heading in a north-easterly direction, it then passes through the upper reaches of Bucca Creek and a major ridge line known locally as Polyosma. From this point it trends north and north-east through the Lower Bucca Valley toward Settles Road. The connection to the existing highway near Bucca Road passes over the main escarpment near the western end of Maccues Road. Once down on the lower level terrain around West Moonee it would then rejoin the existing Pacific Highway near its intersection with Bucca Road. This northern end of the Coastal Ridge Way alignment can also connect to Option A in the Sapphire to Woolgoolga section.

Due to the nature of the terrain traversed by the Coastal Ridge Way, substantial depths of cutting and heights of embankments would be required to construct the route using conventional road construction practices. Depths of cutting in the range of 60-90m and embankment heights up to 40m mean that structures would be necessary to limit earthworks volumes and reduce the impact on the natural environment, as earthworks of this magnitude are not practical. As such the route has been developed assuming up to 2.5 km of tunnels through approximately six ridges and viaducts (or high bridge structures) across three deep valleys.



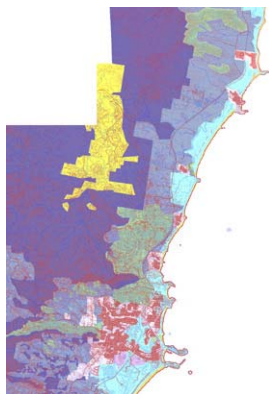
-  Coastal Ridge Way
-  Bucca Road Connection
-  Option A Connection
-  Proposed Tunnel

-  Ridges
 -  Drainage Corridors
- | | | | |
|---|-----------------------------|---|-------------------------|
| 1 | Coastal wetland | 4 | Cleared Land (pastoral) |
| 2 | Cleared Land (Recreational) | 5 | Cleared Land (crops) |
| 3 | Woodland | 6 | Forest |

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FIGURE 4.2 - Coastal Ridge Way
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 Plan- 1:100,000 @ A4
 Section- 1:75,000 (horizontal)
 1:15,000 (vertical)



05 Visual Impact



The visual impact of the Existing Highway and Coastal Ridge Way proposals is defined by the extent of change in the visual environment as viewed by people from surrounding areas. The visual catchment areas are illustrated on Figure 5.0.

5.1 Visual Catchments 1 and 2

The Existing Highway passes through these visual catchments. These two visual catchments, whilst separated by Ridge 1, will be affected identically.

The potential visual impacts of the Existing Highway on visual catchments 1 and 2 may include;

- very little change in the visual environment due to the fact the current road itself is similar in character to the Existing Highway proposal;
- the requirement for frontage access roads and the accompanying interchanges may have a high impact on the adjacent properties, which would be difficult to mitigate due to the road corridor constraints; and
- the increase in traffic volumes may have a high visual impact due to the increased requirement for noise attenuation, which would be difficult to mitigate due to the road corridor constraints.

5.2 Visual Catchment 3

The Existing Highway proposal passes through this visual catchment. Visual catchment 3 is bounded by ridges 2d and 3a and contains a majority of rural (crops) with some recreational and urban development on the coastal fringes. It should be noted that the recreational and urban developments are all located to the east of the road proposal and are oriented towards the coast and do not overlook the road proposal.

The potential visual impacts of the Existing Highway on visual catchment 3 may include;

- primarily the road would take the same form, although increased traffic volumes may increase the requirement for noise attenuation; and
- the potential grade separated intersection at Bruxner Park Road may have a high visual impact on the adjacent properties, which would be difficult to mitigate due to the road corridor constraints.

5.3 Visual Catchment 4

Only the Existing Highway passes through this visual catchment. Visual catchment 4 contains the urban centre of Coffs Harbour.

The potential visual impacts of the Existing Highway on visual catchment 4 may include;

- the introduction of grade-separated crossings may have a high visual impact on the adjacent properties, which would be difficult to mitigate due to the road corridor constraints;
- increased road widths to accommodate extra lanes may have a high visual impact on the adjacent properties, which would be difficult to mitigate due to the road corridor constraints; and
- increased traffic volumes may have a high visual impact due to the increased requirement for noise attenuation, which would be difficult to mitigate due to the road corridor constraints.

05 Visual Impact

5.4 Visual Catchment 5

The Existing Highway and the Coastal Ridge Way pass through this visual catchment. Visual catchment 5 is bounded by Ridges 5 and 6 and currently only has ribbon development along the existing highway, although this will change in the future as development extends west.

The potential visual impacts of the Existing Highway on visual catchment 5 may include;

- the introduction of grade-separated crossings may have a high visual impact on the adjacent properties, which would be difficult to mitigate due to the road corridor constraints; and
- increased traffic volumes may have a high visual impact due to the increase requirement for noise attenuation, which would be difficult to mitigate due to the road corridor constraints.

The potential impacts of the Coastal Ridge Way may include the following;

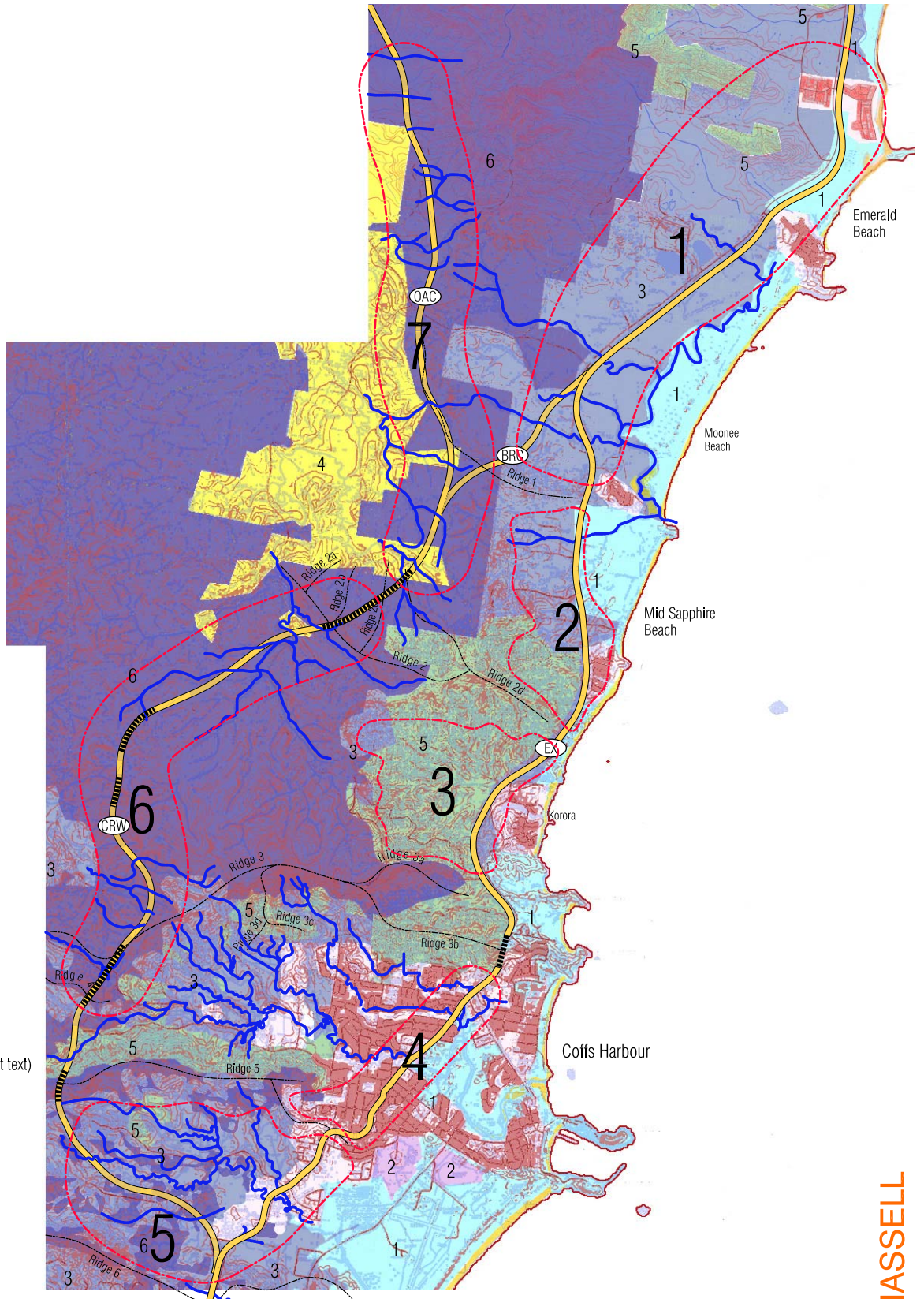
- the route across ridge 5 may have a low visual impact on the entire catchment, although these impacts could be successfully mitigated;
- the route through the centre of the catchment may have a high visual impact on the adjacent properties, although these impacts could be successfully mitigated; and
- the intersection with the existing highway may have a high visual impact on the adjacent properties, although these impacts could be successfully mitigated.













5.5 Visual Catchment 6 and 7

The Coastal Ridge Way passes through these visual catchments. Visual catchment 6 runs through the forested upper ranges and valleys. Visual catchment 7 runs adjacent to the rural (pastoral) areas.

The potential visual impacts of the Coastal Ridge Way on visual catchments 6 and 7 may include;

- the introduction of deep cuttings may have a high visual impact on the adjacent environment, which would be difficult to mitigate;
- the introduction of filled batters may have a high visual impact on the adjacent environment, which would be difficult to mitigate;
- the creation of bridges and tunnels through existing ridges and valleys may have a high visual impact on the adjacent environment, which would be difficult to mitigate; and
- the creation of bridges over existing roads and railway may have a high visual impact on the roads they cross, which would be difficult to mitigate.



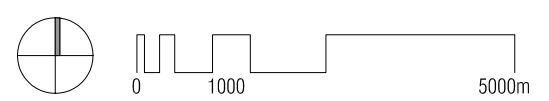
-  Coastal Ridge Way
-  Bucca Road Connection
-  Option A Connection
-  Proposed Tunnel
-  1 Visual Catchment Areas (refer report text)
-  Ridge Lines
-  1 Coastal wetland
-  2 Cleared Land (Recreational)
-  3 Woodland
-  4 Cleared Land (pasture)
-  5 Cleared Land (crops)
-  6 Forest

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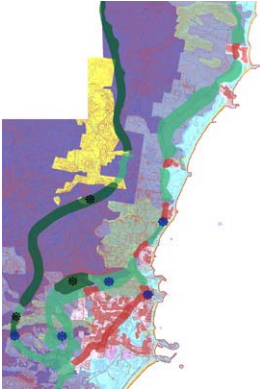
FIGURE 5.0 - Visual Catchments

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06 Road User Experience



The road user experience of the Existing Highway and the Coastal Ridge Way is defined by the adjacent visual environment, topography and opportunities for potential views. These qualities are summarised graphically in Figure 6.0 over page.

6.1 Existing Highway






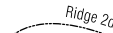

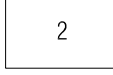
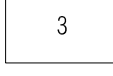
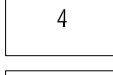
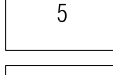
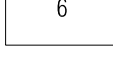





The changes to the user experience travelling along the Existing Highway may be;

