3.2 FAUNA SURVEY METHODOLOGY

3.2.1 Bird Survey Methods

The survey methods for diurnal and nocturnal birds are outlined below while the survey details are provided in Tables 3.2 and 3.3.

Diurnal Bird Survey

Seasonal diurnal bird surveys were conducted to allow for detection of migratory and nomadic species, resident species and seasonal species.

The following survey methodologies were applied:

Bird Census

- The bird census involved traversing the subject site for 1-2 hours and recording all observed birds. The census was undertaken during periods of peak bird activity (6am-9am and 3pm-6pm or later depending on season). Threatened bird species were targeted during each census by ensuring traverses passed through potential habitat for these species. Birds were observed and identified using binoculars. Calls were identified in the field by the observer. Unknown calls were recorded and identified post-survey using references recordings.

Opportunistic Survey

- Opportunistic bird observations were made during all survey work including koala habitat searches, hollow bearing tree assessment and checking of traplines. Signs of birds such as feeding stations are also recorded.

Habitat Searches

- Habitat searches were undertaken to detect signs of bird activity such as nesting, tree hollow use or feeding (eg. *Allocasuarina* cones with characteristic chew marks, owl pellets, owl whitewash etc).

Diurnal Searches

Diurnal searches of the subject site were conducted during tree hollow assessments to identify any obvious roosting or nesting sites for owl species. These sites are normally distinguished by whitewash splattered over lower canopy foliage and ground cover, or by the presence of suitable nesting hollows with regurgitated pellets on the ground below.

TABLE 3.2
FAUNA SURVEY DETAILS
DIURNAL BIRD

14/8/07	Opportunistic observation / habitat tree assessment	1300-1415 1.25hrs
17/8/07	Opportunistic observation / habitat tree assessment	1300-1700 4hrs
27/8/07	Opportunistic observation / habitat tree assessment	1130-1330 2hrs
10/9/07	Opportunistic observation / habitat tree assessment	1300-1700 4hrs
19/9/07	Opportunistic observation / set overnight Anabat's	1730-1830 1hr
20/9/07	Opportunistic observation / collect overnight Anabat's	0730-0830 1hr
21/9/07	Opportunistic observation / set hairtubes	1300-1430 1.5hrs

TABLE 3.2 FAUNA SURVEY DETAILS DIURNAL BIRD		
24/9/07	Opportunistic observation / habitat assessment	1400-1700 3hrs
25/9/07	Opportunistic observation / set up harp traps	1600 – 1800 2hrs
26/9/07	Opportunistic observation / check harp traps	0645-0815 1.75hrs
27/9/08	Opportunistic observation / check harp traps	0700-0845 1.75hrs
3/10/07	Opportunistic observation / identify weeds for removal	1400-1700 2hrs
27/11/07	Bird Census 2 sites	1300-1500 2hrs
28/11/07	Bird Census 5 sites	0800-1100/1300-1500 5hrs
29/11/07	Bird Census 5 sites	0800-1100/ 1400-1700 5hrs
30/11/07	Opportunistic observation	0800-1100 3hrs
23/1/08	Opportunistic observation / photograph veg etc	0800-1000 2hrs
19/2/08	Bird Census 3 sites	0900-1130 2.5hrs
20/2/08	Bird Census 5 sites	0900-1100 2hrs
21/2/08	Bird Census 5 sites	0900-1100 2hrs
22/2/08	Opportunistic observation	0700-0900 2hrs
19/3/08	Opportunistic observation / GPS hollow trees	1400-1700 3hrs
3/4/08	Opportunistic observation / GPS hollow trees	1500-1700 2hrs
5/5/08	Opportunistic observation / Habitat assess	1500-1700 2hrs
18/9/08	Opportunistic observation	0900-1100 2hrs
3/10/08	Opportunistic observation	0800-1000 2hrs
29/5/09	Opportunistic observation	0930-1230/1300-1600 6hrs
16/6/09	Opportunistic observation	0830-0930 1hr
23/6/09	Opportunistic observation	1330-1630 3hrs

Nocturnal Bird Survey

Nocturnal bird surveys were conducted during both summer and winter.

The following survey methodologies were applied:
Spotlighting

- Spotlight surveys were conducted in the evening after sunset for two hours. Surveys were carried out by one or more persons using a 55 watt spotlight powered by a 12 volt rechargeable battery. Spotlighting was carried out along existing tracks within woodland or forest with open understorey, around individual trees, and trapping transects (if accessible).

Recorded Call Playback

- Prior to the completion of spotlighting, recorded calls of the Powerful, Barking, Masked, and Sooty Owls were broadcast using 13 watt battery operated loudspeaker. Each call type was played for five minutes followed by a two minute listening period. The immediate area was then surveyed with a spotlight to survey for owls.

Stagwatching

- Stagwatch surveys were conducted in the evening for approximately 15 minutes prior to and 45 minutes after sunset. Selected groups of hollow trees identified as habitat potential were observed for use by fauna. Any owls observed leaving hollows are noted and identified.

TABLE 3.3 FAUNA SURVEY DETAILS NOCTURNAL BIRDS		
17/8/07	Opportunistic observation / habitat tree assessment	1300-1700 4hrs
10/9/07	Opportunistic observation / habitat tree assessment	1300-1700 4hrs
19/9/07	Spotlight / Call Playback	1730-1830 1hr
25/9/07	Spotlight / Call Playback	1600-1800 2hrs
27/11/07	Spotlight / Call Playback	2000-2200 2hrs
28/11/07	Spotlight / Call Playback	2000-2200 2hrs
29/11/07	Spotlight / Call Playback	2000-2200 2hrs
19/2/08	Spotlight / Call Playback	2045-2215 1.5hrs
20/2/08	Spotlight / Call Playback	2045-2215 1.5hrs
21/2/08	Spotlight / Call Playback	2045-2215 1.5hrs

2.2.2 Mammal Survey Methods

The methods used for mammal surveys are outlined below and detailed in Table 3.4 and Table 3.5 with the small mammal trapping details provided in Table 3.6.

Arboreal Mammal Survey

The following survey methodologies were applied:

Elliott Trapping

- Arboreal mammal trapping involved the use of Type A, Type B and Type E Elliott Traps. Traps were secured with rubber bands onto mounts that were attached to the trunk of large trees (Diameter at Breast Height - DBH > 100mm) at heights of approximately two metres.

- Traps were set for a period of three consecutive nights. Traps were baited with a mixture of peanut butter, rolled oats and honey. A 50/50 solution of honey and water was sprayed on the tree trunk, trap and mount to act as an attractant for arboreal mammals. All traps were checked each morning. Any captured animals, were traced to their den sites if possible.

Spotlighting

- Spotlight surveys were conducted in the evening after sunset for two hours. Surveys were carried out by one or more persons using a 55 watt spotlight powered by a 12 volt rechargeable battery. Spotlighting was carried out along existing tracks and within woodland or forest with open understorey, around individual trees, and trapping transects (if accessible).

Hair Tubes

- Hair tubes comprising large (90mm diameter) and small (30mm diameter) PVC stormwater pipe fitted with a PVC plug and cap at one end creating a bait chamber were used. Bait was placed in the chamber between the cap and the plug. The chamber had several holes drilled into it to allow the smell of the bait to permeate from the tube without allowing access into the chamber. Strips of Schafco Advance Tape were placed around the inner surface of the tube opening to catch hairs of fauna visiting the hair tubes.

- For arboreal fauna surveying, the hair tube was attached to the trunk of the tree using nails and rubber bands, at a height of approximately 2 metres. Tubes were attached with the open side facing down to prevent rain affecting the adhesiveness of the tape. Tubes were baited with a mixture of rolled oats, peanut butter and honey, and a 50/50 honey water mix sprayed on the trunk of the tree as an attractant. Hair tubes were left in place for 10 days. Hair samples were sent to Barbara Triggs for analysis.

Stagwatch

- Stagwatch surveys were conducted in the evening for approximately 15 minutes prior to and 45 minutes after sunset. Hollow bearing trees identified as habitat potential were observed for use by fauna. Any mammals observed leaving hollows were noted and identified.

TABLE 3.4
FAUNA SURVEY DETAILS
ARBOREAL MAMMALS

17/8/07	Opportunistic observation / habitat tree assessment	1300-1700 4hrs
10/9/07	Opportunistic observation / habitat tree assessment	1300-1700 4hrs
19/9/07	Spotlight / Call Playback	1930-2100 1.5hr
25/9/07	Spotlight / Call Playback	1830-2000 1.5hrs
27/11/07	Spotlight / Call Playback	2000-2200 2hrs
28/11/07	Spotlight / Call Playback	2000-2200 2hrs
29/11/07	Spotlight / Call Playback	2000-2200 2hrs
19/2/08	Spotlight / Call Playback	2045-2215 1.5hrs
20/2/08	Spotlight / Call Playback	2045-2215 1.5hrs
21/2/08	Spotlight / Call Playback	2045-2215 1.5hrs
29/5/09	Opportunistic observation / habitat tree assessment	0930-1230/1300-1600 6hrs
16/6/09	Opportunistic observation / habitat assessment	0830-0930 1hr
23/6/09	Opportunistic observation / habitat tree assessment	1330-1630 3hrs

Terrestrial Mammal Survey

The following survey methodologies were applied for terrestrial mammals.

Diurnal Observations

- Any mammal species observed during daylight hours were recorded. This method is appropriate for the larger macropod species and feral species such as foxes and cats.

Elliott Trapping

- Terrestrial mammal trapping involved the combined use of both Type A and Type B Elliott Traps.

- Traps were placed on the ground along predefined transects. There were 5-10 traps per transect with transect length generally between 100-200 metres.

- Traps were set for a period of three consecutive nights. Traps were baited with a mixture of peanut butter, rolled oats and honey, and strategically positioned next to animal diggings, burrows, fallen logs, tree trunks and animal runways.

Spotlighting

- Spotlight surveys were conducted in the evening after sunset for two hours. Surveys were carried out by one or two persons using a 55 watt spotlight powered by a 12 volt rechargeable battery. Spotlighting was carried out along existing tracks and within cleared areas with scattered trees or forest with open understorey, around individual trees, and trapping transects (if accessible).

Hair Tubes

- Hair tubes comprising of large (90mm diameter) and small (30mm diameter) PVC stormwater pipe fitted with a PVC plug and cap at one end creating a bait chamber were used. Bait was placed in the chamber between the cap and the plug. The chamber has several holes drilled into it to allow the smell of the bait to permeate from the tube without allowing access into the chamber. Strips of Schafco Advance Tape were placed around the inner surface of the tube opening to catch hairs of fauna visiting the hair tubes.

- Hair tubes were placed along transects in suitable locations and left in place for 10 days. Tubes were baited either with chicken meat or with a mixture of peanut butter, rolled oats and honey. Hair samples were sent to Barbara Triggs for analysis.

Cage Trapping

- Traps were baited with chicken or rolled oats, peanut butter and honey and placed within transect lines, usually in conjunction with Elliott trapping. Traps are set for a period of three consecutive nights.

TABLE 3.5
FAUNA SURVEY DETAILS
TERRESTRIAL MAMMALS

19/9/07	Spotlight	1930-2100 1.5hrs
21/9/07-2/10/07	Hairtubes x 30 x 12 nights	360 hairtube nights
25/9/07	Spotlight	1830-2000 1.5hrs
27/11/07	Spotlight / Call Playback	2000-2200 2hrs
28/11/07	Spotlight / Call Playback	2000-2200 2hrs
29/11/07	Spotlight / Call Playback	2000-2200 2hrs
19/2/08	Spotlight / Call Playback	2045-2215 1.5hrs
20/2/08	Spotlight / Call Playback	2045-2215 1.5hrs
21/2/08	Spotlight / Call Playback	2045-2215 1.5hrs

TABLE 3.6 SMALL MAMMAL TRAPPING – SURVEY DETAILS									
Survey Area	**Transect**	**Survey Period**	**Nights**	**Arboreal Elliot Traps**			**Terrestrial Elliot Traps**		
				A	**B**	**E**	**A Cage**	**B**	
A				No Trapping					
B	1	1	3	2	3	-	2	5	5
	2	1	3	2	3	-	2	3	2
	4	1	3	2	3	-	2	3	2
C				No Trapping					
D	3	1	3	2	3	-	2	3	2
	5	1	3	2	3	-	2	3	2
	6	1	3	2	3	-	2	3	2
	7	1	3	2	3	-	2	3	2
E	8	2	3	2	3	5	2	5	3
	9	2	3	2	3	5	2	5	3
	10	2	3	2	3	5	2	5	3
	11	2	3	2	3	5	2	5	3

Survey Periods/Dates
1 27, 28, 29 November 2007
2 19, 20, 21 February 2008

Bats

The bat survey details are provided in Table 3.7. The following survey methodologies for bat species were utilized:

Sonar Detection

- The ultrasonic calls of Microchiroptera bats were recorded to audio cassette tapes using an Anabat II echolocation call detector. Recordings were made for a continuous two hour period at dusk/early evening with the Anabat II then being left overnight with call activated recording switch.

- An Anabat II ZCA Interface Module and Anabat 5.2b Software package for an IBM Compatible computer was used to analyse the ultrasonic call patterns recorded during the field survey and to identify those species recorded on site.

Harp Traps

- Harp traps were placed across flyways, eg. across tracks, trails or understorey openings within suitable vegetation types for a minimum of three nights. Harp traps were checked each morning, and any captured bats identified and held for release after sunset.

Stagwatch

- Stagwatch surveys were conducted in the evening for approximately 15 minutes prior to and 45 minutes after sunset. Hollow trees identified as habitat potential were

observed for use by microchiroptera bats. Any bats observed leaving hollows were recorded by Anabat II detectors positioned at the base of the tree.

Spotlighting

- Flying-foxes were surveyed for spotlighting potential food trees and identifying their characteristic social calls.

TABLE 3.7 FAUNA SURVEY DETAILS BATS		
19/9/07	Anabat II x 2 + Spotlighting	1800-0700 26hrs
25/9/07	Anabat II x 2 + Spotlighting	1800-0700 26hrs
25/9/07	Harp trapping x 2	1800-0700 26hrs
26/9/07	Harp trapping x 2	1800-0700 26hrs
27/9/07	Harp trapping x 2	1800-0700 26hrs
27/11/07	Anabat II x 2	2000-0730 26hrs
28/11/07	Anabat II x 2	2000-0730 26hrs
29/11/07	Anabat II x 2	2000-0730 26hrs
19/2/08	Anabat II x 2	2000-0730 26hrs
20/11/08	Anabat II x 2	2000-0730 26hrs
21/11/08	Anabat II x 2	2000-0730 26hrs

3.2.3 Frog Surveys

The frog survey methods used are outlined below and detailed in Table 3.8.

The following survey methodologies were utilized:

Habitat Search

- Habitat searches involved searching likely niches such as dense undergrowth, around trees, under logs and rocks, and aquatic habitats. Amphibian species observed during habitat searches were noted and the unidentified calls of species not visually observed were recorded onto a personal cassette recorder for later comparison with call reference libraries. Captured individuals were identified on-site using field reference texts and released.

Nocturnal Habitat Searches

- Nocturnal watercourse searches based on one hour per 100m of water body edge were conducted using a torch and headlamp of 15 watts of power.

- Aquatic freshwater habitats present were sampled for the presence of tadpoles and particular fish species to gather information on any predatory fish species such as *Gambusia holbrooki*. A small dip net was passed through the water body several times to sample the fish stock of the aquatic habitat.

Opportunistic Survey

- Opportunistic sightings of any amphibians were also made while undertaking other survey work and during spotlight surveys of the site.

Recorded Frog Call Playback

- Recorded frog call playback was undertaken as part of a targeted survey for the Green and Golden Bell Frog and Green-thighed Frog.

Call Identification

- Any frogs heard calling were identified in the field or recorded onto cassette for later identification.

TABLE 3.8 FAUNA SURVEY DETAILS AMBHIBIANS		
14/8/07	Habitat search/call observation	1300-1415 1.25hrs
17/8/07	Opportunistic observation / habitat tree assessment	1300-1700 4hrs
27/8/07	Habitat search/call observation	1130-1330 2hrs
10/9/07	Opportunistic observation / habitat tree assessment	1300-1700 4hrs
19/9/07	Call observation/spotlight	1930-2100 1.5hr
20/9/07	Habitat search/call observation	0730-0830 1hr
20/9/07	Spotlighting	1930-2100 1.5hrs
21/9/07	Opportunistic observation / set hairtubes	1300-1430 1.5hrs
25/9/07	Habitat search/call observation	1600-1800 2hrs
25/9/07	Opportunistic call observation/collect harp traps	0700-0845 1.75hrs
3/10/07	Opportunistic call observation/identify weeds for removal	1400-1700 2hrs
27/11/07	Habitat search/call observation	1900-2000 1hr
28/11/07	Habitat search/call observation	1900-2000 1hr
29/11/07	Habitat search/call observation	1900-2000 1hr
23/1/08	Opportunistic observation / photograph veg etc	0800-1000 2hrs
19/2/08	Habitat search/call observation	1900-2000 1hr
20/2/08	Habitat search/call observation	1900-2000 1hr
21/2/08	Habitat search/call observation	1900-2000 1hr
19/3/08	Opportunistic observation / GPS hollow trees	1400-1700 3hrs
3/4/08	Opportunistic observation / GPS hollow trees	1500-1700 2hrs
5/5/08	Opportunistic observation / Habitat assess	1500-1700 2hrs
18/9/08	Opportunistic observation/call observation	0900-1100 2hrs
3/10/08	Opportunistic observation/call observation	0800-1000 2hrs
29/5/09	Opportunistic observation /call observation	0930-1230/1300-1600 6hrs
16/6/09	Opportunistic observation /call observation	0830-0930 1hr
23/6/09	Opportunistic observation /call observation	1330-1630 3hrs

3.2.5 Reptile Surveys

Details on surveys for reptiles are provided in Table 3.9 and outlined below.

Habitat Searches

- Habitat searches involved searching likely niches such as dense undergrowth, around trees, under logs and rocks, and aquatic edge habitats. Reptile species observed during habitat searches were noted and if individuals are captured in pitfall traps they are identified on site using field reference texts and released.

Opportunistic Searches

- Opportunistic sightings of any reptiles also made while undertaking other survey work were recorded.

Spotlighting

- Spotlight surveys were conducted in the evening for two hours after sunset to target nocturnal reptile species. Both terrestrial and arboreal habitats were searched during nocturnal searches. Surveys were carried out by one or two persons and involve the use of a 55 watt spotlight powered by a 12 volt rechargeable battery. Spotlighting was carried out along existing tracks within woodland or forest with open understorey, individual trees, and where accessible, trapping transects.

- Spotlight searches were undertaken for the Stephens' Banded Snake which is a nocturnal species recorded in the locality.

TABLE 3.9 FAUNA SURVEY DETAILS REPTILES		
14/8/07	Habitat search	1800-1930 23hrs
17/8/07	Opportunistic observation / habitat tree assessment	1300-1700 4hrs
27/8/07	Habitat search	1300-1415 1.25hrs
10/9/07	Opportunistic observation / habitat tree assessment	1300-1700 4hrs
19/9/07	Opportunistic observation / set overnight Anabat's	1730-1830 1hr
20/9/07	Opportunistic observation / collect overnight Anabat's	0730-0830 1hr
20/9/07	Spotlighting	1930-2100 1.5hrs
21/9/07	Opportunistic observation / set hairtubes	1300-1430 1.5hrs
25/9/07	Opportunistic observation / set up harp traps	1600 – 1800 2hrs
25/9/07	Spotlighting	1930-2030 1 hr
26/9/07	Opportunistic observation / check harp traps	0645-0815 1.75hrs
27/9/07	Opportunistic observation / check harp traps	0700-0845 1.75hrs
27/11/07	Opportunistic observation	1300-1500 2hrs
28/11/07	Opportunistic observation	0800-1100/1300-1500 5hrs
29/11/07	Opportunistic observation	0800-1100/ 1400-1700 5hrs
30/11/07	Opportunistic observation	0800-1100 3hrs
23/1/08	Opportunistic observation / photograph veg etc	0800-1000 2hrs
19/2/08	Targeted Survey (Stephens' Banded Snake)	1900-2000 1hr
20/2/08	Targeted Survey (Stephens' Banded Snake)	1900-2000 1hr
21/2/08	Opportunistic observation	1900-2000 1hr
19/3/08	Opportunistic observation / GPS hollow trees	1400-1700 3hrs
3/4/08	Opportunistic observation / GPS hollow trees	1500-1700 2hrs
5/5/08	Opportunistic observation	1500-1700 2hrs
18/9/08	Opportunistic observation	0900-1100 2hrs
3/10/08	Opportunistic observation	0800-1000 2hrs
29/5/09	Opportunistic observation	0930-1230/1300-1600 6hrs
16/6/09	Opportunistic observation	0830-0930 1hr
23/6/09	Opportunistic observation	1330-1630 3hrs

3.2.7 Hollow Bearing Tree Assessment

Hollow bearing trees were identified across the subject site in detail for the northern and central areas. A further survey of the southern parts of the site was undertaken to determine a general distribution of hollow bearing trees through the forest areas. No detailed analysis was completed for these trees. Trees were assessed recording tree species, diameter at breast height, spread and height and percentage health of the tree, notes on fauna usage were also made. Hollows identified within these trees were graded by aperture size ranging from <10cm to >30cm and divided into trunk or branch hollows, broken trunk, areas where

fauna can take refuge such as tree splits and bark splits were also recorded. The location of hollow bearing trees was recorded onto a field GPS unit for recording onto a site plan. Details of the hollow bearing trees observed and assessed are provided in Table 3.10. A total of 123 hollow bearing trees have been identified on the site with an estimated 74 present in the proposed off set areas of the subject site.