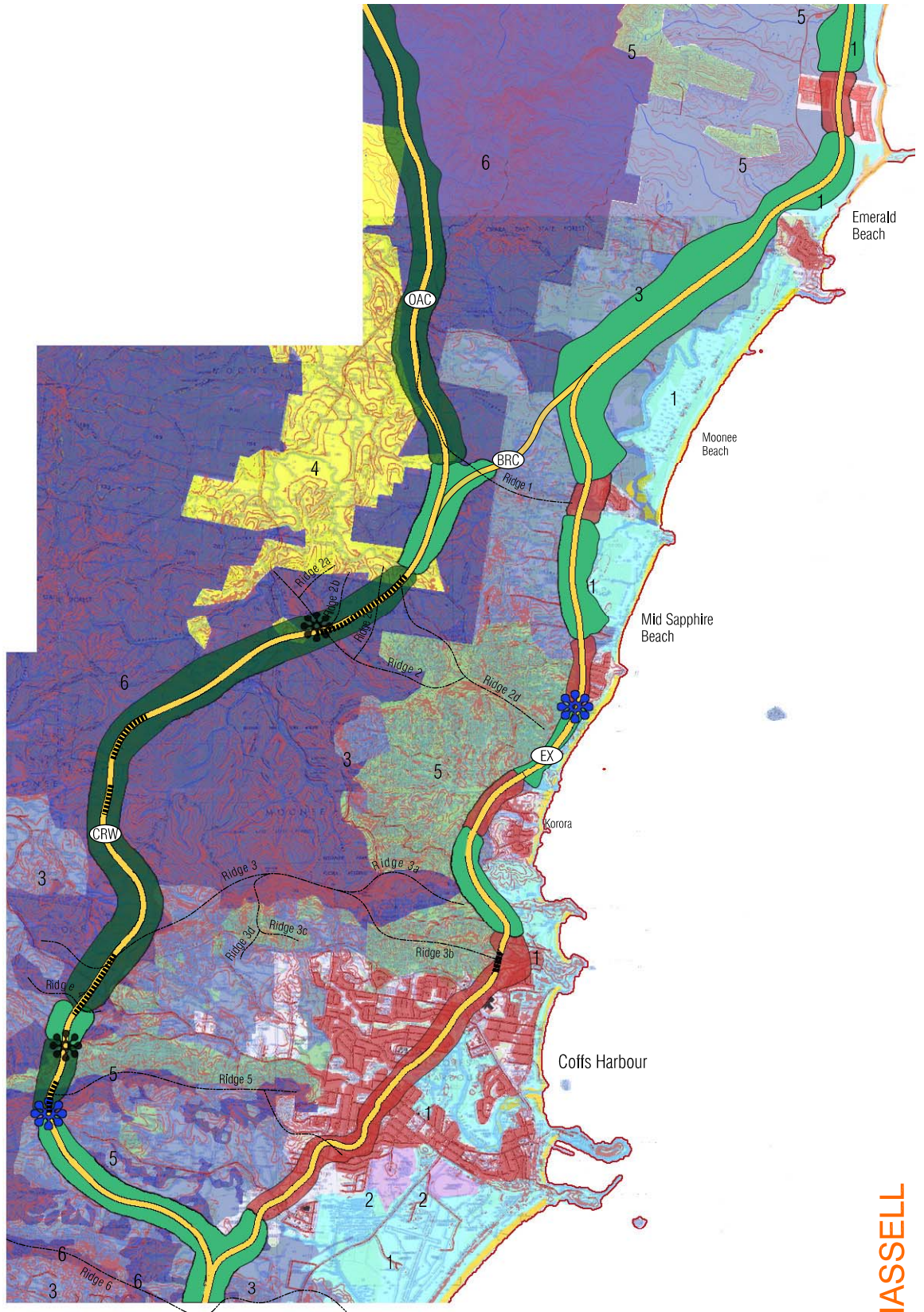
- the introduction of noise walls for noise attenuation, may result in a sense of enclosure within the road corridor itself;
- the limited space for these noise walls may result in noise walls with a form which cause a loss of orientation through a lack of visual connection to the immediate surroundings;
- a less varied experienced as traffic flows increase due to the introduction of grade-separated intersections; and
- the loss of a coastal view at ridge 3b due to the introduction of a tunnel.

6.2 Coastal Ridge Way

The user experience travelling along the Coastal Ridge Way may be as follows;

- open bushland views through the southern portion of the road
- district views at ridge 4;
- district views at ridge 2; and
- enclosed bushland views through the majority of the proposal north of ridge 5, with areas of open bushland views at cleared land (pastoral).

-  Existing Highway
-  Coastal Ridge Way
-  Bucca Road Connection
-  Option A Connection
-  Proposed Tunnel
-  Ridge Lines
-  Coastal wetland
-  Cleared Land (Recreational)
-  Woodland
-  Cleared Land (pasture)
-  Cleared Land (crops)
-  Forest
-  Urban Enclosed
-  Bushland/Rural Glimpses
-  Bushland Enclosed
-  Potential for District Views
-  Potential for Coastal Views

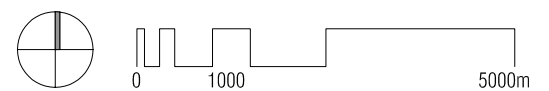


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FIGURE 6.0 - User Experience

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07 Comparative Assessment

7.1 Comparative Assessment

The Coastal Ridge Way may result in the urban design outcomes detailed in figure 7.4. Key elements of these outcomes may include:

- **high** - little or no capacity to absorb impact of proposed elements resulting in major change to the surrounding character;
- **medium** - moderate ability to absorb proposed elements which are considered in keeping with surrounding character; and
- **low** - will have little impact on surrounding character and may result in some positive outcomes.

	Visual Impact (Section 5.0)	User Experience (Section 6.0)
Existing Highway	High	High
Coastal Ridge Way	Low*	Medium

This rating system is then applied to each criterion using the following methodology:

Visual Impact. The impacts are judged upon:

- number of people affected, with the greater the number people affected the higher the rating; and
- the degree of change, with the higher the degree of change the higher the rating.

User Experience. The impacts are judged upon the road users sense of:

- visual connectivity with the surrounding landscape, with the greater the loss in visual connectivity, the higher the rating;
- enclosure within the road corridor, with the greater the sense of enclosure, the higher the rating (for example, noise walls and tunnels providing medium and maximum ratings respectively); and
- orientation within the immediate surrounds, with the greater the loss of orientation experienced, the higher the rating.

*Note that the low rating was determined because the visual impacts for the Coastal Ridge Way Option may be mitigated and because of the small number of people affected.

7.2 Potential Urban Design Outcomes

The following sections illustrate examples of the potential urban design outcomes for each Bypass option. These are presented together with images of the existing character for comparison purposes.

7.2.1 Upgrade of Existing Highway

This option may result in the following urban design outcomes (refer figures 7.2). Key elements of these outcomes may include;

- vertical noise walls for noise attenuation;
- grade-separated intersections;
- the introduction of a tunnel; and
- some street closures.



Figures 7.1 (Existing Character). Examples of the typical landscape characters through which the Upgraded Highway would pass. From far left to right: woodland, residential areas with noise walls on one side, and the Coffs Harbour CBD.



Figures 7.2 (Potential Urban Design Outcomes). Examples of potential urban design outcomes for the Existing Highway. From far left to right: an aerial view of Lyons Road / Pacific Highway interchange, an enclosed road corridor formed by walls on both sides on the Gore Hill freeway, and a tunnel along the Nundah bypass in Queensland.

7.2.3 Coastal Ridge Way

The Coastal Ridge Way may result in the urban design outcomes detailed in Figure 7.4. Key elements of these outcomes may include;

- planted batters within cutting;
- planting batters within fill;
- bridges; and
- tunnels.



Figures 7.3 (Existing Character). Typical landscape forms through which the Coastal Ridge Way would pass through. From left to right: rural, forest, and rugged terrain.



Figures 7.4 (Potential Urban Design Outcomes). Examples of potential landscape treatments for the Coastal Ridge Way. From left to right: a modified image based upon the Cudgen Road Tunnel on the Yelgun to Chinderah project demonstrating a tunnel through a forested area, a deep cutting on the Bulahdelah to Coolongolook Deviation demonstrating the scale of cutting required through an undulating terrain, and a modified image based upon a bridge along the Yelgun to Chinderah Pacific Highway upgrade demonstrating a bridge through a forested area.

Appendix H

Key Socio Economic Issues Identified by the Community

APPENDIX H

Coastal RidgeWay Socio economic issues raised through the February CFG meeting.

Advantages	Disadvantages
<i>Community Cohesion</i>	
<ul style="list-style-type: none"> • Limited sensitive social receptors in vicinity • Reduced division of Coffs Harbour by the Pacific Highway • Pacific Highway would remain for local access 	<ul style="list-style-type: none"> • Potential barrier against natural features • Psychological impact due to proximity to natural lands • Potential restrictions to forestry access used by locals • Impacts on local church adjacent to route
<i>Amenity Effect</i>	
<ul style="list-style-type: none"> • Lack of receptors limits the impact of pollution, visual scarring, noise • Will provide a visually attractive route for use by tourists. • Lack of development allows for adoption of planning measures to minimise impacts 	<ul style="list-style-type: none"> • Receptors include Old Coast Rd, Gudrons Rd, Kororo Valley, Kororo, Bruxner Park, Bucca, Sapphire, Moonee and Forest Glen • Low background noise will increase impact of traffic noise and potential amplification of noise due to topography • Negates cleansing effect of easterly breezes • Visual impacts in an area of high scenic value • Air quality/noise impacts on flora and fauna • Potential for water pollution (creeks used to supply water)
<i>Access and Movement Patterns</i>	
<ul style="list-style-type: none"> • Reduced travel time • Trucks may favour route with lower local traffic volumes • Swift access for fire engines in event of bushfire • Provides a true bypass option • Improved access to hinterland • Traffic benefits along Pacific Highway • Less sensitive receptors in event of HAZMAT spill • Opportunities to remove gradients through provision of tunnels etc. 	<ul style="list-style-type: none"> • Trucks may continue to use Pacific Highway • Will not assist areas of proposed urban development • Will not be used by local traffic • Will increase the strain on Bucca Road interchange • Issues associated with access to town
<i>Land Use and Property</i>	
<ul style="list-style-type: none"> • Lower land acquisition costs • Will allow for future planned growth of West Coffs • Fewer sensitive receptors, and reduced requirement for mitigation measures on residential properties (A/C, insulation) • Potential rise in property value of some properties in hinterland • Developable areas in Central Bucca could become more viable 	<ul style="list-style-type: none"> • Noise/light impacts on rural residents • Rugged topography will increase area of landtake (for cuttings etc.) • Impact on rural properties and agricultural areas, particularly banana plantations • Impacts on existing and future eco-tourism ventures • Impact on 4wd recreational forest track • Impact on heritage tours, Beacon mine, Aboriginal sites (Bucca) • Impacts on forestry opportunities • Impacts on quarry operations • Impact on threatened species/habitat • Impact on draft rural residential subdivision plans for CH • Impact on water quality
<i>Effects on Business Activity</i>	
<ul style="list-style-type: none"> • Benefits in CBD due to reduced traffic volumes • Pacific Highway to be more tourist/people friendly. 	<ul style="list-style-type: none"> • May reduce business activity due to the distance from the town

<ul style="list-style-type: none"> • Potential relocation of business to intersections • Would allow business to the west to advertise for custom 	<ul style="list-style-type: none"> • Vehicles servicing Coffs Harbour unlikely to use the Coastal Ridgeway • Impact commercial properties Bennetts Rd, Red Hill • Impact on eco tourism, Swans Rd, Mount Coramba Rd • Impact on 4wd and heritage tours in Ulidarra national park, Swans Rd, Sherwood Forest Rd. • removal of potential business from Pacific Highway • Exits too far away for travellers to get off once committed from Coramba Exchange • Cutting in North Boambee valley allowing cold air from the hinterland into the valley, impacting banana plantations •
<i>Effects on Tourism</i>	
<ul style="list-style-type: none"> • Visitors will be able to hop on/hop off the highway • Potential for provision of scenic lookouts en route • Coffs Harbour will be a destination • Potential to enhance Pacific Highway and increase business due to reduced traffic volumes • Opportunities for businesses to the west of Redhill/ business spin offs in smaller villages • Would open up the hinterland to tourism • Would allow travellers to hop on/hop off 	<ul style="list-style-type: none"> • Intrusion onto recreation areas • Noise/traffic/air quality/light impacts on ecological resource/eco-tourism • Impact on overseas student numbers who come to the area to study forestry • Severe impact on tourism at Redhill, Bucca • Impact on the enjoyment of tourism in Red Hill and Bucca area • Natural environment is very important, negative impacts could influence tourism.

Appendix I

Biodiversity Assessment

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Coffs Harbour Highway Planning

Biodiversity Assessment Coastal Ridge Way

*February 2004
Reference 1093.74.GE*

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1. Biodiversity

1.1 Introduction

This report identifies the broad impacts of the Coastal Ridge Way on ecological communities, threatened terrestrial species, wildlife linkages, Koala habitat and threatened aquatic species from a review of available information. The mitigation of impacts is also briefly addressed in this report as it has some relevance to the minimising of impacts. The impacts and mitigation measures will be addressed in detail at a later stage of the project, following the selection of a preferred route, through the studies required to complete an EIS and / or SIS.

1.2 Ecological Communities

Vegetation communities in the study area differ in terms of their conservation status and distribution (Appendix A; Table A.1). Communities located on more fertile soils, such as Flooded Gum and Tallowood, have been extensively cleared and have a high conservation status, whereas communities less amenable to agriculture, such as Blackbutt, have been less extensively cleared and have a lower conservation status. The conservation status and distribution of vegetation communities likely to be impacted by the proposal is shown in Appendix A1; Table A.1 and Figure 5.5 of the Coastal Ridge Way report.

The Coastal Ridge Way passes through twelve vegetation types, including a number of rainforest, wet and dry sclerophyll eucalypt forests and a swamp forest. This variety of communities reflects the passage of the proposal from the environments associated with coastal lowlands in the south and north, to those of the more elevated and rugged land to the west.

One endangered ecological community, Lowland Subtropical Rainforest on Floodplain, has the potential to occur in the study area. To identify vegetation potentially similar to this community, rainforest vegetation from Comprehensive Regional Assessment Aerial Photograph Interpretation (CRAFTI) maps, prepared by NSW Department of Environment and Conservation (DEC), was overlaid on contour maps, to identify rainforest vegetation existing on floodplain. The resultant overlay showed that rainforest was associated with steep hillsides and gullies, which is clearly not part of a floodplain and not Lowland Subtropical Rainforest on Floodplain (refer Figure 5.5 of the Coastal Ridge Way report). It should be noted that the DEC CRAFTI map has not been verified by field survey, and as such there may be small areas of Lowland Subtropical Rainforest on Floodplain that are not identified on this map.

The estimated level of clearing (calculated by using a Geographical Information System (Arcview) to intersect the footprint over the DEC CRAFTI maps) of vegetation communities as a result of the Coastal Ridge Way is presented in Table 1. This estimate only includes the road footprint, as the clearing required for construction, ancillary works, possible alterations to haulage options and consequent impacts on the road network in State Forests etc is not available at this stage of the project. As such, the level of clearing is likely to be an underestimate.

Table . 1: Vegetation Removal likely with the Footprint of the Coastal Ridge Way

Vegetation Type & Conservation Significance	Hectares Removed
Rainforest (High): comprising the Booyong, Yellow Carbeen, Corkwood Sassafras and Viney Scrub communities	7.3
Brushbox (High)	3.2
Flooded Gum (High)	12.5
Tallowwood (High)	2.5
Tallowwood - Sydney Blue Gum (High)	2.7
Sydney Blue Gum (High)	11.9
Moist Blackbutt (High)	23.4
Spotted Gum Ironbark / Grey Gum Forest (High)	0.6
Swamp Mahogany (High)	0.3
Dry Blackbutt (Low)	18.5
Paperbark (Low)	1.5
Total	84.4

A significant proportion of the Coastal Ridge Way passes through lands administered by NSW State Forests. Within State Forests, a number of Forest Management Zones (FMZ) have been identified. The Coastal Ridge Way would directly remove approximately 0.23 ha of FMZ 2 (Special Management: management and protection of natural and cultural conservation values - informal reserves) and approximately 3.9 ha of FMZ 3 (Special Prescription: management for conservation of identified values and forest ecosystems and their natural processes). FMZ's 2 and 3 have recently been declared special management zones under the *National Park Estate (Reservations) Act 2002* and are recognised in the *Forestry Act 1916* as areas of State forest that have special conservation value. With certain exceptions, Section 21A of the *Forestry Act* prohibits such a declaration to be revoked except by an Act of Parliament or by notice of the Governor of NSW. The exceptions enabling revocation of special management zones only apply in certain circumstances and in accordance with the provisions of the *Forestry Act*.

The impacts of the Coastal Ridge Way on communities of high conservation status, including and those within FMZ 2 and 3, are considered to be extensive and are likely to require mitigation measures such as reducing construction zones, landscaping and revegetation and site rehabilitation. Considering the level of clearing of native vegetation, these measures are considered likely only to partly mitigate the impacts of the proposal.

1.3 Terrestrial Species Assessment

1.3.1 Threatened Flora Species Known or Likely to Occur

In order to examine the potential impact of the Coastal Ridge Way on threatened flora, it is necessary to determine which threatened species are likely to occur in the study area. At this level of study, it is only possible to determine the probability of occurrence, as not all of the study area has been surveyed. A review of the habitat preferences of threatened species known to occur in the Coffs Harbour LGA, vegetation maps and location data was used to identify species considered likely to occur (Appendix A; Table A2).

All vegetation types in the study area have the potential to contain one or a number of threatened species. Some threatened species, such as those associated with the Paperbark community (Appendix A; Table A2) are only likely to occur in the low lying areas to the south and the north of the Coastal Ridge Way. Others, such as those associated with dry, wet sclerophyll eucalypt forests or rainforests have the potential to be located across the study area.

The location of records and the presence of suitable habitats indicate that the Coastal Ridge Way may impact a number of threatened flora species. Should a threatened species occur on the proposal, the level of habitat removal is considered such that it may put at risk one or a number of local populations.

1.3.2 Threatened Fauna Species Known or Likely to Occur

Threatened fauna likely to occur in the study area were identified from a review of the habitat preferences of threatened species known to occur in the Coffs Harbour LGA, vegetation maps and location data (Appendix A; Table A3). At this level of study, it is only possible to determine the probability of occurrence, as not all of the study area has been surveyed.

Threatened species considered likely to occur were grouped according to habitat preference, with habitat being based on vegetation types (See Appendix A; Table A3). This process identified the four groups of threatened species: Coastal Vegetation Species, Aquatic Habitat Species, Mesic Forest Species and Eucalypt Forest Fauna.

The Coastal Ridge Way has the potential to impact on a diverse range of threatened fauna and their habitats. This is a result of the proposal impacting on a diverse range of habitats, from coastal lowland vegetation such as Paperbark Forests, through to mesic vegetation more common in the higher western section of the study area such as Corkwood Sassafras and Viney Scrub forests (refer Figure 5.6 of the Coastal Ridge Way report and Table 6.1). Based on the level of habitat removal shown in Table 6.1, the impact of the proposal would be greatest on the threatened Eucalypt Forest Fauna and Mesic Forest species. The level of habitat removal would also indicate that the proposal is likely to impact on a range of foraging and breeding habitats and may put at risk a local population of threatened species (see: NPWS 1996).

The impact of the Coastal Ridge Way is likely to be relatively lower for Coastal Vegetation Species and Aquatic Habitat Species, as only the northern and southern ends of the proposal occur in the lowland habitats of these species. Notwithstanding this, where the proposal does pass through these habitats, it may put at risk a local population of Coastal Vegetation Species or Aquatic Habitat Species.

Considering the likely level of impact of the Coastal Ridge Way on threatened fauna, extensive mitigation measures such as underpasses and / or overpasses, exclusion fencing, reduction of construction zones, landscaping and revegetation and site rehabilitation are likely to be required. While these measures would partly mitigate impacts on fauna, the level of habitat removal indicates that the residual level of impact may still put at risk a number of local populations of threatened species.

1.4 Wildlife Linkages

Wildlife Corridors in the study area have been identified from the DEC Key Habitats and Corridors Project (Scotts, 2003) (refer Figure 5.6 of the Coastal Ridge Way report). These linkage corridors are intended to maintain ecological processes such as migration, dispersal, predation and pollination, which are required for the long-term viability and interaction of an ecosystem.

The Coastal Ridge Way will intersect 3 Sub-regional and 4 Regional movement corridors (refer Figure 5.6 of the Coastal Ridge Way report). It is apparent that the North – South passage of the proposal is likely to have a substantial impact on the movement of fauna from large areas of vegetation in the west to coastal areas. While mitigation measures, such as crossings and fauna proof fencing would partly mitigate impacts on fauna movements, the proposal would still severely restrict the movement of fauna. This would represent a substantial impact on local fauna including numerous threatened species

1.5 Koala Habitat - Comprehensive Koala Plan of Management

The DEC and Coffs Harbour City Council (1999), under the statutory provisions of State Environmental Planning Policy 44 (SEPP 44) have prepared a Comprehensive Koala Plan of Management (KPoM) for lands where Council is consent authority. This plan does not apply to land administered by the DEC or NSW State Forests.

The KPoM divides Core Habitats, as defined in SEPP 44, into Primary, Secondary and Tertiary Koala Habitat. Primary habitats are considered to be critical to securing the population in the Local Government Area and Secondary Koala Habitat Types requires protection and only limited development is permissible when it can be shown that it is compatible with Koala conservation (NPWS and Coffs Harbour City Council 1999).

The Coastal Ridge Way passes through approximately 50.2ha of Core Koala Habitat that contains numerous records on the southern half of the proposal (refer Figure 5.6 of the Coastal Ridge Way report) in addition to relatively smaller areas of habitat along the northern section of the alignment. The 38-km length of the North – South alignment of the proposal is also likely to have a substantial impact on the movement of Koalas from large areas of vegetation in the west to coastal areas. This impact will include the intersection of 3 Regional movement corridors for Koalas (NPWS and Coffs Harbour City Council 1999) (refer Figure 5.6 of the Coastal Ridge Way report).

The length and location of the Coastal Ridge Way would require extensive provision of impact minimisation measures such as crossings and fauna proof fencing. These measures are considered likely to only partly mitigate the substantial loss of Koala habitats and restriction of movement. As such, the proposal is not considered to be consistent with the objectives on the KPoM.

1.6 Aquatic Species Assessment

Information from outside the study area indicates that two threatened fish species, listed under the *Fisheries Management Act 1994*, are present in waterways to the west and north west of the study area. These are the Eastern Freshwater Cod and the Oxleyan Pygmy Perch.

The Eastern Freshwater Cod is listed as *endangered* under the NSW Fisheries Management Act 1994, and has been in the recorded Orara River system, which is to the west of the study area (Anderson and Howland 1998). The NSW Fisheries 'Fish files' database contains a record for this species from the Orara River in 2002, the closest town to this record being Coramba. The habitat requirements of Eastern Freshwater Cod are poorly known, but probably resemble related species (NSW Fisheries 1999) being clear flowing rivers with rocky substrate and large amounts of in-stream cover.

Considering that the Eastern Freshwater Cod has been record in the Orara River system, it is possible that this may occur along the Coastal Ridge Way or in streams and rivers receiving run off from the road, namely Bucca Bucca Creek, Orara River and associated streams. It is possible that this species has, or will be, released from stock into suitable habitats in the study area. However, no breeding has been observed in releases (NSW Fisheries 1999) and is generally being restricted to naturally occurring populations in more pristine environments. Indeed, there are a number of anecdotal observations of the onset of agricultural land uses and other disturbances (that lower water quality) coinciding with rapid population declines (NSW Fisheries 1999).

As the Coastal Ridge Way traverses the Orara River catchment (specifically, the Bucca Bucca Creek subcatchment), there is the potential for impacts on the habitats of this species. This, in turn, may adversely affect a Recovery Action identified in the draft recovery plan for the Eastern Freshwater Cod - Habitat Protection/Restoration (NSW Fisheries 1999). A detailed assessment would be required to determine if the proposal is likely to impact on a viable (viz. Breeding) population of this species.

The Oxleyan Pygmy Perch, listed as endangered under the *NSW Fisheries Management Act 1994*, is associated with coastal creeks and lakes on sandy coastal lowlands between Ballina and Coffs Harbour characterised by tannin-stained, acidic freshwaters, where it frequented low flow environments in moderate water depths (Knight 2002). The Oxleyan Pygmy Perch was not recorded from 55 waterbodies with apparently suitable habitat, with one third of these sites being degraded by urban and rural development (Knight 2002).

The Coastal Ridge Way has the potential to impact on the habitats of this species in the north and south of the study area, particularly in the vicinity of Paperbark Forests. However the restriction or absence of sandy soils (Milford 1999) and the presence of cleared / developed areas indicates that this is not likely. Notwithstanding this, the Oxleyan Pygmy Perch may occur in streams receiving runoff from the proposal, and as such the adoption of appropriate water quality controls would be required to minimise the potential for indirect impacts to this species.

Distributional information provided by Morgan (1997) indicated that two high-conservation value species of Spiny Crayfish may occur in catchments traversed by the Coastal Ridge Way. Due to the need for cool, clean, well oxygenated water, it is considered that this species is most likely to occur in the State Forests to the west of the study area. The proposal would involve the placement of large amounts of fill in gullies and the crossing of numerous watercourses, which has the potential to substantially impact on the water qualities required by the Spiny Crayfish.

1.7 Conclusion

The Coastal Ridge Way passes through twelve vegetation types, including a number of rainforest, wet and dry sclerophyll eucalypt forests and a swamp forest. This variety of communities reflects the passage of the Coastal Ridge Way from the environments associated with coastal lowlands in the south and north, to those of the more elevated and rugged land to the west. The native vegetation removed directly as a result of the Coastal Ridge Way consists of approximately:

- 64.4 ha of High Conservation Status and 20 ha of Low Conservation Status ecological communities; and
- 4.1 ha of Forest Management Zones 2 and 3, which with certain exceptions, can only be revoked by an Act of Parliament or by notice of the Governor of NSW.

All vegetation types in the study area have the potential to contain one or a number of threatened species. The location of records and the presence of suitable habitats indicate that the Coastal Ridge Way may impact a number of threatened species. Should a threatened species occur on the proposal, the level of habitat removal is considered such that it is likely to put at risk one or a number of local populations.

The Coastal Ridge Way has the potential to impact on Regional and Sub-regional wildlife linkages and Koala movement corridors, and is likely to have a substantial impact on the movement of fauna from large areas of vegetation in the west to coastal areas.

As the Coastal Ridge Way is likely to result in a significant impact on one or a number of threatened species listed under the TSC and EPBC Acts, it is likely to require approvals from both the Department of Environment and Conservation (DEC) and the Commonwealth Department of Environment and Heritage. The approval process would be onerous and costly requiring extensive and detailed studies

The Coastal Ridge Way is likely to require extensive and expensive mitigative measures. Due to the location of the proposal, it is considered unlikely that the road design or alignment could be altered such that impacts can be avoided or minimised. As such, the proposal is highly dependent on mitigative measures to address impacts. Such mitigation measures are considered likely only to partly

mitigate the impacts of the Coastal Ridge Way and would be required along much of the length of the road. Furthermore, it is likely that there would be a requirement for extensive monitoring studies continuing into the operational phase of the road.