TABLE 3.10
HOLLOW BEARING TREE DETAILS

Tree species	Diameter at Breast Height – (cm) *					Total hollow trees by species
	25-50	51-75	76-100	101-125	126-150	
Angrophra floribunda	3	6	1		1	**11**
Eucalyptus deanii		1				**1**
Eucalyptus pilularis	2	-	8	6	4	**20**
Eucalyptus punctata	1	-	1			**2**
Eucalyptus saligna	5	3	1	1		**10**
Eucalyptus acmenoides	6	1	4	1		**12**
Eucalyptus siderophloia	2	4	4			**10**
Eucalyptus umbra	1	1		2		**4**
Syncarpia glomifera	1	3	7	3	1	**15**
Stag	17	16	5			**38**
Total Hollow Bearing Trees identified throughout the subject site						**123**

3.3 THREATENED FAUNA OBSERVED ON THE SITE

Twelve (12) threatened species as listed on Schedules 1 or 2 of the *Threatened Species Conservation Act* (1995) were observed/ detected within the subject site, these species are the Little Eagle, Little Lorikeet, Powerful Owl, Sooty Owl, Eastern Bentwing-bat, Eastern False Pipistrelle, Greater Broad-nosed Bat, Grey-headed Flying-fox, Little Bentwing-bat, Eastern Freetail Bat, Yellow-bellied Sheathtail Bat and Yellow-bellied Glider. Threatened fauna species record locations are shown in Figure 3.2.

Details of Threatened Fauna Species Observed and Habitats Present
Details of the threatened fauna species observations and habitat types present within the subject site are provided below.

Little Eagle
The Little Eagle was observed soaring above the subject site in the vicinity of Kincumba Mountain during surveys conducted on the 16th June 2009. The habitat attributes available within the subject site for this species are described below in Table 3.11

TABLE 3.11
LITTLE EAGLE HABITAT ATTRIBUTES WITHIN THE SUBJECT SITE

Habitat Attribute	Life Cycle	Habitat Use	Site Vegetation Types with Habitat	Area of Habitat
Forested and woodland areas	Adult / Juvenile	Roosting Breeding Foraging	- Riparian Vegetation - Grassland with Occasional Trees - Disturbed Open Forest - Open Forest (southern area)	54ha

Little Lorikeet
The Little Lorikeet was observed foraging within *Eucalyptus pilularis* (Blackbutt) during surveys conducted on 22nd February 2008. The habitat attributes available within the subject site for this species are described below in Table 3.12.

TABLE 3.12
LITTLE LORIKEET HABITAT ATTRIBUTES WITHIN THE SUBJECT SITE

Habitat Attribute	Life Cycle	Habitat Use	Site Vegetation Communities with Habitat	Area of Habitat (ha)
Tree hollows <5cm in diameter	Adult / Juvenile	Breeding	- Riparian Vegetation - Grassland with Occasional Trees - Disturbed Open Forest - Open Forest (southern area)	326 hollows surveyed
Flowering Eucalypts	Adult / Juvenile	Foraging	- Riparian Vegetation - Grassland with Occasional Trees - Disturbed Open Forest - Open Forest (southern area)	54ha

Powerful Owl
The Powerful Owl was recorded in the southern part of the site in May 2008. This species is known to occur within the adjoining Kincumba Mountain Reserve. The habitat attributes available within the subject site for this species are described below in Table 3.13.

TABLE 3.13
POWERFUL OWL HABITAT ATTRIBUTES WITHIN THE SUBJECT SITE

Habitat Attribute	Life Cycle	Habitat Use	Site Vegetation Communities with Habitat	Area of Habitat (ha)
Tree hollows >40cm	Adult / Juvenile	Denning Breeding	- Riparian Vegetation - Disturbed Open Forest -Open Forest (southern area)	47 hollows surveyed
Tall forest with dense mid storey	Adult / Juvenile	Denning Breeding Foraging	- Riparian Vegetation - Disturbed Open Forest -Open Forest (southern area)	30.11ha
Abundant arboreal fauna	Adult / Juvenile	Foraging	- Riparian Vegetation - Disturbed Open Forest -Open Forest (southern area)	30.11ha

Sooty Owl
The Sooty Owl was recorded in the south-western part of the site in August 2004. The habitat attributes available within the subject site for this species are described below in Table 3.14.

TABLE 3.14
SOOTY OWL HABITAT ATTRIBUTES WITHIN THE SUBJECT SITE

Habitat Attribute	Life Cycle	Habitat Use	Site Vegetation Communities with Habitat	Area of Habitat (ha)
Tree hollows >40cm	Adult / Juvenile	Roosting Breeding	- Riparian Vegetation - Disturbed Open Forest -Open Forest (southern area)	47 hollows surveyed
Tall wet dense forest	Adult / Juvenile	Roosting Breeding Foraging	- Riparian Vegetation - Disturbed Open Forest -Open Forest (southern area)	30.11ha
Abundant arboreal fauna	Adult / Juvenile	Foraging	- Riparian Vegetation - Disturbed Open Forest -Open Forest (southern area)	30.11ha

Yellow-bellied Glider
This species was heard calling from the Open Forest within the south-western sector and the adjoining Kincumba Mountain Reserve during surveys conducted in November 2007 and February 2008. The habitat attributes available within the subject site for this species are described below in Table 3.15.

TABLE 3.15
YELLOW-BELLIED GLIDER HABITAT ATTRIBUTES WITHIN THE SUBJECT SITE

Habitat Attribute	Life Cycle	Habitat Use	Site Vegetation Communities with Habitat	Area of Habitat (ha) On Site
Tree hollows >30cm	Adult / Juvenile	Denning Breeding	- Riparian Vegetation - Disturbed Open Forest - Open Forest (southern area)	47 hollows surveyed
Forest with tree species diversity	Adult / Juvenile	Denning Breeding Foraging	- Riparian Vegetation - Disturbed Open Forest -Open Forest (southern area)	30.11ha
Feed tree species	Adult / Juvenile	Foraging	- Riparian Vegetation - Disturbed Open Forest -Open Forest (southern area)	30.11ha

Grey-headed Flying-fox
Several Grey-headed Flying-foxes have been observed flying over the subject site from a north to south direction during surveys. The habitat attributes available within the subject site for this species are described below in Table 3.16.

TABLE 3.16
GREY-HEADED FLYING-FOX HABITAT ATTRIBUTES WITHIN THE SUBJECT SITE

Habitat Attribute	Life Cycle	Habitat Use	Site Vegetation Communities with Habitat	Area of Habitat (ha)
Trees associated with rainforest	Adult / Juvenile	Roosting Breeding Foraging	- Riparian Vegetation -Open Forest (southern area)	15.3ha
Flowering and fruiting trees	Adult / Juvenile	Foraging	- Riparian Vegetation - Grassland with Occasional Trees - Disturbed Open Forest -Open Forest (southern area)	54ha

Eastern Bentwing-bat
This species was detected via Anabat during surveys conducted during February 2008.

Eastern False Pipistrelle
This species was detected via Anabat echolocation surveys conducted during February 2008.

Greater Broad-nosed Bat
This species was detected via Anabat echolocation foraging above the creekline vegetation during surveys conducted during February 2008.

Little Bentwing-bat
This species was detected via Anabat echolocation foraging within the Open Forest vegetation community during surveys conducted in September 2007 and November 2007.

Eastern Freetail-bat
This species was detected via Anabat echolocation foraging within the Open Forest vegetation community during surveys conducted in September 2007 and November 2007.

Yellow-bellied Sheathtail-bat
This species was detected via Anabat echolocation foraging within the Open Forest vegetation community during surveys conducted in September 2007 and November 2007.

Threatened Microchiropteran Bats
The habitat attributes available within the subject site for threatened microchiropteran bat species are described below in Table 3.17.

TABLE 3.17 MICROBAT HABITAT ATTRIBUTES WITHIN THE SUBJECT SITE				
Habitat Attribute	**Life Cycle**	**Habitat Use**	**Site Vegetation Communities with Habitat**	**Area of Habitat (ha)**
Tree hollows <5cm / exfoliating bark / tree splits	Adult / Juvenile	Roosting Breeding	- Riparian Vegetation - Grassland with Occasional Trees - Disturbed Open Forest - Open Forest (southern area)	In excess of 393 hollows
Forest and forest clearing ecotone	Adult / Juvenile	Roosting Breeding Foraging	- Riparian Vegetation - Grassland with Occasional Trees - Disturbed Open Forest -Open Forest (southern area)	54ha

3.4 FAUNA SURVEY RESULTS

A large number of fauna species from all vertebrate fauna groups have been recorded within the site and local area. Table 3.18 lists the species observed during cumulative surveys undertaken on the site and within the local area. Twelve threatened fauna species were observed within the subject site, all other species observed are considered to be relatively common in the local area.

The variety of species observed is a result of a combination of several factors including:

- Duration of surveys (commencing in 1998);
- Completion of surveys during all seasons;
- Wide variety of survey methods utilized;
- Surveys specifically targeting particular species, habitats or localities;
- Expertise of the persons completing the surveys;
- Type and variety of fauna habitats present;
- Presence of adjoining bushland area (Kincumba Mountain Reserve).