Appendix A

Threatened Species Assessment Tables

Table A.1: Distribution and Conservation Status of Impacted Vegetation Communities

Booyong
<p>Tall (12-20 metres) closed forest located on stream banks and narrow floodplain, generally only 10-30 metres wide along the upper reaches of streams in the Coast Range and foothills. In steep, hilly country, sometimes extending to lower hill slopes in deep protected gullies.</p> <p><u>Conservation Priority:</u> High</p> <p>Stream bank subtropical rainforest equates with the Black Booyong alliance, sub-alliances 7 or 9 of the rainforest classification of Floyd (1990). This community is common along small streams in the coastal ranges of the Coffs Harbour district. Although these communities are relatively widespread, all rainforests are protected from logging and clearing in NSW and generally considered of high conservation value.</p>
Yellow Carbeen
<p>Dominated by the Yellow Carbeen (<i>Sloanea woollsi</i>) this is a closed forest growing to a maximum height of 40m, with a moderately dense canopy and more open sub-canopy and ground layer.</p> <p><u>Conservation Priority:</u> High</p> <p>This community is equivalent to Forest Type 2. Hager and Benson (1994) considered this community to be adequately conserved. Notwithstanding this, all rainforests are protected from logging and clearing in NSW and generally considered of high conservation value.</p>
Corkwood Sassafras
<p>This community is a tall closed subtropical rainforest with canopy trees typically over 35m tall, with a moderate canopy and sub-canopy cover and an open ground cover.</p> <p><u>Conservation Priority:</u> High</p> <p>This community is equivalent to Forest Type 3. Hager and Benson (1994) considered this community to be adequately conserved. Notwithstanding this, all rainforests are protected from logging and clearing in NSW and generally considered of high conservation value.</p>
Viney Scrub
<p>This community is associated with scree slopes, has relatively few trees and sub canopy with a maximum height of 20m with a dense cover of shrubs, small trees and vines.</p> <p><u>Conservation Priority:</u> High</p> <p>This community is equivalent with Forest Type 26 or RF210 of Hager and Benson (1994) which is considered to be adequately conserved. Notwithstanding this, all rainforests are protected from logging and clearing in NSW and generally considered of high conservation value.</p>
Brushbox
<p>Typically a tall forest, with trees 30-50m high, approximately 50% cover dominated by the Brush Box (<i>Lophostemon confertus</i>), with a number of other trees occurring, such as the Flooded Gum (<i>Eucalyptus grandis</i>), Tallowwood (<i>E. microcorys</i>), Sydney Blue Gum (<i>E. saligna</i>) and Turpentine (<i>Syncarpia glomulifera</i>). This community often forms an intermediate stage between Eucalypt forests and rainforest.</p> <p><u>Conservation Priority:</u> High</p> <p>This community is equivalent to Forest Type 53a. Hager and Benson (1994) considered this community to be considered inadequately conserved over a major part of its range.</p>
Flooded Gum

Table A.1: Distribution and Conservation Status of Impacted Vegetation Communities

<p>This community is typically a tall to very tall (20-40m) open forest associated with valley floors and lower slopes throughout the Coast Range and foothills. Sites generally have less topographic protection from fire than those occupied by Brush Box do.</p> <p><u>Conservation Priority:</u> High</p> <p>This community is equivalent with Forest Type 48 Flooded Gum or EF010a-b of Hager and Benson (1994) which considered being inadequately reserved.</p>
<p>Tallowwood</p>
<p>This community is typically a tall to very tall (30 to 45m) open forest associated with mid to lower slopes between Flooded Gum and Blackbutt communities, where free quartz is less available. Found on a range of aspects and topographic positions, but is best developed on sheltered slopes of moderate to high fertility.</p> <p><u>Conservation Priority:</u> High</p> <p>This community is equivalent with Forest Type 45 Tallowwood or EF0165a of Hager and Benson (1994) which is considered to be inadequately conserved over a major part of its range.</p>
<p>Tallowwood - Sydney Blue Gum</p>
<p>This community is a tall to very tall (35 to 45m) open forest associated with moist, sheltered slopes (Binns and Chapman 1993). This community dominated by the Sydney Blue Gum (<i>Eucalyptus saligna</i>) and Tallowwood (<i>E. microcorys</i>). Other common trees include the Brushbox (<i>Lophostemon confertus</i>), Turpentine (<i>Syncarpia glomulifera</i>) and Flooded Gum (<i>Eucalyptus grandis</i>).</p> <p><u>Conservation Priority:</u> High</p> <p>This community is equivalent with Forest Type 47 <i>Eucalyptus saligna</i> - <i>E. microcorys</i> or EF011b of Hager and Benson (1994), that is considered to be inadequately conserved over a major part of its range.</p>
<p>Sydney Blue Gum</p>
<p>This community is a tall to very tall (30 to 40m) open forest associated with on moderately fertile sites on exposed aspects. It replaces the Flooded Gum (<i>Eucalyptus grandis</i>) in exposed gullies and ascends to the ridges where the Blackbutt dominates moist, sheltered slopes (Binns and Chapman 1993). This community dominated by the Sydney Blue Gum (<i>Eucalyptus saligna</i>), with <i>Lophostemon confertus</i>, <i>E. microcorys</i>, <i>E. grandis</i>, <i>E. pilularis</i> and <i>Angophora costata</i>.</p> <p><u>Conservation Priority:</u> High</p> <p>This community is equivalent with Forest Type 46 Sydney Blue Gum or EF011a of Hager and Benson (1994), that is considered to be inadequately conserved over a major part of its range.</p>
<p>Moist Blackbutt</p>
<p>This community is a tall to very tall (40m) open forest associated with mid to lower hill slopes on a protected south west to south east aspect.</p> <p><u>Conservation Priority:</u> High</p> <p>This community is equivalent with Forest Type 36 Moist Blackbutt or EF0145a-c of Hager and Benson (1994), considered inadequately conserved over a major part of its range. In the forest ecosystem classification this association appears to be equivalent to FE 72 Low Relief Coastal Blackbutt or FE 153 Wet Coastal Tallowwood-Brushbox (co-dominated by Blackbutt), which are 45% and 47% cleared and have 859ha and 6581 ha remaining, respectively.</p>
<p>Spotted Gum Ironbark / Grey Gum Forest</p>

Table A.1: Distribution and Conservation Status of Impacted Vegetation Communities

<p>This community is an open forest to 35m in height with a canopy cover of 40 – 50% associated with yellow clay podsolic soils and dry upper slopes with skeletal rocky soils of low fertility on north to western aspects (Fisher et al. 1996). Indicator species include the Grey Gum (<i>Eucalyptus propinqua</i>), Grey Ironbark (<i>E. siderophloia</i>) and the Spotted Gum (<i>Corymbia maculata</i>).</p> <p><u>Conservation Priority:</u> High</p> <p>This community is equivalent with Forest Type 74a or EF040c/d of Hager and Benson (1994) which is considered not or poorly conserved in upper north eastern NSW.</p>
<p>Swamp Mahogany</p>
<p>Open forest (to 25m) with a dense mid and lower stratum. Poorly drained saline soils and quaternary deposits of sedimentary clays and deep sandy loams near the coast.</p> <p><u>Conservation Priority:</u> High</p> <p>Of the approximately 2755 hectares of this community or 48% of this community is thought to remain in the region (NPWS 1999). Hager and Benson (1994) consider this community to be adequately conserved in upper north eastern NSW. However, this may change with continued land clearing (SFNSW 1995).</p>
<p>Dry Blackbutt</p>
<p>This community is a tall to very tall (25m) open forest associated with steep, hilly country on exposed upper hill slopes, ridges and spurs, and surrounding gently undulating country. This community typically occurs on yellow podsolic soil on metasediment.</p> <p><u>Conservation Priority:</u> Low</p> <p>This community is equivalent with Forest Type 37 Dry Blackbutt or EF0145a-c of Hager and Benson (1994) which is considered to be adequately conserved in upper north eastern NSW. In the forest ecosystem classification this association appears to be equivalent to FE32 Dry Foothills Blackbutt-Turpentine, which is 21% cleared and has 7364ha remaining.</p>
<p>Paperbark</p>
<p>This community is an open forest to 15-20m in height with a closed mid-stratum, associated with periodically waterlogged heavy clay soil on floodplains.</p> <p><u>Conservation Priority:</u> Low</p> <p>This community is equivalent to Forest Type 31 Paperbark or EF0145a-c of Hager and Benson (1994) which is considered to be adequately conserved in upper north eastern NSW. In the forest ecosystem classification this association appears to be equivalent to FE112 Paperbark, which has 28,577ha remaining (extent of clearing not given).</p>

Table A.2 Threatened Flora Species Habitat Assessment

Plant Species	Vegetation Associations	Assessment
<p><i>Acronychia littoralis</i> Scented Acronychia TSC – E</p>	<p>Coastal dune and littoral rainforest</p>	<p>No suitable habitat present</p> <p><i>Species is not likely to be affected and is not assessed further.</i></p>

Table A.2 Threatened Flora Species Habitat Assessment

Plant Species	Vegetation Associations	Assessment
<i>Alexfloydia repens</i> TSC – E	Recorded in the understorey of <i>Casuarina glauca</i> forest and along the uppermost fringe of mangroves (NSW Scientific Committee 2001).	No suitable habitat present <i>Species is not likely to be affected and is not assessed further.</i>
<i>Allocasuarina defungens</i> Dwarf Heath She-oak TSC – E; EPBC - E	Heath on sedimentary substrate	No suitable habitat present <i>Species is not likely to be affected and is not assessed further.</i>
<i>Amorphospermum whitei</i> Rusty Plum TSC – V; EPBC - E	Gully, littoral or warm temperate rainforests generally below 600 m altitude on the less fertile soils derived from rhyolite or metasediments (Floyd 1989). Occurrences are likely in rainforest and wet sclerophyll forest along drainage lines or on protected lower slopes in the study area. In the study area suitable habitat exists in the: Suitable habitat exists in the Yellow Carbeen, Corkwood Sassafras, Viney Scrub, Brushbox, Flooded Gum, Tallowwood, Tallowwood - Sydney Blue Gum, Sydney Blue Gum, Moist Blackbutt vegetation types	Suitable habitat present <i>Species potentially affected and is assessed further.</i>
<i>Angophora robur</i> Large-fruited Angophora TSC – V; EPBC - V	Forests with a heath understorey on sandstone substrates.	No suitable habitat present <i>Species is not likely to be affected and is not assessed further.</i>
<i>Arthraxon hispidus</i> TSC – E; EPBC - V	Known from Coffs Harbour district; suitable swamp and streamside seepage habitat present – detectable summer to autumn, after disturbance. In the study area suitable habitat exists in the: Swamp Mahogany and Paperbark vegetation type	Suitable habitat present (the far northern and southern sections of the study area) <i>Species potentially affected and is assessed further.</i>
<i>Boronia umbellata</i> TSC – V; EPBC – V	Known from Conglomerate SF; shrubby, moist open forest present, but preferred sedimentary substrate In the study area suitable habitat exists in the: Flooded Gum, Tallowwood, Tallowwood - Sydney Blue Gum, Sydney Blue Gum, Moist Blackbutt and Spotted Gum Ironbark / Grey Gum Forest, Dry Blackbutt	Suitable habitat present <i>Species potentially affected and is assessed further.</i>
<i>Eleocharis tetraquetra</i> Square-stemmed Spike Rush TSC – E	Known from Coffs Harbour district; suitable swamp and streamside seepage habitat present – detectable summer to autumn. Very rare. In the study area suitable habitat exists in the: Swamp Mahogany and Paperbark vegetation type.	Suitable habitat present (the far northern and southern sections of the study area) <i>Species potentially affected and is assessed further.</i>
<i>Lindsaea incisa</i> TSC – V	Suitable stream bank habitat present in the Little Arrawarra Creek area. Recorded from Waihou Flora Reserve. In the study area suitable habitat exists in the: Swamp Mahogany and Paperbark vegetation type.	Suitable habitat present (the far northern and southern sections of the study area) <i>Species potentially affected and is assessed further.</i>

Table A.2 Threatened Flora Species Habitat Assessment

Plant Species	Vegetation Associations	Assessment
<i>Marsdenia longiloba</i> Slender Marsdenia TSC – E; EPBC – V	Lowland wet sclerophyll forest, often in ecotones between wet sclerophyll and rainforest. Also occurs in sub tropical and warm temperate rainforest. In the study area suitable habitat exists in the: Yellow Carbeen, Corkwood Sassafras, Viney Scrub, Brushbox, Flooded Gum, Tallowwood, Tallowwood - Sydney Blue Gum, Sydney Blue Gum, Moist Blackbutt, vegetation types.	Suitable habitat present <i>Species potentially affected and is assessed further.</i>
<i>Parsonsia dorrigoensis</i> TSC – V; EPBC - E	Known from Woolgoolga area; preferred wet sclerophyll - rainforest habitat widespread in study area. In the study area suitable habitat exists in the: Yellow Carbeen, Corkwood Sassafras, Viney Scrub, Brushbox, Flooded Gum, Tallowwood, Tallowwood - Sydney Blue Gum, Sydney Blue Gum and Moist Blackbutt vegetation types.	Suitable habitat present <i>Species potentially affected and is assessed further.</i>
<i>Phaius australis</i> Swamp Orchid TSC – E; EPBC - E	Known from Coffs Harbour district; slight chance of being found in damp sub-coastal sites. In the study area suitable habitat exists in the: Swamp Mahogany and Paperbark vegetation type.	Suitable habitat present (the far northern and southern sections of the study area) <i>Species potentially affected and is assessed further.</i>
<i>Quassia</i> sp.1 'Mooney Creek' Quassia TSC – E; EPBC - E	Wet and dry sclerophyll forest. Some records are from heathy open forest dominated by <i>E. planchoniana</i> and <i>E. pyrocarpa</i> on poor sandstone soils, while others are from wet sclerophyll forest. A. Floyd regards <i>Quassia</i> sp. 1 as a forest edge species (Quinn et al. 1995). Many locations appear to be in the ecotone between wet and dry sclerophyll forest. In the study area suitable habitat exists in the: Brushbox, Flooded Gum, Tallowwood, Tallowwood - Sydney Blue Gum, Sydney Blue Gum, Moist Blackbutt, Spotted Gum Ironbark / Grey Gum Forest and Dry Blackbutt communities.	Suitable habitat present <i>Species potentially affected and is assessed further.</i>
<i>Sarcophilus fitzgeraldii</i> Ravine Orchid TSC – V; EPBC – V	Associated with gorges and cliff faces in subtropical rainforest, usually close to water but sometimes on protected ridges at altitudes of 500 to 700masl (Bishop 1996).	Suitable habitat present <i>Species potentially affected and is assessed further.</i>
<i>Sarcophilus hartmannii</i> TSC – V; EPBC – V	Associated with cliff faces on steep narrow ridges supporting sclerophyll forest, growing in clefts on volcanic rock, occasionally epiphytic on grass trees at altitudes of 500 to 1000masl (Bishop 1996).	No suitable habitat present <i>Species is not likely to be affected and is not assessed further.</i>
<i>Senna acclinis</i> TSC – V	Sub-tropical rainforest communities (Harden 1994). In the study area suitable habitat exists in the: Yellow Carbeen, Corkwood Sassafras, Viney Scrub, Brushbox, Flooded Gum, Tallowwood, Tallowwood - Sydney Blue Gum, Sydney Blue Gum, Moist Blackbutt, vegetation types.	Suitable habitat present <i>Species potentially affected and is assessed further.</i>

Table A.2 Threatened Flora Species Habitat Assessment

Plant Species	Vegetation Associations	Assessment
<i>Thesium australe</i> Austral Toadflax TSC – V; EPBC - V	Coastal headlands dominated by Kangaroo Grass (<i>Themeda australis</i>).	No suitable habitat present <i>Species is not likely to be affected and is not assessed further.</i>
<i>Zieria prostrata</i> Headland Zieria TSC – E; EPBC - E	Coastal headlands	No suitable habitat present <i>Species is not likely to be affected and is not assessed further.</i>

Table A.3 Threatened Fauna Species Habitat Assessment

Amphibians & Reptiles	Habitat Associations	Probability of Occurrence
<i>Assa darlingtoni</i> Pouched Frog TSC – V	Highlands and uplands of the eastern Great Dividing Range (300 to 1180m above sea level MASL). Cool temperate and Subtropical Rainforest (Ehmann 1997).	Low No suitable habitat, not assessed further
<i>Crinia tinnula</i> Wallum Froglet TSC – V	Wallum swamps and associated low land meandering watercourses on coastal plains (Ehmann 1997).	Low Records associated with coastal areas, which are distant from the Coastal Ridge Way
<i>Litoria aurea</i> Green and Golden Bell Frog TSC – E; EPBC – V	Large ephemeral bodies of water exhibiting well-established fringing vegetation adjacent to open grassland areas for foraging (Ehmann 1997). In the study area suitable habitat exists in the: Vicinity of Coastal Ridge Way in dams, ponds, swamps and streams.	Low Species has severely declined in the region and is unlikely to occur.
<i>Litoria olongburensis</i> Wallum Sedge Frog TSC – V; EPBC – V	Wallum and woodlands on coastal and swamps. Swamps are typically acidic (Ehmann 1997).	Low Records associated with coastal areas, which are distant from the Coastal Ridge Way
<i>Mixophyes balbus</i> TSC – V; EPBC – V	A variety of habitats that are characterised by deep leaf litter or thick cover from understorey vegetation. Breeding habitats are streams and occasionally springs. Not known from streams disturbed by humans (Ehmann 1997). In the study area suitable habitat exists in the: Yellow Carbeen, Corkwood Sassafras, Viney Scrub, Brushbox, Flooded Gum, Tallowwood, Tallowwood - Sydney Blue Gum, Sydney Blue Gum, Moist Blackbutt, Spotted Gum Ironbark / Grey Gum Forest and Dry Blackbutt communities	High The location of records and suitable habitats indicates that this species is likely to occur in the study area
<i>Mixophyes iteratus</i> Giant Barred Frog TSC – E; EPBC – E	Found on forested slopes of the escarpment and adjacent ranges in riparian vegetation, subtropical and dry rainforest and wet sclerophyll forests. This species is associated with flowing streams with high water quality, though habitats may contain weed species (Ehmann 1997). In the study area suitable habitat exists in the: Yellow Carbeen, Corkwood Sassafras, Viney Scrub, Brushbox, Flooded Gum, Tallowwood, Tallowwood - Sydney Blue Gum, Sydney Blue Gum and Moist Blackbutt communities	High The location of records and suitable habitats indicates that this species is likely to occur in the study area

Table A.3 Threatened Fauna Species Habitat Assessment

<i>Philoria sphagnicolus</i> Sphagnum Frog TSC – V	Recorded between 640 to 1470 MASL in rainforest and wet sclerophyll forest with more than 1500mm annual rainfall (Ehmann 1997).	Low No suitable habitat, not assessed further
<i>Coeranoscincus reticulatus</i> Three-toed Snake-tooth Skink TSC – V; EPBC – V	Inhabits rainforests and adjacent wet sclerophyll forests, where it is usually found in rotting logs or under fallen timber (Cogger 1996). In the study area suitable habitat exists in the: Yellow Carbeen, Corkwood Sassafras, Viney Scrub, Brushbox, Flooded Gum, Tallowwood, Tallowwood - Sydney Blue Gum, Sydney Blue Gum, and Moist Blackbutt communities	High The location of records and suitable habitats indicates that this species is likely to occur in the study area
<i>Hoplocephalus stephensii</i> Stephen's Banded Snake TSC – V	Wet Sclerophyll and rainforest (Cogger 1996). This species is threatened by fragmentation, with a low reproductive rate and late reproductive age (Shine 1993 in SFNSW 1995) indicates continued occupation of isolated fragments unlikely. Recorded in Orara State Forest (Hugget pers. com.) In the study area suitable habitat exists in the: Yellow Carbeen, Corkwood Sassafras, Viney Scrub, Brushbox, Flooded Gum, Tallowwood, Tallowwood - Sydney Blue Gum, Sydney Blue Gum, and Moist Blackbutt communities	High The location of records and suitable habitats indicates that this species is likely to occur in the study area
Avifauna	Habitat Associations	Probability of Occurrence
<i>Burhinus grallarius</i> Bush Stone-curlew TSC – E	Associated with dry open woodland with grassy areas (SFNSW, 1995), dune scrubs, in savanna areas, the fringes of mangroves, golf courses and open forest / farmland (Pittwater Council 2000, Marchant & Higgins, 1999). Forages in areas with fallen timber, leaf litter, little undergrowth and where the grass is short and patchy (Environment Australia 2000; Marchant & Higgins, 1999). Is thought to require large tracts of habitat to support breeding, in which there is a preference for relatively undisturbed to lightly disturbed habitat (in SFNSW 1995). In the study area suitable habitat exists in the: Brushbox, Flooded Gum, Tallowwood, Tallowwood - Sydney Blue Gum, Sydney Blue Gum, Moist Blackbutt, Spotted Gum Ironbark / Grey Gum Forest, Dry Blackbutt, Swamp Mahogany and Paperbark communities	High Records to the north of the study area and presence of suitable habitats indicates that this species may occur.
<i>Calyptorhynchus lathami</i> Glossy Black-Cockatoo TSC – V	Associated with a variety of forest types containing <i>Allocasuarina</i> species (Environment Australia 2000, NPWS 1997 and SFNSW 1995). Nests in large trees with large hollows (Environment Australia, 2000). In the study area suitable habitat exists in the: Tallowwood, Tallowwood - Sydney Blue Gum, Sydney Blue Gum, Moist Blackbutt, Spotted Gum Ironbark / Grey Gum Forest, Dry Blackbutt, Swamp Mahogany and Paperbark	High The location of records and suitable habitats indicates that this species is likely to occur in the study area

Table A.3 Threatened Fauna Species Habitat Assessment

<p><i>Coracina lineata</i> Barred Cuckoo-shrike TSC – V</p>	<p>Associated with rainforests and moist forests, often in creek lines located in gullies. Recorded locally in the Woolgoolga Creek Flora Reserve (SFNSW 1995).</p> <p>In the study area suitable habitat exists in the: Yellow Carbeen, Corkwood Sassafras, Viney Scrub, Brushbox, Flooded Gum, Tallowwood, Tallowwood - Sydney Blue Gum, Sydney Blue Gum and Moist Blackbutt communities</p>	<p>High</p> <p>While known from a small number of records, the proximity of these and suitable habitat to the proposal indicates that this species is likely to occur in the study area</p>
<p><i>Cyclopsitta diophthalma</i> Double-eyed Fig-Parrot TSC – E; EPBC - E</p>	<p>Associated with upland (to 1200MASL) to lowland rainforests, tropical semi-deciduous vine thickets and gallery forests, usually containing fig trees. Usually in large tracks of forests, particularly near edges, rarely in partly cleared or fragmented rainforest (Marchant and Higgins 1999).</p> <p>In the study area suitable habitat exists in the: Yellow Carbeen, Corkwood Sassafras, Viney Scrub and Brushbox communities</p>	<p>Moderate</p> <p>While known from a small number of records, the presence of suitable habitat indicates that this species may occur in the study area</p>
<p><i>Ephippiorhynchus asiaticus</i> Black-necked Stork TSC – E</p>	<p>Associated with tropical and warm temperate terrestrial wetlands, estuarine and littoral habitats, and occasionally woodlands and grasslands. Forages in fresh or saline waters up to 0.5m deep, mainly in open fresh waters, extensive sheets of shallow water over grasslands or sedgeland, shallow swamps with short emergent vegetation and permanent billabongs and pools on floodplains (Marchant and Higgins 1999).</p>	<p>Low</p> <p>The location of records and suitable habitats indicates that this species is unlikely to occur in the study area</p>
<p><i>Erythrotriorchis radiatus</i> Red Goshawk TSC – V; EPBC - V</p>	<p>Associated with forests and woodlands with a mosaic of vegetation types, an abundance of birds and permanent water. In NSW, this species is thought to favour mixed subtropical rainforest, Melaleuca Swamp Forest, and open Eucalypt forest along rivers, often in rugged terrain (Marchant and Higgins 1999). Is thought to require contiguous tracts of woodland / forest and a sustainable supply of pesticide free prey (Debus 1993 in SFNSW 1995).</p> <p>In the study area suitable habitat exists in the: Yellow Carbeen, Corkwood Sassafras, Viney Scrub, Brushbox, Flooded Gum, Tallowwood, Tallowwood - Sydney Blue Gum, Sydney Blue Gum, Moist Blackbutt, Spotted Gum Ironbark / Grey Gum Forest, Dry Blackbutt, Swamp Mahogany and Paperbark communities</p>	<p>High</p> <p>While known from a number of records, the presence of suitable habitat indicates that this species may occur in the study area</p>
<p><i>Grantiella picta</i> Painted Honeyeater TSC – V</p>	<p>Considered a rare vagrant to the area (SFNSW 1995). Associated with dry woodland / forest habitats. Woodlands, which are laden with Mistletoes (esp. <i>Amyema spp.</i>), are particularly important as this species feeds almost exclusively on mistletoe nectar and fruit (Environment Australia 2000, SFNSW 1995).</p> <p>In the study area suitable habitat exists in the: Flooded Gum, Tallowwood, Tallowwood - Sydney Blue Gum, Sydney Blue Gum, Moist Blackbutt, Spotted Gum Ironbark / Grey Gum Forest and Dry Blackbutt communities</p>	<p>Moderate</p> <p>While known from a small number of records, the presence of suitable habitat indicates that this species may occur in the study area</p>