TABLE 3.18 FAUNA OBSERVED AND RECORDED		
Common Name	***Scientific Name***	**Method**
Amphibians		
Common Eastern Froglet	*Crinia signifera*	C
Bleating Tree Frog	*Litoria dentata*	C
Broad-palmed Frog	*Litoria latopalmata*	C
Peron's Tree Frog	*Litoria peronii*	OC
Green Leaf Tree Frog	*Litoria phyllochroa*	C
Laughing Tree Frog	*Litoria tyleri*	OC
Dwarf Tree Frog	*Litoria fallax*	C
Whistling Tree Frog	*Litoria verreauxii*	C
Striped Marsh Frog	*Limnodynastes peronii*	C
Smooth Toadlet	*Uperoleia laevigata*	C
Reptiles		
Eastern Snake-necked Turtle	*Chelodina longicollis*	OS
Skink	*Lampropholis delicata*	S
Eastern Water Skink	*Eulamprus quoyii*	S
Eastern Water Dragon	*Physignathus lesueurii*	S
Garden Skink	*Lampropholis guichenoti*	S
Land Mullet	*Egernia major*	S
Lace Monitor	*Varanus varius*	S
Red-Bellied Black Snake	*Pseudechis porphyriacus*	S
Birds		
Australian Wood Duck	*Chenonetta jubata*	OC
Pacific Black Duck	*Anas superciliosa*	OC
Chestnut Teal	*Anas castanea*	OC
Dusky Moorhen	*Gallinula tenebrosa*	OC
Purple Swamphen	*Porphyrio porphyrio*	OC
Little Pied Cormorant	*Phalacrocorax melanoleucos*	O
White-faced Heron	*Egretta novaehollandiae*	O
Cattle Egret	*Ardea ibis*	O
White-necked Heron	*Ardea pacifica*	O
Australian White Ibis	*Threskiornis molucca*	O
Masked Lapwing	*Vanellus miles*	OC
Little Eagle	*Hieraaetus morphnoides*	O
Whistling Kite	*Haliastur sphenurus*	OC
Brown Goshawk	*Accipiter fasciatus*	OC
Grey Goshawk	*Accipiter novaehollandiae*	O
Wonga Pigeon	*Leucosarcia melanoleuca*	OC
Topknot Pigeon	*Lopholaimus antarcticus*	O
White-headed Pigeon	*Columba leucomela*	OC
Crested Pigeon	*Ocyphaps lophotes*	O
Spotted Turtle-Dove*	*Streptopelia chinensis*	OC
Brown Cuckoo-Dove	*Macropygia amboinensis*	OC
Yellow-tailed Black-Cockatoo	*Calyptorhynchus funereus*	OC

TABLE 3.18 FAUNA OBSERVED AND RECORDED		
Common Name	***Scientific Name***	**Method**
Sulphur-crested Cockatoo	*Cacatua galerita*	OC
Little Corella	*Cacatua sanguinea*	OC
Long-billed Corella	*Cacatua tenuirostris*	OC
Galah	*Cacatua roseicapilla*	OC
Rainbow Lorikeet	*Trichoglossus haematodus*	OC
Musk Lorikeet	*Glossopsitta concinna*	OC
Little Lorikeet	*Glossopsitta pusilla*	OC
Eastern Rosella	*Platycercus eximius*	OC
Australian King-Parrot	*Afsterus scapularis*	OC
Channel-billed Cuckoo	*Scythrops novaehollandiae*	OC
Fan-tailed Cuckoo	*Cacomantis flabelliformis*	OC
Shining Bronze-Cuckoo	*Chrysococcyx lucidus*	OC
Common Koel	*Eudynamys scolopacea*	OC
Sacred Kingfisher	*Todiramphus sanctus*	OC
Laughing Kookaburra	*Dacelo novaeguineae*	OC
Dollarbird	*Eurystomus orientalis*	OC
Southern Boobook	*Ninox novaeseelandiae*	OC
Powerful Owl [TS]	*Ninox strenua*	SpC
Sooty Owl [TS]	*Tyto tenebricosa*	SpC
Tawny Frogmouth	*Podargus strigoides*	O
Superb Fairy-wren	*Malurus cyaneus*	OC
Variegated Fairy-wren	*Malurus lamberti*	OC
White-throated Treecreeper	*Cormobates leucophaeus*	OC
Spotted Pardalote	*Pardalotus punctatus*	OC
Striated Pardalote	*Pardalotus striatus*	OC
Yellow-throated Scrubwren	*Sericornis citreogularis*	OC
White-browed Scrubwren	*Sericornis frontalis*	OC
Large-billed Scrubwren	*Sericornis magnirostris*	OC
Brown Gerygone	*Gerygone mouki*	OC
Striated Thornbill	*Acanthiza lineata*	OC
Brown Thornbill	*Acanthiza pusilla*	OC
Buff-rumped Thornbill	*Acanthiza reguloides*	OC
Yellow Thornbill	*Acanthiza nana*	OC
Noisy Friarbird	*Philemon corniculatus*	OC
Red Wattlebird	*Anthochaera carunculata*	OC
Little Wattlebird	*Anthochaera chrysoptera*	OC
Noisy Miner	*Manorina melanocephala*	OC
Bell Miner	*Manorina melanophrys*	OC
Lewins Honeyeater	*Meliphaga lewinii*	OC
Yellow-faced Honeyeater	*Lichenostomus chrysops*	OC
Eastern Spinebill	*Acanthorhynchus tenuirostris*	OC
Eastern Yellow Robin	*Eopsaltria australis*	OC
Golden Whistler	*Pachycephala pectoralis*	OC
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	OC
Rufous Fantail	*Rhipidura rufifrons*	OC

TABLE 3.18 FAUNA OBSERVED AND RECORDED		
Common Name	***Scientific Name***	**Method**
Grey Fantail	*Rhipidura fuliginosa*	OC
Willie Wagtail	*Rhipidura leucophrys*	OC
Eastern Whipbird	*Psophodes olivaceus*	OC
Olive-backed Oriole	*Oriolus sagittatus*	OC
Grey Butcherbird	*Cracticus torquatus*	OC
Pied Butcherbird	*Cracticus nigrogularis*	OC
Magpie-lark	*Grallina cyanoleuca*	OC
Australian Magpie	*Gymnorhina tibicen*	OC
Pied Currawong	*Strepera graculina*	OC
Australian Raven	*Corvus coronoides*	OC
Green Catbird	*Ailuroedus crassirostris*	OC
Satin Bowerbird	*Ptilonorhynchus violaceus*	OC
Regent Bowerbird	*Sericulus chrysocephalus*	O
Red-browed Finch	*Neochmia temporalis*	OC
Chestnut-breasted Mannikin	*Lonchura castaneothorax*	OC
Welcome Swallow	*Hirundo neoxena*	OC
Red-whiskered Bulbul *	*Pycnonotus jocosus*	OC
Silvereye	*Zosterops lateralis*	OC
Common Myna *	*Acridotheres tristis*	OC
Mammals		
Brown Antechinus	*Antechinus stuartii*	E Sp
Bush Rat	*Rattus fuscipes*	E
Feathertail Glider	*Acrobates pygmaeus*	Sp
Common Brushtail Possum	*Trichosurus vulpecula*	Sp
Common Ringtail Possum	*Pseudocheirus peregrinus*	Sp
Cow *	*Bos taurus*	O C Sc
Dog *	*Canis familiaris*	C Sc
European Red Fox *	*Vulpes vulpes*	O Sp Sc
Grey-headed Flying-fox [TS]	*Pteropus poliocephalus*	Sp
Eastern Bentwing-bat [TS]	*Miniopterus schreibersii*	A
Eastern Broad-nosed Bat	*Scotorepens orion*	A
Eastern False Pipistrelle [TS]	*Falsistrellus tasmaniensis*	A
Eastern Forest Bat	*Vespadelus pumilus*	A
Eastern Freetail-bat [TS]	*Mormopterus norfolkensis*	A
Eastern Horseshoe-bat	*Rhinolophus megaphyllus*	A
Gould's Wattled Bat	*Chalinolobus gouldii*	A
Greater Broad-nosed Bat [TS]	*Scoteanax rueppelli*	A
Large Forest Bat	*Vespadelus darlingtoni*	A
Lesser Long-eared Bat	*Nyctophilus geoffroyi*	A
Little Bentwing-bat [TS]	*Miniopterus australis*	A
Little Forest Bat	*Vespadealus vulturnus*	A H
White-striped Freetail-bat	*Nyctinomus australis*	A
Yellow-bellied Sheathtail-bat [TS]	*Saccolaimus flaviventris*	A
Greater Glider	*Petauroides volans*	Sp
Northern Brown Bandicoot	*Isoodon macrourus*	Sc

TABLE 3.18
FAUNA OBSERVED AND RECORDED

Common Name	*Scientific Name*	Method
Rabbit *	*Oryctolagus cuniculus*	O,Sp
Southern Forest Bat	*Vespadelus regulus*	A
Sugar Glider	*Petaurus breviceps*	C Sp E
Swamp Rat	*Rattus lutreolus*	E
Swamp Wallaby	*Wallabia bicolor*	Sp
Yellow-bellied Glider [TS]	*Petaurus australis*	C Sp
Fish		
Short-finned Eel	*Anguilla australis*	O
Mosquitofish *	*Gambusia holbrooki*	O

Key to Methods of Observation

O	-	Observation (Visual)	S	-	Search
C	-	Call identification	A	-	Anabat II
Sp	-	Spotlight	Sc	-	Scat, Track or Sign I
E	-	Elliott Trap	An	-	Anecdotal
H	-	Harp Trap			

Note: * indicates introduced species

[TS] indicates threatened species

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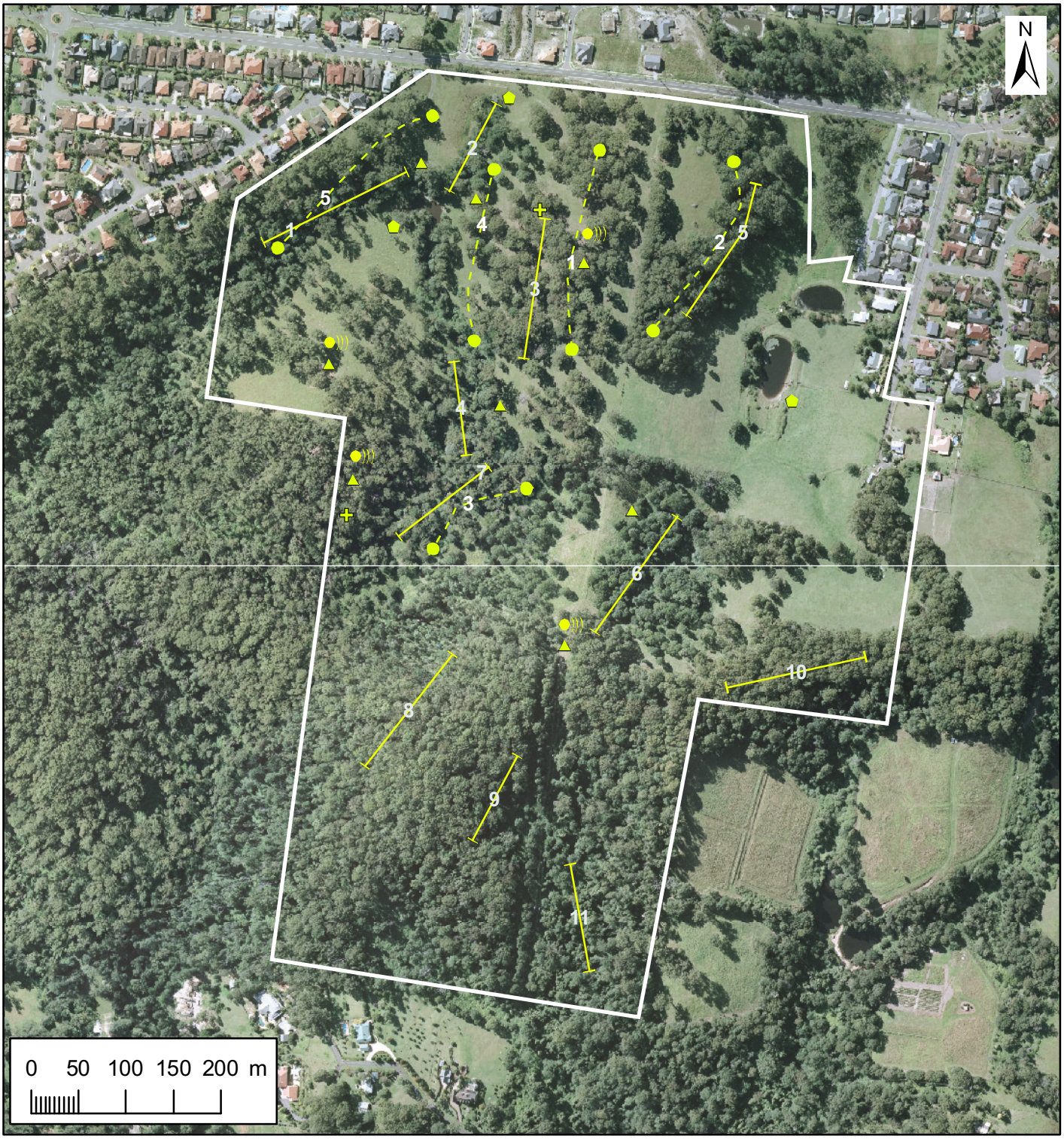

Flora and fauna survey locations are approximate and have not been fixed by land survey.
Plan for indicative purposes only. Not for detailed measurement. *Subject Site boundary subject to final survey.