Table A.3 Threatened Fauna Species Habitat Assessment

<p><i>Grus rubicundus</i> Brolga TSC – V</p>	<p>During breeding season mostly near shallow freshwater marshes or freshwater meadows. During non-breeding seasons congregates near deep, permanent freshwater marshes, mostly foraging in nearby field, pastures and fallow fields and occasionally foraging in littoral zones of marshes (Marchant and Higgins 1999).</p>	<p>Low</p> <p>Records associated with coastal areas, which are distant from the Coastal Ridge Way</p>
<p><i>Irediparra gallinacea</i> Comb-crested Jacana TSC – V</p>	<p>Freshwater wetlands, such as lagoons, billabongs, swamps, lakes and reservoirs, generally with abundant floating aquatic vegetation (Marchant and Higgins 1999).</p>	<p>Low</p> <p>Records associated with coastal areas, which are distant from the Coastal Ridge Way</p>
<p><i>Ixobrychus flavicollis</i> Black Bittern TSC – V</p>	<p>Associated with the margins of wetlands and quiet watercourses flowing through coastal forest, woodland, mangroves and Melaleuca swamps (NPWS 1997, SFNSW 1995).</p>	<p>Low</p> <p>Records associated with coastal areas, which are distant from the Coastal Ridge Way</p>
<p><i>Lathamus discolor</i> Swift Parrot TSC – E; EPBC - E</p>	<p>Associated with dry open Eucalypt forests and woodlands with winter flowering Eucalypts (Marchant and Higgins 1999). In the local area, this species has utilised Spotted Gum (<i>Corymbia maculata</i>), Banksias (<i>Banksia integrifolia</i> and <i>B. serrata</i>) (SFNSW 1995). Winter flowering eucalypts in the study area include Blackbutt (<i>Eucalyptus pilularis</i>), Swamp Mahogany (<i>E. robusta</i>) and the Forest Red Gum (<i>E. tereticornis</i>) (Law et al. 2000). Often located in urban areas and farmlands with remnant Eucalypts.</p> <p>In the study area suitable habitat exists in the: Flooded Gum, Tallowwood, Tallowwood - Sydney Blue Gum, Sydney Blue Gum, Moist Blackbutt, Spotted Gum Ironbark / Grey Gum Forest, Dry Blackbutt, Swamp Mahogany and Paperbark communities</p>	<p>High</p> <p>The number of records and suitable habitats indicates that this species is likely to occur in the study area</p> <p>(The coastal location of records may be a reflection of distribution of survey effort)</p>
<p><i>Lophoictinia isura</i> Square-tailed Kite TSC – V</p>	<p>In coastal areas associated tropical and temperate forests and woodlands on fertile soils with an abundance of passerine birds (Marchant and Higgins 1999, NPWS 1999). Likely to require a large area for foraging (Marchant and Higgins 1999).</p> <p>In the study area suitable habitat exists in the: Flooded Gum, Tallowwood, Tallowwood - Sydney Blue Gum, Sydney Blue Gum, Moist Blackbutt, Spotted Gum Ironbark / Grey Gum Forest and Dry Blackbutt communities</p>	<p>Moderate</p> <p>While known from a small number of records, the presence of suitable habitat indicates that this species may occur in the study area</p>
<p><i>Monarcha leucotis</i> White-eared Monarch TSC – V</p>	<p>Associated with lowland subtropical rainforest edges and remnants; littoral and floodplain rainforest, swamp sclerophyll with mesomorphic mid storey, coastal wet sclerophyll. Appears to prefer rainforest with edges. Is thought to avoid moving into small remnants; preferring to move through areas of continuous forest cover (Environment Australia 2000).</p> <p>In the study area suitable habitat exists in the: Yellow Carbeen, Corkwood Sassafras, Viney Scrub, Brushbox, Flooded Gum, Tallowwood, Tallowwood - Sydney Blue Gum, Sydney Blue Gum and Moist Blackbutt communities</p>	<p>High</p> <p>While known from a small number of records, the presence of suitable habitat indicates that this species may occur in the study area</p>

Table A.3 Threatened Fauna Species Habitat Assessment

<p><i>Pachycephala olivacea</i> Olive Whistler TSC - V</p>	<p>Elevated (>500 MASL), cool temperate rainforest and moist eucalypt forest in the northern part of their range. This species appears to favour large tracts of undisturbed and densely vegetated forest (SFNSW 1995).</p>	<p>Low</p> <p>No suitable habitat, not assessed further</p>
<p><i>Pandion haliaetus</i> Osprey TSC - V</p>	<p>Associated with waterbodies including coastal waters, inlets, lakes, estuaries, beaches, offshore islands and sometimes along inland rivers (Schodde and Tidemann 1986; Clancy 1991; Olsen 1995). Osprey may nest on the ground on sea cliffs or in trees (Olsen 1995). Osprey generally prefer emergent trees, often dead or partly dead with a broken off crown (Olsen 1995).</p>	<p>Low</p> <p>Records associated with coastal areas, which are distant from the Coastal Ridge Way</p>
<p><i>Podargus ocellatus</i> Marbled Frogmouth TSC - V</p>	<p>Tropical and subtropical rainforests, usually with luxuriant epiphytic growth. Rarely seen outside of rainforests (Marchant and Higgins 1999).</p> <p>In the study area suitable habitat exists in the: Yellow Carbeen, Corkwood Sassafras and Viney Scrub communities</p>	<p>Moderate</p> <p>While known from a small number of records, the presence of suitable habitat indicates that this species may occur in the study area</p>
<p><i>Ptilinopus magnificus</i> Wompoo Fruit-Dove TSC - V</p>	<p>Associated with large, undisturbed patches of tall tropical or subtropical rainforest, at all altitudes. Occasionally located in patches of monsoon rainforest, closed gallery forest, wet sclerophyll forest, tall open forest, open woodland or vine thickets near rainforest (Marchant and Higgins 1999).</p> <p>In the study area suitable habitat exists in the: Suitable habitat exists in Yellow Carbeen, Corkwood Sassafras, Viney Scrub communities</p>	<p>High</p> <p>The location of records and suitable habitats indicates that this species is likely to occur in the study area</p>
<p><i>Ptilinopus regina</i> Rose-crowned Fruit-Dove TSC - V</p>	<p>Tall tropical and subtropical, evergreen or semi-deciduous rainforests, especially with a dense growth of vines. Also located in closed wet sclerophyll forest, gallery forests or sclerophyll woodlands with abundant fruiting trees, near or next to rainforest. Is thought to prefer large areas of vegetation, but has been located in patches and occasionally in parks and gardens with fruiting trees (Marchant and Higgins 1999).</p> <p>In the study area suitable habitat exists in the: Yellow Carbeen, Corkwood Sassafras, Viney Scrub, Brushbox, Flooded Gum, Tallowwood, Tallowwood - Sydney Blue Gum and Sydney Blue Gum</p>	<p>High</p> <p>The location of records and suitable habitats indicates that this species is likely to occur in the study area</p>
<p><i>Ptilinopus superbus</i> Superb Fruit-Dove TSC - V</p>	<p>Lives mainly within rainforests but will feed in adjacent mangroves or Eucalypt forests (Blakers et al. 1984). Nests are well hidden within the rainforest habitat and are built in trees from 10 to 30m off the ground (Recher et al. 1995).</p> <p>In the study area suitable habitat exists in the: Yellow Carbeen, Corkwood Sassafras, Viney Scrub, Brushbox, Flooded Gum, Tallowwood, Tallowwood - Sydney Blue Gum, Sydney Blue Gum, Moist Blackbutt, Spotted Gum Ironbark / Grey Gum Forest, Dry Blackbutt, Swamp Mahogany and Paperbark communities</p>	<p>High</p> <p>The location of records and suitable habitats indicates that this species is likely to occur in the study area</p>
<p><i>Todiramphus chloris</i> Collared Kingfisher TSC - V</p>	<p>Virtually confined to mangrove lining sheltered coastal embayment, inlets, estuaries and adjacent tidal flats (Marchant and Higgins 1999).</p>	<p>Low</p> <p>No suitable habitat, not assessed further</p>

Table A.3 Threatened Fauna Species Habitat Assessment

<p><i>Turnix melanogaster</i> Black-breasted Button-quail TSC - E; EPBC - V</p>	<p>Drier rainforests with dense overhead cover and a thick dry litter layer. Observations in Lantana thickets and hoop pine plantations indicate this species may be able to utilise human modified environments (Blakers et al. 1984).</p> <p>In the study area suitable habitat exists in the: Yellow Carbeen, Corkwood Sassafras, Viney Scrub, Brushbox communities</p>	<p>High</p> <p>Suitable habitats indicate that this species may occur in the study area.</p>
<p><i>Xanthomyza phrygia</i> Regent Honeyeater TSC - E; EPBC - E</p>	<p>Feeds primarily on nectar from box and ironbark eucalypts and occasionally from Banksias and Mistletoes (NPWS 1995). Associated with temperate Eucalypt woodland and open forest including forest edges, wooded farmland and urban areas with mature Eucalypts, riparian forests of River Oak (<i>Casuarina cunninghamiana</i>) (SFNSW 1995, Garnett 1993). Reliant on locally abundant nectar sources, especially flowering eucalypts that occur mainly in dry open woodland (SFNSW 1995), on richer soil types with different flowering times to provide reliable supply of nectar (Environment Australia 2000). Areas containing Swamp Mahogany (<i>Eucalyptus robusta</i>) in coastal areas have been observed to be utilised (NPWS 1997, SFNSW 1995).</p> <p>In the study area suitable habitat exists in the: Flooded Gum, Tallowwood, Tallowwood - Sydney Blue Gum, Sydney Blue Gum, Moist Blackbutt, Spotted Gum Ironbark / Grey Gum Forest, Dry Blackbutt, Swamp Mahogany and Paperbark communities</p>	<p>High</p> <p>The number of records and suitable habitats indicates that this species is likely to occur in the study area</p> <p>(<i>The coastal location of records may be a reflection of distribution of survey effort</i>)</p>
<p><i>Ninox connivens</i> Barking Owl TSC - V</p>	<p>Associated with a variety of habitats such as savanna woodland, open Eucalypt forests, wetland and riverine forest. Kavanagh et al. (1995), which suggests that the species is particularly associated with coastal lowland or riparian woodland dominated by various red gum species. The diet of the Barking Owl consists of mammals, birds and insects, the percentage of which depends largely on seasonal availability (Debus 1997). Species rich habitats, such as woodlands and ecotones, are considered to important habitat for this species due to its diverse diet (Environment Australia 2000). Usually nests in large tree hollows with entrances averaging 2-29 metres above ground, depending on the forest or woodland structure and the canopy height (Debus 1997).</p> <p>In the study area suitable habitat exists in the: Flooded Gum, Tallowwood, Tallowwood - Sydney Blue Gum, Sydney Blue Gum, Moist Blackbutt, Spotted Gum Ironbark / Grey Gum Forest, Dry Blackbutt, Swamp Mahogany and Paperbark communities</p>	<p>Low</p> <p>Despite the presence of suitable habitat, the rarity of the species indicates that this species is not likely to occur in the study area.</p>

Table A.3 Threatened Fauna Species Habitat Assessment

<p><i>Ninox strenua</i> Powerful Owl TSC – V</p>	<p>Powerful Owls are associated with a wide range of wet and dry forest types with a high density of prey, such as arboreal mammals, large birds and flying foxes (Environment Australia 2000, Debus & Chafer 1994). Large trees with hollows at least 0.5m deep are required for shelter and breeding (Environment Australia 2000).</p> <p>In the study area suitable habitat exists in the: Flooded Gum, Tallowwood, Tallowwood - Sydney Blue Gum, Sydney Blue Gum, Moist Blackbutt, Spotted Gum Ironbark / Grey Gum Forest and Dry Blackbutt communities</p>	<p>High</p> <p>The location of records and suitable habitats indicates that this species is likely to occur in the study area</p>
<p><i>Tyto capensis</i> Grass Owl TSC – V</p>	<p>In NSW the Grass Owl is rarely recorded and is strictly tied to the occurrence of suitable habitat. Compared with other owls, the Grass Owl is unusual in that it nests on the ground within dense tall grass, sedges, reeds and even sugarcane plantations. Reported habitats include tall grass, swampy, sometimes tidal areas, mangrove fringes, grassy plains, coastal heaths, grassy woodland, cane grass, lignum, sedges, cumbungi, cane fields and grain stubble (Pizzey and Knight, 1997). The Grass Owl primarily feeds on rodents, hunting on the wing over heathland, grassland and sedgeland, as well as along the edge of sugar cane, crops and pastureland.</p>	<p>Low</p> <p>Records associated with coastal areas, which are distant from the Coastal Ridge Way</p>
<p><i>Tyto novaehollandiae</i> Masked Owl TSC – V</p>	<p>Associated with forest with sparse, open, understorey, particularly the ecotone between wet and dry forest, and non-forest habitat (Environment Australia 2000). Known to utilise forest margins and isolated stands of trees within agricultural land (Hyem 1979) and heavily disturbed forest where its prey of small and medium sized mammals can be readily obtained (Kavanagh and Peake 1993).</p> <p>In the study area suitable habitat exists in the: Flooded Gum, Tallowwood, Tallowwood - Sydney Blue Gum, Sydney Blue Gum, Moist Blackbutt, Spotted Gum Ironbark / Grey Gum Forest and Dry Blackbutt communities</p>	<p>High</p> <p>The location of records and suitable habitats indicates that this species is likely to occur in the study area</p>