Legend

- Subject Site Boundary
- Small Mammal Trapline (1-11)
- Amphibian Survey
- Anabat Station
- Harp Trap
- Recorded Call Playback Station
- Hairtube Transect (1-5)

Original plan produced in A4 colour

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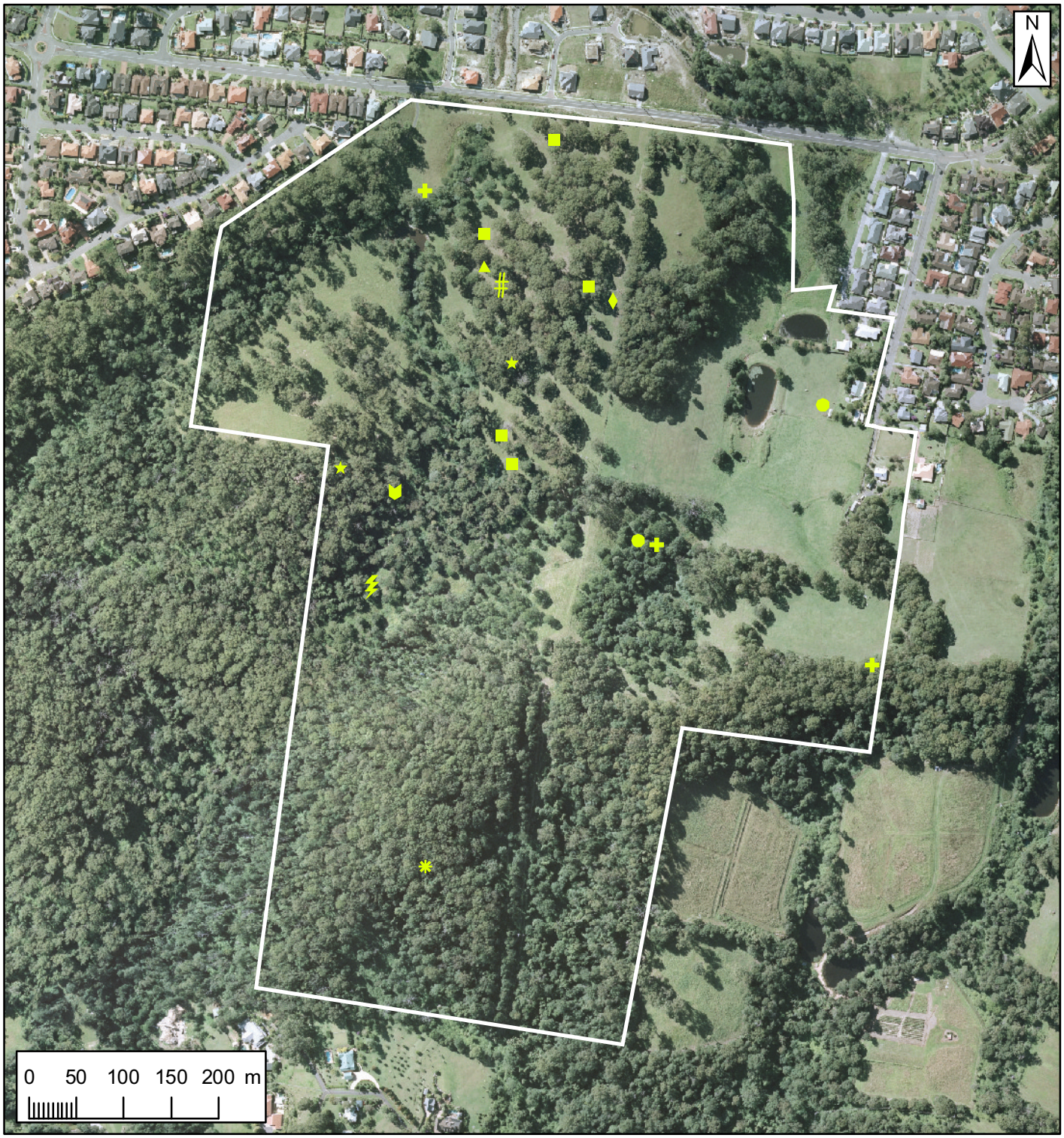
Figure 3.1

Fauna Survey Locations
Kings Avenue, Terrigal

Ver:FX By:JM 13/05/10 Ref.No. 10/050

Source: Aerial © Department of Lands (2007)



Flora and fauna survey locations are approximate and have not been fixed by land survey.
*Subject Site boundary subject to final survey. Plan for indicative purposes only. Not for detailed measurement.

Legend

- Subject Site Boundary
- Eastern Bentwing-bat
- Yellow-bellied Sheathtail-bat
- Grey-headed Flying-fox flight direction
- Eastern Freetail-bat
- Eastern False Pipistrelle
- Greater Broad-nosed Bat
- Little Bentwing-bat
- Sooty Owl
- Yellow-bellied Glider
- Powerful Owl

Original plan produced in A4 colour

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Figure 3.2

Threatened Fauna Observation Locations

Kings Avenue, Terrigal

Ver.FX By.JM 13/05/10 Ref.No. 10/050

Source: Aerial © Department of Lands (2007)

APPENDIX 2

THREATENED BIODIVERSITY ASSESSMENTS (7-PART TESTS)

1. INTRODUCTION

This report provides an assessment of the potential for the proposed activity to significantly impact on the endangered ecological community and threatened species identified as having suitable habitat within the subject site and addresses the provisions of Section 5(A) of *the Environmental Planning and Assessment (EP&A) Act* 1979 and the *Threatened Species Conservation Act* 1995.

2.1 ASSESSMENT OF DEVELOPMENT IMPACT ON ENDANGERED ECOLOGICAL COMMUNITIES AND THREATENED SPECIES AND MITIGATION MEASURES PROPOSED

An assessment of the potential impacts of the proposed development on the endangered ecological community and threatened species observed within the subject site is provided below in Table 2.1. Table 2.2 identifies the potential loss of habitat while the recommended ameliorative measures for affected species is provided in Table 2.3

TABLE 2.1
ASSESSMENT OF POTENTIAL IMPACTS OF DEVELOPMENT ON AFFECTED THREATENED SPECIES AND COMMUNITIES

Potential Impact	Lowland Rainforest	Little Eagle	Little Lorikeet	Large Forest Owls (Powerful Owl and Sooty Owl)	Yellow-bellied Glider	Grey-headed Flying-fox	Threatened Micropteran Bats
Fragmentation and isolation of habitat	Rainforest to be retained and protected.	Increased distance between foraging habitats. Loss of prey habitat.	Increased distance between foraging habitats.	Increased distance between foraging habitats. Loss of prey habitat.	Increased distance between foraging habitats.	Increased distance between foraging habitats.	Increased distance between foraging habitats.
Incremental decline in habitat quality and extent	Management plan to improve vegetation quality	Alterations to foraging behaviour.	Alterations to foraging behaviour.	Alterations to foraging behaviour.	Alterations to foraging behaviour.	Alterations to foraging behaviour.	Alterations to foraging behaviour.
Loss of foraging or nesting habitat	Rainforest to be retained and protected.	Reduction of foraging and nesting habitat. Reduction of prey foraging and nesting habitat.	Reduction of foraging and nesting habitat.	Reduction of foraging and nesting habitat. Reduction of prey foraging and nesting habitat.	Reduction of foraging and nesting habitat.	Reduction of foraging and nesting habitat.	Reduction of foraging and nesting habitat.
Indirect impacts on adjacent areas	Rainforest to be retained and protected. No likely impact from this action.	Reduction/decrease in quality of available home range.	Reduction/decrease in quality of available local habitat.	Reduction/decrease in quality of available home range.	Reduction/decrease in quality of available home range.	Reduction/decrease in quality of available home range.	Reduction/decrease in quality of available home range.
Altered Fire	No impact likely from	Loss of young. Reduction of	Reduction in foraging	Loss of young. Reduction of	Loss of young.	Loss of young. Reduction of	Loss of young. Reduction of

TABLE 2.1
ASSESSMENT OF POTENTIAL IMPACTS OF DEVELOPMENT ON AFFECTED THREATENED SPECIES AND COMMUNITIES

Potential Impact	Lowland Rainforest	Little Eagle	Little Lorikeet	Large Forest Owls (Powerful Owl and Sooty Owl)	Yellow-bellied Glider	Grey-headed Flying-fox	Threatened Micropteran Bats
Regimes	this action due to proposed Asset protection Zone.	prey and competition for prey species.	habitat.	prey and competition for prey species.	Reduction of and competition for foraging habitat.	and competition for foraging habitat.	and competition for foraging habitat.
Increased Exposure to Exotic Predators	Rainforest to be retained and protected.	No impact likely from this action. Species not likely to be susceptible to known exotic predators.	Increased competition for breeding hollows.	Increased competition for roosting/breeding hollows.	Increased competition for den sites and loss of young.	No impact likely from this action. Species not likely to be susceptible to known exotic predators.	Increased competition for roosting sites.
Increased Threat During Clearing and Development	Rainforest to be retained and protected.	Increased physical threat. Reduction in foraging and nesting habitat. Reduction in prey foraging and nesting habitat.	Increased physical threat. Reduction in foraging and nesting habitat.	Increased physical threat. Reduction in foraging and nesting habitat. Reduction in prey foraging and nesting habitat.	Increased physical threat. Reduction in foraging and nesting habitat. Reduction in prey foraging and nesting habitat.	Increased physical threat. Reduction in foraging habitat.	Increased physical threat. Reduction in foraging habitat.
Changes in hydrological regime	Rainforest to be retained and protected.	Modification of habitat due to changes in vegetative assemblages. Loss of prey habitat.	Modification of habitat due to changes in vegetative assemblages.	Modification of habitat due to changes in vegetative assemblages. Loss of prey habitat.	Modification of habitat due to changes in floristic structure.	Modification of habitat due to change in floristic structure.	Modification of habitat due to change in floristic structure.
Increased Soil Erosion	Rainforest to be retained and protected.	No likely impact from this action.	No likely impact from this action.	No likely impact from this action.	No likely impact from this action.	No likely impact from this action.	No likely impact from this action.
Modification of vegetation, species composition and structure	Rainforest to be retained and protected.	Modification of habitat due to changes in vegetative assemblages. Loss of prey habitat.	Modification of habitat due to changes in vegetative assemblages.	Modification of habitat due to changes in vegetative assemblages. Loss of prey habitat.	Modification of habitat due to changes in floristics.	Modification of habitat due to change in floristic structure.	Modification of habitat due to change in floristic structure.
Increased Runoff	Rainforest to be retained and protected.	No likely impact from this action.	No likely impact from this action.	No likely impact from this action.	No likely impact from this action.	No likely impact from this action.	No likely impact from this action.
Flooding	No likely	No likely	No likely	No likely	No likely	No likely	No likely

TABLE 2.1
ASSESSMENT OF POTENTIAL IMPACTS OF DEVELOPMENT ON AFFECTED THREATENED SPECIES AND COMMUNITIES

Potential Impact	Lowland Rainforest	Little Eagle	Little Lorikeet	Large Forest Owls (Powerful Owl and Sooty Owl)	Yellow-bellied Glider	Grey-headed Flying-fox	Threatened Micropteran Bats
	impact from this action.	impact from this action.	impact from this action.	impact from this action.	impact from this action.	impact from this action.	impact from this action.
Increased Weed Invasion	Rainforest to be retained and protected.	Modification of habitat due to changes in floristics. Loss of prey habitat.	Modification of habitat due to changes in floristics.	Modification of habitat due to changes in floristics. Loss of prey habitat.	Modification of habitat due to changes in floristics.	Modification of habitat due to change in floristic structure.	Modification of habitat due to change in floristic structure.
Grazing	Rainforest to be retained and protected.	Already occurring within the site. No further impact likely from this action.	Already occurring within the site. No further impact likely from this action.	Already occurring within the site. No further impact likely from this action.	Already occurring within the site. No further impact likely from this action.	Already occurring within the site. No further impact likely from this action.	Already occurring within the site. No further impact likely from this action.
Mowing / Slashing	Rainforest to be retained and protected.	Already occurring within the site. No further impact likely from this action.	Already occurring within the site. No further impact likely from this action.	Already occurring within the site. No further impact likely from this action.	Already occurring within the site. No further impact likely from this action.	Already occurring within the site. No further impact likely from this action.	Already occurring within the site. No further impact likely from this action.
Light/noise pollution	Rainforest to be retained and protected.	Alterations to foraging and roosting behaviour.	Alterations to foraging and roosting behaviour.	Alterations to foraging and roosting behaviour.	Alterations to foraging behaviour.	No impact likely from this action. Known to forage and roost in suburban areas	No impact likely from this action. Known to forage and roost in suburban areas
Increased threat of vehicle injury/death	Rainforest to be retained and protected.	Increased exposure of species and prey to vehicle injury/death.	Increased exposure species and prey to vehicle injury/death.	Increased exposure of species and prey to vehicle injury/death.	Increased exposure to vehicle injury/death.	Increased exposure to vehicle injury/death.	Increased exposure to vehicle injury/death.
Rubbish Dumping	Rainforest to be retained and protected.	No impact likely from this action.	No impact likely from this action.	No impact likely from this action.	No impact likely from this action.	No impact likely from this action.	No impact likely from this action.
Physical Damage e.g. Trampling	Rainforest to be retained and protected.	Modification of habitat due to changes in floristics. Loss of prey habitat.	Modification of habitat due to changes in floristics.	Modification of habitat due to changes in floristics. Loss of prey habitat.	Modification of habitat due to changes in floristics.	Modification of habitat due to change in floristic structure.	Modification of habitat due to change in floristic structure.

TABLE 2.2 QUANTATIVE LOSS OF VEGETATION AND HABITAT FOR THREATENED SPECIES WITHIN THE SUBJECT SITE			
Species and Site Occurrence	**Amount of Suitable Veg/habitat in Subject Site**	**Amount of Suitable Veg/habitat in Subject Site to be Removed/ Modified**	**Short Term and Long Term Effect on Habitats**
Lowland Rainforest (EEC) Restricted to the riparian areas along the western drainage line. To be retained and subject to Vegetation Management Plan	3.97ha	nil	**Short Term** Restoration and rehabilitation. **Long Term** Regeneration of the community. Possible increase in weed invasion from exotic urban gardens if management practices lapse.
Little Eagle	54ha	17.38ha (32%)	**Short Term** Removal of foraging habitat Possible removal of roosting habitat. Alteration to prey species density. **Long Term** Regeneration of foraging and roosting habitats. Prey switching to more abundant possibly exotic species. Disturbance to future nesting and foraging sites from an increase in urban activities.
Little Lorikeet	54ha	17.38ha (32%)	**Short Term** Removal of foraging habitat Possible removal of roosting habitat. **Long Term** Regeneration of foraging and roosting habitats. Disturbance to future nesting and foraging sites from an increase in urban activities.
Powerful Owl Recorded within the southern section of subject site in May 2008. This species is known to occur	30.11ha	11.6ha (38.5%)	**Short Term** Removal of foraging habitat Possible removal of roosting habitat. Alteration to prey species density.

TABLE 2.2 QUANTATIVE LOSS OF VEGETATION AND HABITAT FOR THREATENED SPECIES WITHIN THE SUBJECT SITE			
Species and Site Occurrence	**Amount of Suitable Veg/habitat in Subject Site**	**Amount of Suitable Veg/habitat in Subject Site to be Removed/ Modified**	**Short Term and Long Term Effect on Habitats**
within Kincumba Mountain Reserve.			Loss of potential roosting hollows **Long Term** Regeneration of foraging and roosting habitats. Prey switching to more abundant possibly exotic species. Installation of owl nest boxes. Disturbance to future roosting and foraging sites from an increase in urban activities.
Sooty Owl Recorded within the southern section of subject site in August 2004. This species is known to occur within Kincumba Mountain Reserve.	30.11ha	11.6ha (38.5%)	**Short Term** Removal of foraging habitat Possible removal of roosting habitat. Alteration to prey species density. Loss of potential roosting hollows **Long Term** Regeneration of foraging and roosting habitats. Prey switching to more abundant possibly exotic species. Installation of owl nest boxes Disturbance to future roosting and foraging from an increase in urban activities.
Yellow-bellied Glider Recorded within the south-western and central sections of subject site in November 2007 and February 2008. This species is known to occur within Kincumba Mountain	30.11ha	11.6ha (38.5%)	**Short Term** Possible removal of foraging and denning habitat. Alteration to feed tree species density. Loss of potential denning hollows **Long Term**

TABLE 2.2 QUANTATIVE LOSS OF VEGETATION AND HABITAT FOR THREATENED SPECIES WITHIN THE SUBJECT SITE			
Species and Site Occurrence	**Amount of Suitable Veg/habitat in Subject Site**	**Amount of Suitable Veg/habitat in Subject Site to be Removed/ Modified**	**Short Term and Long Term Effect on Habitats**
Reserve.			Regeneration of foraging and roosting habitats. Installation of suitable roosting boxes Disturbance to possible future denning and foraging sites from an increase in urban activities.
Grey-headed Flying-fox Recorded during several surveys flying over the subject site from a northern direction most likely from the known roost camp within the Wambina NR at Matcham. This species has not been recorded foraging or roosting within the subject site.	54ha	17.38ha (32%)	**Short Term** Removal of foraging habitat. **Long Term** Foraging resource variation. Foraging switch to exotic vegetation. Disturbance to possible future roosting (camp) sites from an increase in urban activities.
Microchiropteran Bat Species The following threatened microchiropteran bats have been recorded within the subject site during surveys. Eastern False Pipistrelle Eastern Bentwing-bat Little Bentwing-bat Greater Broad-nosed Bat. Eastern Freetail-bat & Yellow-bellied Sheathtailed-bat. These microbats were recorded throughout the subject site during surveys.	54ha	17.38ha (32%)	**Short Term** Removal of foraging habitat. Removal of possible roosting sites. **Long Term** Installation of bat roosting boxes. Disturbance to possible future denning and foraging sites from an increase in urban activities.

The measures proposed to mitigate the effects of the proposed development on the endangered ecological community and threatened species observed within the subject site are detailed below in Table 3.19.

TABLE 2.3 PROPOSED MITIGATION MEASURES FOR EACH AFFECTED SPECIES	
Species / EEC	**Mitigation Measures**
Lowland Rainforest	- Creation of vegetation buffer and asset protection zones. - Maintenance of habitat connectivity with the adjoining Kincumba Mountain Reserve - Development of a water quality management strategy to maintain natural flows and nutrient levels - Removal of weeds through low impact measures - Allow / encourage natural regeneration of native flora species - Installation of sediment and erosion control measures - Revegetate EEC and buffer / asset protection zones with locally occurring endemic flora species. - Regular maintenance of weeds and plant replacement. - Ongoing monitoring of works.
Little Eagle	- Restoration of foraging and roosting habitat within retained lands in riparian areas and conservation land (9.34ha). - Dedication of 27.28 hectares of habitat to council as public reserve
Little Lorikeet	- Restoration of foraging and roosting habitat within retained lands in riparian areas and conservation land (9.34ha). - Dedication of 27.28 hectares of habitat to council as public reserve
Powerful Owl	- Installation of purpose built owl nest boxes. - Restoration of foraging and roosting habitat within retained lands in riparian areas and conservation land (9.34ha). - Dedication of 27.28 hectares of habitat to council as public reserve
Sooty Owl	- Installation of purpose built owl nest boxes. - Restoration of foraging and roosting habitat within retained lands in riparian areas and conservation land (9.34ha). - Dedication of 27.28 hectares of habitat to council as public reserve.
Yellow-bellied Glider	- Installation of nests boxes. - Restoration of foraging and roosting habitat through the replanting of known feed trees within retained lands in riparian areas and conservation land (9.34ha). - Dedication of 27.28 hectares of habitat to council as public reserve
Grey-headed Flying-fox	- Restoration of foraging and possible future roosting habitat through the replanting of known feed trees within retained lands in riparian areas and conservation land (9.34ha). - Dedication of 27.28 hectares of habitat to council as public reserve
Microbats	- Installation of purpose built owl nest boxes. - Restoration of foraging and roosting habitat within retained lands in riparian areas and conservation land (9.34ha). - Dedication of 27.28 hectares of habitat to council as public reserve

2. 7 PART TEST OF SIGNIFICANCE

An assessment of the potential impact of the proposed development on the habitats or populations of threatened species is provided below in accordance with the matters required for consideration under Section 5A of the *Environmental Planning and Assessment Act* (1979) and *Threatened Species Conservation Act* (1995) and *Threatened Species Conservation Amendment Act* (2002).