Table A.3 Threatened Fauna Species Habitat Assessment

<p><i>Tyto tenebricosa</i> Sooty Owl TSC – V</p>	<p>Sooty Owls are associated with tall wet old growth forest on fertile soil with a dense understorey and emergent tall Eucalyptus species (Environment Australia 2000, Debus, 1994). Pairs roost in the daytime amongst dense vegetation, in tree hollows and sometimes in caves. The Sooty Owl is typically associated with an abundant and diverse supply of prey items and a selection of large tree hollows (Debus, 1994, Garnett 1993, Hyem 1979).</p> <p>In the study area suitable habitat exists in the: Yellow Carbeen, Corkwood Sassafras, Viney Scrub, Brushbox, Flooded Gum, Tallowwood, Tallowwood - Sydney Blue Gum, Sydney Blue Gum and Moist Blackbutt communities</p>	<p>High</p> <p>The location of records and suitable habitats indicates that this species is likely to occur in the study area</p>
<p>Mammals</p>	<p>Habitat Associations</p>	<p>Probability of Occurrence</p>
<p><i>Aepyprymnus rufescens</i> Rufous Bettong TSC – V</p>	<p>Associated with grassy open forests and woodland, typically with an absence of shrub layer, but may also occur on grassy ridges with a dense shrub layer (SFNSW, 1995). Has been observed more commonly in forests characterised by the Spotted Gum (<i>Corymbia maculata</i>) in northern eastern NSW (SFNSW, 1995). This species has been positively related to high food plant density, moderate topography and grazing (SFNSW, 1995).</p> <p>In the study area suitable habitat exists in the: Flooded Gum, Tallowwood, Tallowwood - Sydney Blue Gum, Sydney Blue Gum, Moist Blackbutt, Spotted Gum Ironbark / Grey Gum Forest and Dry Blackbutt communities</p>	<p>High</p> <p>Known from a small number of records, the presence of suitable habitat indicates that this species may occur in the study area</p>
<p><i>Dasyurus maculatus</i> Spotted-tailed Quoll TSC – V; EPBC - V</p>	<p>The Spotted-tailed Quoll inhabits a range of forest communities including wet and dry sclerophyll forests and rainforests (Mansergh, 1984), more frequently recorded near the ecotones of closed and open forest (SFNSW 1995). Maternal den sites include logs with cryptic entrances, rock outcrops, windrows and burrows (Environment Australia 2000).</p> <p>In the study area suitable habitat exists in the: Yellow Carbeen, Corkwood Sassafras, Viney Scrub, Brushbox, Flooded Gum, Tallowwood, Tallowwood - Sydney Blue Gum, Sydney Blue Gum, Moist Blackbutt, Spotted Gum Ironbark / Grey Gum Forest and Dry Blackbutt communities</p>	<p>High</p> <p>The location of records and suitable habitats indicates that this species is likely to occur in the study area</p>

Table A.3 Threatened Fauna Species Habitat Assessment

<p><i>Phascogale tapoatafa</i> Brush-tailed Phascogale TSC – V; EPBC - V</p>	<p>Preferred habitat is Dry Open forest with a sparse open understorey, however, has been located in heath, swamps and rainforest and wet sclerophyll forest (NPWS 1999).</p> <p>In the study area suitable habitat exists in the: Yellow Carbeen, Corkwood Sassafras, Viney Scrub, Brushbox, Flooded Gum, Tallowwood, Tallowwood - Sydney Blue Gum, Sydney Blue Gum, Moist Blackbutt, Spotted Gum Ironbark / Grey Gum Forest and Dry Blackbutt communities</p>	<p>High</p> <p>The location of records and suitable habitats indicates that this species is likely to occur in the study area</p>
<p><i>Macropus parma</i> Parma Wallaby TSC - V</p>	<p>Associated with dry and mesic sclerophyll forests and occasionally in rainforest. Optimum habitat appears to be mesic Eucalypt forests with a mosaic of open and closed thick shrubby understorey patches (in SFNSW 1995).</p> <p>In the study area suitable habitat exists in the: Yellow Carbeen, Corkwood Sassafras, Viney Scrub, Brushbox, Flooded Gum, Tallowwood, Tallowwood - Sydney Blue Gum, Sydney Blue Gum, Moist Blackbutt, Spotted Gum Ironbark / Grey Gum Forest and Dry Blackbutt communities</p>	<p>High</p> <p>Known from a small number of records, the presence of suitable habitat indicates that this species may occur in the study area</p>
<p><i>Petaurus australis</i> Yellow-bellied Glider TSC – V</p>	<p>Associated with a range of forest types but is more common at ecotone between dry and wet sclerophyll forests. Habitats are characterised by a mosaic of tree species including some that flower in winter (Environment Australia 2000, Braithwaite 1984, Davey 1984, Kavanagh 1984). Large hollows within mature trees are required for nesting and breeding (Henry and Craig 1984).</p> <p>In the study area suitable habitat exists in the: Flooded Gum, Tallowwood, Tallowwood - Sydney Blue Gum, Sydney Blue Gum, Moist Blackbutt, Spotted Gum Ironbark / Grey Gum Forest and Dry Blackbutt communities</p>	<p>High</p> <p>The location of records and suitable habitats indicates that this species is likely to occur in the study area</p>
<p><i>Petaurus norfolcensis</i> Squirrel Glider TSC – V</p>	<p>Associated with dry hardwood forest and woodlands (Menkhorst et al. 1988, Quin 1993, Traill 1991). Habitats typically include gum barked and high nectar producing species, including winter flower species (Menkhorst et al. 1988). The presence of hollow bearing eucalypts is a critical habitat value (Quin 1995). Recorded locally in Wedding Bells SF and Moonee Beach Nature Reserve.</p> <p>In the study area suitable habitat exists in the: Dry Blackbutt, Swamp Mahogany and Paperbark communities</p>	<p>High</p> <p>The location of records and suitable habitats indicates that this species is likely to occur in the study area</p>
<p><i>Petrogale penicillata</i> Brush-tailed Rock-wallaby TSC – V; EPBC - V</p>	<p>Rocky areas in a variety of habitats, typically north facing sites with numerous ledges, caves and crevices (Strahan 1995).</p>	<p>Low</p> <p>No suitable habitat, not assessed further</p>
<p><i>Potorous tridactylus</i> Long-nosed Potoroo TSC - V; EPBC - V</p>	<p>Associated with dry coastal heath and dry and wet sclerophyll forests with relatively thick ground cover and light sandy soils (Strahan 1995).</p>	<p>Low</p> <p>No suitable habitat, not assessed further</p>

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<p><i>Phascolarctos cinereus</i> Koala TSC – V</p>	<p>Associated with both wet and dry Eucalypt forests that contain a canopy cover of approximately 10 to 70% (Reed et al. 1990), with acceptable Eucalypt food trees.</p> <p>In the study area suitable habitat exists in the: Brushbox, Flooded Gum, Tallowwood, Tallowwood - Sydney Blue Gum, Sydney Blue Gum, Moist Blackbutt, Spotted Gum Ironbark / Grey Gum Forest, Dry Blackbutt, Swamp Mahogany and Paperbark communities.</p>	<p>High</p> <p>The location of records and suitable habitats indicates that this species is likely to occur in the study area</p>
<p><i>Thylogale stigmatica</i> Red-legged Pademelon TSC - V</p>	<p>Predominantly a rainforest species, also in wet sclerophyll forest and deciduous vine thickets. Requires a dense understorey for cover (SFNSW, 1995).</p> <p>In the study area suitable habitat exists in the: Yellow Carbeen, Corkwood Sassafras, Viney Scrub, Brushbox, Flooded Gum, Tallowwood, Tallowwood - Sydney Blue Gum, Sydney Blue Gum and Moist Blackbutt communities</p>	<p>High</p> <p>Known from a small number of records, the presence of suitable habitat indicates that this species may occur in the study area</p>
<p><i>Chalinolobus dwyeri</i> Large Pied Bat TSC – E; EPBC - V</p>	<p>The Large-eared Pied Bat has been recorded in a variety of habitats, including dry sclerophyll forests, woodland, sub-alpine woodland, edges of rainforests and wet sclerophyll forests. This species roosts in caves (Churchill, 1998).</p> <p>In the study area suitable habitat exists in the: Brushbox, Flooded Gum, Tallowwood, Tallowwood - Sydney Blue Gum, Sydney Blue Gum, Moist Blackbutt, Spotted Gum Ironbark / Grey Gum Forest, Dry Blackbutt, Swamp Mahogany and Paperbark communities</p>	<p>Low</p> <p>The distance to suitable roosting habitats to the west, indicates that this species is not likely to occur in the study area</p>
<p><i>Chalinolobus nigrogriseus</i> Hoary Wattled Bat TSC – V</p>	<p>The preferred habitat of this species appears to be variable, with dry open forest, woodland, vine thickets, coastal scrub, sand dunes, grasslands and floodplains recorded (Churchill, 1998). This species often forages along watercourses, swampy areas and over farm dams. In NSW, this species has been recorded in Spotted Gum (<i>Corymbia maculata</i>), Grey Box (<i>Eucalyptus moluccana</i>) and Northern Ironbark (<i>E. siderophloia</i>) and woodland characterised by Scribbly Gums (<i>E. signata</i>) and Pink Bloodwood (<i>C. intermedia</i>) and sites dominated by the Blackbutt (<i>E. pilularis</i>). Roost sites have been identified as tree hollows, rock crevices and the roofs of buildings (Churchill, 1998).</p> <p>In the study area suitable habitat exists in the: Viney Scrub, Brushbox, Flooded Gum, Tallowwood, Tallowwood - Sydney Blue Gum, Sydney Blue Gum, Moist Blackbutt, Spotted Gum Ironbark / Grey Gum Forest, Dry Blackbutt, Swamp Mahogany and Paperbark communities</p>	<p>Moderate</p> <p>Suitable habitats indicate that this species may occur in the study area.</p>

Table A.3 Threatened Fauna Species Habitat Assessment

<p><i>Falsistrellus tasmaniensis</i> Eastern False Pipistrelle TSC – V</p>	<p>This species is associated with forested areas with higher rainfall (Parnaby, 1983), and has been located from the highlands to the coast, appearing to be less common at low altitudes, and tending to favour the cool moist forests of the ranges (Phillips, 1998). While the Eastern False Pipistrelle roosts primarily in tree trunk hollows, individuals have also be found in caves and abandoned buildings (Klippel, 1992).</p> <p>In the study area suitable habitat exists in the: Brushbox, Flooded Gum, Tallowwood, Tallowwood - Sydney Blue Gum, Sydney Blue Gum, Moist Blackbutt, Spotted Gum Ironbark / Grey Gum Forest, Dry Blackbutt, Swamp Mahogany and Paperbark communities</p>	<p>High</p> <p>The location of records and suitable habitats indicates that this species is likely to occur in the study area</p>
<p><i>Kerivoula papuensis</i> Golden-tipped Bat TSC – V</p>	<p>The most favoured habitat for this species is moist closed forests often with a rainforest influence, however, some captures have been made in dry forests some distance from any rainforest (Lunney et. al., 1986, Parnaby and Mills, 1994). It has been suggested that the amount of vines and complex tree layers allows for increased numbers of spiders and webs and such areas are sought by the Golden-tipped Bat (Schulz & Eyre, 2000). This species is often caught over streams within rainforest and is known to frequently roost within the pendulous nests of Yellow-throated and Large-billed Scrub Wrens and Brown Gerygone in such areas. (Schulz, & Eyre, 2000).</p> <p>In the study area suitable habitat exists in the: Yellow Carbeen, Corkwood Sassafras, Viney Scrub, Brushbox, Flooded Gum, Tallowwood, Tallowwood - Sydney Blue Gum, Sydney Blue Gum and Moist Blackbutt communities</p>	<p>High</p> <p>The location of records and presence of suitable habitats indicate that this species may occur in the study area.</p>
<p><i>Miniopterus australis</i> Little Bent-wing Bat TSC – V</p>	<p>Breeding occurs in caves, usually in association with <i>M. schreibersii</i>. This species shelter in a range of structures including culverts, drains, mines and caves. Foraging is associated with forested areas, predominantly moist Eucalypt forests, rainforests, and some dry forest types (Environment Australia 2000).</p> <p>In the study area suitable habitat exists in the: Brushbox, Flooded Gum, Tallowwood, Tallowwood - Sydney Blue Gum, Sydney Blue Gum, Moist Blackbutt, Spotted Gum Ironbark / Grey Gum Forest, Dry Blackbutt, Swamp Mahogany and Paperbark communities</p>	<p>High</p> <p>The location of records and suitable habitats indicates that this species is likely to occur in the study area</p>