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

FLORA

No threatened flora species were observed within the subject site during surveys. There is suitable habitat on the subject site for *Caladenia tessellata*, *Cryptostylis hunteriana Dendrobium melaleucaphilum, Melaleuca biconvexa* and *Syzygium paniculatum*. Each of these species is assessed individually below.

***Caladenia tessellata* (Thick-lipped Spider Orchid)**
The flowering period for Caladenia tessellata is between September and October. In the Gosford/Lake Macquarie District Caladenia tessellata has been recorded in Open forest in soils of the Woodbury's Bridge or Wyong Soil Landscapes at Wyong and from Munmorah State Recreation Area. This species favours low open forest with a healthy or sometimes grassy understorey (Bishop, 2000). This orchid often grows in dense shrubbery in coastal areas and is often only evident after fire (Bishop, 2000).

It is considered that suitable habitat for this species is present on the subject site, however this species was not observed during surveys or recorded within a 10km radius of the subject site (NPWS 2010). It is considered that the action proposed is not likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

***Cryptostylis hunteriana* (Leafless Tongue Orchid)**
The preferred habitat of Cryptostylis hunteriana is that of swamp heath on sandy soils (Harden 1994) or swamp fringes and tall eucalypt forest (Bishop, 2000). It flowers between December and February. It is a leafless saprophytic herb with a flowering stem that is pale yellow and up to 45cm tall, bearing up to 10 flowers. The flower is up to 25mm long with deep maroon, linear, spreading sepals and petals. The labellum is raised upwards and is oblong with strongly recurved margins and is also deep maroon with 5 dark lines with most of the upper surface densely and conspicuously hairy (Bishop, 2000). The distribution of this species is generally coastal, from the Gibraltar Range – Northern Tablelands of NSW, to Orbost in Victoria (Bishop, 2000).

It is considered that suitable habitat for this species is present on the subject site, however this species was not observed during surveys or recorded within a 10km radius of the subject site (NPWS 2010). It is considered that the action proposed is not likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Dendrobium melaleucaphilum
This species is an epiphytic orchid that favours *Melaleuca stypheloides*, and is less commonly found on rainforest trees or on rocks in coastal districts. The flowering period or this species is July to October. Distribution of this species is from the NSW / Qld border to the Lower Blue Mountains. Despite detailed searches this species was not observed on the subject site. It is considered that the action proposed is not likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

It is considered that suitable habitat for this species is present on the subject site, however this species was not observed during surveys or recorded within a 10km radius of the subject site (NPWS 2010). It is considered that the action proposed is not likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Melaleuca biconvexa
This species is a paperbark shrub or small tree which prefers poorly drained habitats near swamps and along drainage lines. The geographical distribution of this species is predominantly the Central Coast in the Gosford / Wyong area with disjunct populations near Jervis Bay and Port Macquarie (NSW Scientific Committee, 1998).

This species was not observed on the subject site. Despite a detailed targeted search this species was not found on the subject site. Due to the presence of large areas of more suitable habitat in the local area, lack of observations within the site and the retention of suitable habitat along the drainage lines within the subject site it is considered that the action proposed is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Syzygium paniculatum
Syzygium paniculatum is found predominantly along the coast on headlands and ranges. It is usually found growing in or near subtropical and littoral rainforests on sandy soils, stabilised dunes near the sea or sheltered gullies, especially near watercourses (Fairly and Moore 1989; Harden 1994).

Despite a detailed targeted search this species was not found on the subject site. Due to the presence of large areas of more suitable habitat in the local area, lack of observations within the site and the retention of suitable habitat along the drainage lines within the subject site it is considered that the action proposed is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

FAUNA
Twelve threatened fauna species, the Little Eagle, Little Lorikeet, Powerful Owl, Sooty Owl, Yellow-bellied Glider, Grey-headed Flying-fox, Eastern False Pipistrelle, Little Bentwing-bat, Eastern Bentwing-bat, Eastern Freetail-bat, Yellow-bellied Sheathtail-bat and Greater Broad-nosed Bat were recorded within the subject site. An assessment of these species and those with suitable potential habitat on the subject site is provided below.

Giant Burrowing Frog (*Heleioporus australiacus*)
This species is most common on the Hawkesbury Sandstone in the Sydney region. It occurs south to Victoria (Barker et. al. 1995). Males call from beside smaller semi permanent-to-permanent streams or dams or from burrows within the bank of streams or dams (Anstis 2002). They call mainly in spring and late autumn, but also after rain in late summer. Foamy egg mass are laid in a burrow such as an old crayfish hole in a stream bank, or concealed under dense vegetation (Anstis 2002).

The subject site contains suitable foraging and breeding habitat for this species within the Aquatic Areas and Riparian Vegetation of the subject site. This species was not detected during surveys.

The large majority of the subject site is highly disturbed and of low habitat value for this species. The rezoning and subsequent development is likely to include the retention of suitable aquatic habitat areas for this species. There are large areas of suitable habitat for this species adjacent to the subject site and within the local area including habitats reserved within Brisbane Waters and Bouddi National Parks, Kincumba Mountain Reserve and other reserves of the Coastal Open Space System. It is considered that the action proposed is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Stuttering Frog (*Mixophyes balbus*)
This species is a terrestrial inhabitant of rainforest, Antarctic Beech and moist hardwood forest. They feed principally on insects and small frogs (Cogger, 1999). Males call during spring and summer from beside streams, often well camouflaged on leaf litter, under banks, or on dry parts of the stream floor or logs just above flowing water midstream (Anstis 2002).

The subject site contains suitable foraging and breeding habitat for this species within the Aquatic Areas and Riparian Vegetation of the subject site. This species was not detected during surveys.

The large majority of the subject site is highly disturbed and of low habitat value for this species. The rezoning and subsequent development will include the retention of suitable aquatic habitat areas for this species. There are large areas of suitable habitat for this species adjacent to the subject site and within the local area including habitats reserved within Brisbane Waters and Bouddi National Parks, Kincumba Mountain Reserve and other reserves of the Coastal Open Space System. It is considered that the action proposed is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Giant Barred Frog (*Mixophyes iteratus*)
This large frog inhabits the coast and ranges from south-eastern Qld to mid-northern NSW. It is associated with flowing streams in wet sclerophyll forest or rainforest. Males call during spring and summer from the ground, often on leaf litter, near streams or ponds (Anstis 2002).

The subject site contains suitable foraging and breeding habitat for this species within the Aquatic Areas and Riparian Vegetation of the subject site. This species was not detected during surveys.

The large majority of the subject site is highly disturbed and of low habitat value for this species. The rezoning and subsequent development will include the retention of suitable aquatic habitat

areas for this species. There are large areas of suitable habitat for this species adjacent to the subject site and within the local area including habitats reserved within Brisbane Waters and Bouddi National Parks, Kincumba Mountain Reserve and other ridgeland reserves of the Coastal Open Space System. It is considered that the action proposed is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Red-crowned Toadlet (*Pseudophryne australis*)
The Red-crowned Toadlet uses small ephemeral drainage lines, which feed water from the top of ridges to perennial creeks below. It is totally confined to the Hawkesbury sandstone formation. Breeding congregations occur deep in grass and debris beside non-perennial creeks and gutters in sandstone areas. At other times, individuals disperse and can be found under rocks and logs on sandstone ridges (Cogger 2000).

Suitable foraging and breeding habitat is present within the more elevated areas adjoining Kincumba Mountain Reserve where sandstone outcropping is exposed. This species was not observed during surveys.

The large majority of the subject site is highly disturbed and of low habitat value for this species. There are large areas of suitable habitat for this species adjacent to the subject site and within the local area including habitats reserved within Brisbane Waters and Bouddi National Parks, Kincumba Mountain Reserve and other ridgeland reserves of the Coastal Open Space System. It is considered that the action proposed is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Green and Golden Bell Frog (*Litoria aurea*)
The Green and Golden Bell Frog is largely aquatic and can be found among vegetation on the edges of permanent water (Cogger 1999). The males call mainly after rain from spring to autumn while afloat among vegetation, usually in larger permanent dams, swamps and lagoons. Breeding often peaks after heavy rains in January to February.

The subject site contains suitable foraging and breeding habitat for this species within the Aquatic Areas of the subject site. This species was not detected during surveys.

A population of the Green and Golden Bell Frog is situated at Avoca Lagoon North Avoca some two (2) kilometres south east of the subject site. This known population is not connected to the subject site via any suitable habitat. The large majority of the subject site is highly disturbed and of low habitat value for this species. The rezoning and subsequent development will include the retention of suitable aquatic habitat areas for this species. There are large areas of suitable habitat for this species adjacent to the subject site and within the local area including habitats reserved within Brisbane Waters and Bouddi National Parks, Kincumba Mountain Reserve and other ridgeland reserves of the Coastal Open Space System. It is considered that the action proposed is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Green-thighed Frog (*Litoria brevipalmata*)
The preferred habitats of the Green-thighed Frog are largely unknown. The Green-thighed Frog has been found in mostly terrestrial habitats including the grassy margins of semi-permanent and permanent ponds in late spring and rainforests, moist open forest (Robinson 1993), drier

open forest and woodland (Nattrass & Ingram 1993), coastal swamp forest and along the perimeter of flooded paddocks (Barker & Grigg 1977).

Suitable foraging and breeding habitat for this species is present within the within the Aquatic Areas and Riparian Vegetation of the subject site. This species was not detected during surveys.

The large majority of the subject site is highly disturbed and of low habitat value for this species. The rezoning and subsequent development will include the retention of suitable aquatic habitat areas for this species. There are large areas of suitable habitat for this species adjacent to the subject site and within the local area including habitats reserved within Brisbane Waters and Bouddi National Parks, Kincumba Mountain Reserve and other ridgeland reserves of the Coastal Open Space System. It is considered that the action proposed is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Rosenberg's Goanna (*Varanus rosenbergi*)
On the east coast of NSW the Rosenberg's Goanna is a sandstone outcrop specialist. It inhabits humid woodlands, dry hardwood forests and heathland where it shelters in self-dug burrows, hollow logs, rock crevices and sandstone outcrops (Cogger 1992). Eggs are layed within a terrestrial termite mound.

Suitable foraging and shelter habitat is present within the more elevated areas adjoining Kincumba Mountain Reserve where sandstone outcropping is exposed. This species was not observed during surveys.

The large majority of the subject site is highly disturbed and of low habitat value for this species. There are large areas of suitable habitat for this species adjacent to the subject site and within the local area including habitats reserved within Brisbane Waters and Bouddi National Parks, Kincumba Mountain Reserve and other ridgeland reserves of the Coastal Open Space System. It is considered that the action proposed is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Pale-headed Snake (*Hoplocephalus bitorquatus*)
This species occurs in a range of habitats from rainforest to open woodland. It is partly arboreal and usually found in tree hollows or beneath loose bark along watercourses.