Table A.3 Threatened Fauna Species Habitat Assessment

<p><i>Miniopterus schreibersii</i> Common Bent-wing Bat TSC – V; EPBC - V</p>	<p>Associated with a range of habitats, typically well timbered areas where it forages above and below the tree canopy on small insects (Australian Museum Business Services, 1995; Dwyer, 1995, 1981). Will utilise caves, old mines, and stormwater channels, under bridges and occasionally buildings for shelter (Environment Australia 2000, Dwyer 1988). This species has been reported utilising bushland remnants in urban areas and is estimated to forage within a 20km radius in a single night.</p> <p>In the study area suitable habitat exists in the: Brushbox, Flooded Gum, Tallowwood, Tallowwood - Sydney Blue Gum, Sydney Blue Gum, Moist Blackbutt, Spotted Gum Ironbark / Grey Gum Forest, Dry Blackbutt, Swamp Mahogany and Paperbark communities</p>	<p>High</p> <p>The location of records and suitable habitats indicates that this species is likely to occur in the study area</p>
<p><i>Mormopterus norfolkensis</i> East Coast Freetail Bat TSC – V</p>	<p>Although the habitat preferences are unclear, most records of this species have been reported from dry Eucalypt forest and woodland on the eastern side of the Great Dividing Range. Individuals have, however, been recorded flying low over a rocky river in rainforest and wet sclerophyll forest and foraging in clearings at forest edges (Environment Australia, 2000; Allison & Hoyer, 1998). Primarily roosts in hollows or behind loose bark in mature eucalypts, but have been observed roosting in the roof of a hut (Environment Australia, 2000; Allison & Hoyer, 1998). Examination of wing morphology indicate that cleared or open habitats are favoured, such as open habitats (woodlands), cleared forest edges and tracks through forests as well as areas above the forest canopy (Ecotone, 2002).</p> <p>In the study area suitable habitat exists in the: Spotted Gum Ironbark / Grey Gum Forest, Dry Blackbutt, Swamp Mahogany and Paperbark communities</p>	<p>Moderate</p> <p>Suitable habitats indicate that this species may occur in the study area.</p>
<p><i>Myotis macropus</i> Southern Myotis TSC – V</p>	<p>A variety of foraging habitats are used by this species although it is usually found near large bodies of water, including estuaries, lakes, reservoirs, rivers and large streams, often in close proximity to roost sites however movements of up to 20km between roost and foraging site have been recorded (Caddle and Lumsden, 1999). The species apparently has specific roost requirements, and only a small percentage of available caves, mines, tunnels and culverts are used (Richards 1998). While roosting is most commonly associated with caves, this species has been observed to roost in tree hollows (Churchill 1998).</p>	<p>Low</p> <p>No suitable habitat, not assessed further.</p>
<p><i>Nyctophilus bifax</i> Eastern Long-eared Bat TSC - V</p>	<p>In NSW the species is limited to the coastal fringe, south to Iluka and appears to be associated with littoral rainforest.</p>	<p>Low</p> <p>No suitable habitat, not assessed further</p>

Table A.3 Threatened Fauna Species Habitat Assessment

<p><i>Pteropus poliocephalus</i> Grey-headed Flying-Fox TSC – V; EPBC - V</p>	<p>Inhabits a wide range of habitats including rainforest, mangroves, paperbark forests, wet and dry sclerophyll forests and cultivated areas (Eby, 1998).</p> <p>In the study area suitable habitat exists in the: Yellow Carbeen, Corkwood Sassafras, Viney Scrub, Brushbox, Flooded Gum, Tallowwood, Tallowwood - Sydney Blue Gum, Sydney Blue Gum, Moist Blackbutt, Spotted Gum Ironbark / Grey Gum Forest, Dry Blackbutt, Swamp Mahogany and Paperbark communities</p>	<p>High</p> <p>The location of records and suitable habitats indicates that this species is likely to occur in the study area</p>
<p><i>Saccolaimus flaviventris</i> Yellow-bellied Sheathtail-bat TSC – V</p>	<p>Associated with open country, mallee, eucalypt forests, rainforests, heathland and waterbodies (SFNSW 1995). Roosts in tree hollows but may also use caves and has been recorded in a tree hollow in a paddock (Environment Australia 2000). The Yellow-bellied Sheathtail-bat is dependent on suitable hollow-bearing trees to provide roost sites, which may be a limiting factor on populations in cleared or fragmented habitats.</p> <p>In the study area suitable habitat exists in the: Yellow Carbeen, Corkwood Sassafras, Viney Scrub, Brushbox, Flooded Gum, Tallowwood, Tallowwood - Sydney Blue Gum, Sydney Blue Gum, Moist Blackbutt, Spotted Gum Ironbark / Grey Gum Forest, Dry Blackbutt, Swamp Mahogany and Paperbark communities</p>	<p>Moderate</p> <p>Suitable habitats indicate that this species may occur in the study area.</p>
<p><i>Scoteanax rueppellii</i> Greater Broad-nosed Bat TSC – V</p>	<p>Associated with moist gullies in mature coastal forest, or rainforest, east of the Great Dividing Range (Churchill, 1998), tending to be more frequently located in more productive forests. Within denser vegetation types, use is made of natural and man made openings such as roads, creeks and small rivers, where it hawks backwards and forwards for prey (Hoye & Richards 1995).</p> <p>In the study area suitable habitat exists in the: Brushbox, Flooded Gum, Tallowwood, Tallowwood - Sydney Blue Gum, Sydney Blue Gum, Moist Blackbutt, Spotted Gum Ironbark / Grey Gum Forest, Dry Blackbutt, Swamp Mahogany and Paperbark communities</p>	<p>High</p> <p>The location of records and suitable habitats indicates that this species is likely to occur in the study area</p>
<p><i>Syconycteris australis</i> Common Blossom-bat TSC – V</p>	<p>Breeding and sheltering habitats are in subtropical and littoral rainforests. Requires a diverse range of nectar producing plant communities year round. Will occasionally eat some rainforest fruits (Environment Australia, 2000).</p> <p>In the study area suitable habitat exists in the: Yellow Carbeen, Corkwood Sassafras, Viney Scrub, Brushbox, Flooded Gum, Tallowwood, Tallowwood - Sydney Blue Gum, Sydney Blue Gum, Moist Blackbutt, Spotted Gum Ironbark / Grey Gum Forest, Dry Blackbutt, Swamp Mahogany and Paperbark communities</p>	<p>High</p> <p>The location of records and suitable habitats indicates that this species is likely to occur in the study area</p>

Table A.3 Threatened Fauna Species Habitat Assessment

<p><i>Vespadelus troughtoni</i> Eastern Cave Bat TSC - V</p>	<p>Associated with a variety of forest and woodlands, with a preference for mesic vegetation such as wet sclerophyll and rainforest (SFNSW 1995). This species roosts in shallow caves and tunnels (Ecotone 2002, SFNSW 1995).</p> <p>In the study area suitable habitat exists in the: Yellow Carbeen, Corkwood Sassafras, Viney Scrub, Brushbox, Flooded Gum, Tallowwood, Tallowwood - Sydney Blue Gum, Sydney Blue Gum, and Moist Blackbutt communities</p>	<p>Low</p> <p>The distance to suitable roosting habitats to the west, indicates that this species is not likely to occur in the study area</p>
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Table A.3: Threatened Fauna Species Groups and Associated Vegetation

Grouping of Threatened Species	Vegetation Associations and Habitat Features
<p>Coastal Vegetation Species</p> <p>Wallum Froglet (<i>Crinia tinnula</i>), Wallum Sedge Frog (<i>Litoria olongburensis</i>), Osprey (<i>Pandion haliaetus</i>), Grass Owl (<i>Tyto capensis</i>) and the Squirrel Glider (<i>Petaurus norfolcensis</i>).</p>	<p>Lowland Paperbark and Dry Blackbutt communities. Within these the Wallum Froglet and Wallum Sedge Frog occur in swampy areas.</p>
<p>Aquatic Habitat Species</p> <p>Black Bittern (<i>Ixobrychus flavicollis</i>), Brolga (<i>Grus rubicundus</i>), Comb-crested Jacana (<i>Irediparra gallinacea</i>), Black-necked Stork (<i>Ephippiorhynchus asiaticus</i>) and the Southern Myotis (<i>Myotis macropus</i>).</p>	<p>Water bodies, such as dams, ponds, swamps and streams in vicinity of forested areas.</p>
<p>Mesic Forest Species</p> <p><u>Amphibians</u> <i>Mixophyes balbus</i> and the Giant Barred Frog (<i>Mixophyes iteratus</i>).</p> <p><u>Reptiles</u> Three-toed Snake-tooth Skink (<i>Coeranoscincus reticulatus</i>) and Stephen's Banded Snake (<i>Hoplocephalus stephensii</i>).</p> <p><u>Diurnal Avifauna</u> Barred Cuckoo-shrike (<i>Coracina lineata</i>), Black-breasted Button-quail (<i>Turnix melanogaster</i>), Double-eyed Fig-Parrot (<i>Cyclopsitta diophthalma</i>), Rose-crowned Fruit-Dove (<i>Ptilinopus regina</i>), Superb Fruit-Dove (<i>Ptilinopus superbus</i>), White-eared Monarch (<i>Monarcha leucotis</i>) and Wompoo Fruit-Dove (<i>Ptilinopus magnificus</i>).</p> <p><u>Nocturnal Avifauna</u> Marbled Frogmouth (<i>Podargus ocellatus</i>) and Sooty Owl (<i>Tyto tenebricosa</i>).</p> <p><u>Mammals</u> Red-legged Pademelon (<i>Thylogale stigmatica</i>), Eastern Long-eared Bat (<i>Nyctophilus bifax</i>) and Golden-tipped Bat (<i>Kerivoula papuensis</i>).</p>	<p>Typically associated with rainforests and taller, wetter eucalypt forests.</p> <p><i>Suitable habitat predominantly includes Yellow Carbeen, Corkwood Sassafras, Viney Scrub, however, may include Brushbox, Flooded Gum, Tallowwood, Tallowwood - Sydney Blue Gum, Sydney Blue Gum, and Moist Blackbutt communities.</i></p>

Table A.3: Threatened Fauna Species Groups and Associated Vegetation

Grouping of Threatened Species	Vegetation Associations and Habitat Features
<p>Eucalypt Forest Fauna</p> <p><u>Diurnal Avifauna</u> Bush Stone-curlew (<i>Burhinus grallarius</i>), Glossy Black-Cockatoo (<i>Calyptorhynchus lathami</i>), Painted Honeyeater (<i>Grantiella picta</i>), Red Goshawk (<i>Erythrotriorchis radiatus</i>), Regent Honeyeater (<i>Xanthomyza phrygia</i>), Square-tailed Kite (<i>Lophoictinia isura</i>) and Swift Parrot (<i>Lathamus discolor</i>).</p> <p><u>Nocturnal Avifauna</u> Barking Owl (<i>Ninox connivens</i>), Masked Owl (<i>Tyto novaehollandiae</i>) and Powerful Owl (<i>Ninox strenua</i>).</p> <p><u>Mammals</u> Brush-tailed Phascogale (<i>Phascogale tapoatafa</i>), Koala (<i>Phascolarctos cinereus</i>), Parma Wallaby (<i>Macropus parma</i>), Rufous Bettong (<i>Aepyprymnus rufescens</i>), Spotted-tailed Quoll (<i>Dasyurus maculatus</i>) and Yellow-bellied Glider (<i>Petaurus australis</i>).</p> <p><u>Mammals (Microbats)</u> Common Blossom-bat (<i>Syconycteris australis</i>), East Coast Freetail Bat (<i>Mormopterus norfolkensis</i>), Eastern False Pipistrelle (<i>Falsistrellus tasmaniensis</i>), Greater Broad-nosed Bat (<i>Scoteanax rueppellii</i>), Grey-headed Flying-Fox (<i>Pteropus poliocephalus</i>), Hoary Wattled Bat (<i>Chalinolobus nigrogriseus</i>), Southern Myotis (<i>Myotis macropus</i>) and Yellow-bellied Sheathtail-bat (<i>Saccolaimus flaviventris</i>).</p>	<p>Predominantly associated with drier eucalypt forests, however, may utilise mesic forest types, including rainforests.</p> <p><i>Suitable habitat includes Flooded Gum, Tallowwood, Tallowwood - Sydney Blue Gum, Sydney Blue Gum, Moist Blackbutt, Spotted Gum Ironbark / Grey Gum Forest and Dry Blackbutt) and for some species rainforest (Brushbox, Yellow Carbeen, Corkwood Sassafras, Viney Scrub)</i></p>

Appendix B

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