The Open Forest and Disturbed Open Forest areas within the site provide suitable shelter and foraging habitat for this species. This species was not observed during surveys.

The large majority of the subject site is highly disturbed and of low habitat value for this species. The rezoning and subsequent development will include the retention of suitable vegetated riparian habitat areas for this species. There are large areas of suitable habitat for this species adjacent to the subject site and within the local area including habitats reserved within Brisbane Waters and Bouddi National Parks, Kincumba Mountain Reserve and other ridgeland reserves of the Coastal Open Space System. It is considered that the action proposed is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Stephens' Banded Snake (*Hoplocephalus stephensii*)
Stephens Banded Snake is an arboreal, nocturnal species found in wet sclerophyll to drier eucalypt forests. It often rests during the day beneath large sheets of bark on upright or fallen trees (Cogger 1999; Griffith's 1987).

The Open Forest and Disturbed Open Forest areas within the site provide suitable shelter and foraging habitat for this species. This species was not observed during surveys. There is a recent record for this species within land adjacent to the northern boundary of the subject site. However recent intensive targeted surveys failed to detect the presence of this species within adjacent land (Conacher Travers 2003).

The large majority of the subject site is highly disturbed and of low habitat value for this species. The rezoning and subsequent development will include the retention of suitable vegetated riparian habitat areas for this species. There are large areas of suitable habitat for this species adjacent to the subject site and within the local area including habitats reserved within Brisbane Waters and Bouddi National Parks, Kincumba Mountain Reserve and other ridgeland reserves of the Coastal Open Space System. It is considered that the action proposed is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Wompoo Fruit-dove (*Ptilinopus magnificus*)
The Wompoo Fruit-dove inhabits mainly large undisturbed patches of tall tropical or subtropical evergreen rainforest. In NSW the Wompoo Fruit-dove is widespread east of the Great Dividing Range from the Northern Rivers Region, North of Lismore South to the Hunter Valley. The Wompoo Fruit-dove is an obligate frugivore, taking fruits of many species of rainforest trees, palms, vines and epiphytes, feeding mostly in the canopy (Higgins & Davies 1996).

Suitable foraging and roosting habitat is present within the Riparian Vegetation areas of the subject site. This species was not observed during surveys.

The large majority of the subject site is highly disturbed and of low habitat value for this species. The rezoning and subsequent development will include the retention of suitable closed forest and riparian vegetated habitat areas for this species. There are large areas of suitable habitat for this species adjacent to the subject site and within the local area including habitats reserved within Brisbane Waters and Bouddi National Parks, coastal lagoons and wetlands, Kincumba Mountain Reserve and other ridgeland reserves of the Coastal Open Space System. It is considered that the action proposed is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Superb Fruit-dove (*Ptilinopus superbus*)
This species inhabits mostly closed forests, occasionally near streams or lakes within rainforest. Breeding most commonly occurs within dense forests. They are said to be a regular autumn and winter migrant to the Hunter, Sydney, Illawarra and South Coast regions. This species is frugivorous, taking fruits of many species of rainforest trees, vines and palms (Higgins & Davies 1996).

Suitable foraging and roosting habitat is present within the Riparian Vegetation areas of the subject site. This species was not observed during surveys.

The large majority of the subject site is highly disturbed and of low habitat value for this species. The rezoning and subsequent development will include the retention of suitable vegetated habitat areas for this species. There are large areas of suitable habitat for this species adjacent to the subject site and within the local area including habitats reserved within Brisbane Waters and Bouddi National Parks, coastal lagoons and wetlands, Kincumba Mountain Reserve and other ridgeland reserves of the Coastal Open Space System. It is considered that the action proposed is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Rose-crowned Fruit-dove *(Ptilinopus regina)*
The Rose-crowned Fruit-dove inhabits tall tropical and subtropical, evergreen or semi-deciduous rainforest, especially with dense growth of vines. (Higgins & Davies 1996). In NSW this species is widespread in north-east, in Northern Rivers, Northern Tablelands, and Mid-North Coast Regions. (Higgins & Davies 1996). This species is a frugivore, taking fruits of many species of rainforest trees, palms, and vines, feeding mainly in the canopy but also in low trees and undergrowth. (Higgins & Davies 1996).

Suitable foraging and roosting habitat is present within the Riparian Vegetation areas of the subject site. This species was not observed during surveys.

The large majority of the subject site is highly disturbed and of low habitat value for this species. The rezoning and subsequent development will include the retention of suitable vegetated habitat areas for this species. There are large areas of suitable habitat for this species adjacent to the subject site and within the local area including habitats reserved within Brisbane Waters and Bouddi National Parks, coastal lagoons and wetlands, Kincumba Mountain Reserve and other ridgeland reserves of the Coastal Open Space System. It is considered that the action proposed is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Black-necked Stork *(Ephippiorhynchus asiaticus)*
The Black-necked Stork usually forages singly but also forages in large family groups in fresh or saline waters up to 0.5 metres deep (Marchant & Higgins 1990). This species feeds mainly on fish but will also eat reptiles, frog's crabs, insects, rodents and carrion (Schodde & Tiedemann 1986). The Black-necked Stork occurs throughout tropical and warm temperate terrestrial wetlands, estuarine and littoral habitats and occasionally in grassland and wooded lands (Marchant & Higgins 1990).

Suitable foraging and roosting habitat is present within the Aquatic Areas of the subject site. This species was not observed during surveys.

The large majority of the subject site is highly disturbed and of low habitat value for this species. The rezoning and subsequent development will include the retention of suitable vegetated habitat areas for this species. There are large areas of suitable habitat for this species It is considered that the action proposed is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Australisian Bittern (*Botaurus poiciloptilus*)
This species inhabits shallow freshwater or brackish wetlands with tall dense beds of reeds, sedges or rush species and swamp edges. The less disturbed vegetation communities within

the site provide suitable shelter and foraging habitat for this species. This species was not observed during surveys.

Suitable foraging and roosting habitat is present within the Aquatic Areas of the subject site. This species was not observed during surveys.

The large majority of the subject site is highly disturbed and of low habitat value for this species. The rezoning and subsequent development will include the retention of suitable vegetated habitat areas for this species. There are large areas of suitable habitat for this species It is considered that the action proposed is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Black Bittern (*Ixobrychus flavicollis*)
The Australasian Bittern is a large brown heron that inhabits freshwater and brackish wetlands, ponds and streams with tall dense reed beds (Lindsey 1992). It is a solitary and secretive bird that hunts mainly at night for invertebrates, frogs, fish and mice. This species occurs in or over water in tall reedbeds, sedges, rushes Cumbungi and Lignum. Also occurs in drains in tussocky paddocks and occasionally in saltmarshes or brackish wetlands.

Suitable foraging and roosting habitat is present within the Aquatic Areas of the subject site. This species was not observed during surveys.

The large majority of the subject site is highly disturbed and of low habitat value for this species. The rezoning and subsequent development is likely to include the retention of suitable vegetated habitat areas for this species. There are large areas of suitable habitat for this species within the local area. It is considered that the action proposed is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Square-tailed Kite *(Limosa limosa)*
The Square-tailed Kite inhabits the coastal forested and wooded lands of tropical and temperate Australia (Marchant & Higgins 1993). The Square-tailed Kite is a specialist hunter of passerines, especially honeyeaters, and insects in the tree canopy, picking most prey items from the outer foliage (Marchant & Higgins 1993).

Suitable foraging and roosting habitat for this species is present within across the subject site. This species was not observed during surveys.

The large majority of the subject site is highly disturbed and of low habitat value for this species. There are large areas of suitable habitat for this species adjacent to the subject site and within the local area including habitats reserved within Brisbane Waters and Bouddi National Parks, coastal lagoons and wetlands, Kincumba Mountain Reserve and other ridgeland reserves of the Coastal Open Space System. It is considered that the action proposed is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Black-breasted Buzzard (*Haemirostra melanosternon*)
This species inhabits wooded lands and open country of tropical and temperate Australia. In New South Wales this species is found mainly in the west and north-west with very few records on the coast (Marchant & Higgins 1993). The Black-breasted Buzzard eats mammals, birds,

reptiles, carrion particularly young rabbits, bird nestlings (Debus 1998). This species is considered sedentary however local migratory northern movements have been recorded (Marchant & Higgins 1993).

Suitable foraging and roosting habitat for this species is present across the subject site. This species was not observed during surveys.

The large majority of the subject site is highly disturbed and of low habitat value for this species. There are large areas of suitable habitat for this species adjacent to the subject site and within the local area including habitats reserved within Brisbane Waters and Bouddi National Parks, coastal lagoons and wetlands, Kincumba Mountain Reserve and other ridgeland reserves of the Coastal Open Space System. It is considered that the action proposed is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Little Eagle (*Hieraaetus morphnoides*)
This species forages in a variety of habitats including woodland open forest, partially cleared areas, along watercourses and around wetlands, avoiding large areas of dense forest. This species nests in mature living trees in open forest, woodland and remnant areas including farmland and areas close to urban development (Marchant and Higgins 1993).

Suitable foraging and roosting habitat for this species is present across the subject site. This species was observed during surveys soaring above the southern open forest areas of the subject site.

The large majority of the subject site is highly disturbed and of low habitat value for this species. There are large areas of suitable habitat for this species adjacent to the subject site and within the local area including habitats reserved within Brisbane Waters and Bouddi National Parks, coastal lagoons and wetlands, Kincumba Mountain Reserve and other ridgeland reserves of the Coastal Open Space System. It is considered that the action proposed is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Bush Stone-Curlew (*Burhinus grallarius*)
The Bush Stone Curlew occurs in open woodland with fallen branches, leaf-litter, sparse grass, timber along dry watercourses, sand plains with spinifex and mallee, sandy scrub near beaches, mangrove-fringes, country golf courses, timber remnants on roadsides, plantations and urban.

The subject site provides some suitable habitat for this species within the Grassland and Disturbed Open Forest areas of the subject site. This species was not observed during surveys.

The large majority of the subject site is highly disturbed and of low habitat value for this species. There are large areas of suitable habitat for this species. It is considered that the action proposed is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Glossy Black-Cockatoo (*Calyptorhynchus lathami*)
The Glossy Black-Cockatoo inhabits mountain forests, coastal woodland, open forest and trees bordering watercourses where there are substantial stands of Allocasuarina. They choose trees with larger cone crops but show no sign of selecting trees on the basis of cone size – concentrating foraging in trees with a high ratio of total seed weight to cone weight (Clout 1989).

Suitable foraging and roosting habitat is present within the open forest areas of the subject site containing suitable Allocasuarina species. This species or signs of foraging were not observed during surveys.

The large majority of the subject site is highly disturbed and of low habitat value for this species. The rezoning and subsequent development will include the retention of suitable vegetated habitat areas for this species. There are large areas of suitable habitat for this species adjacent to the subject site and within the local area including habitats reserved within Brisbane Waters and Bouddi National Parks, coastal lagoons and wetlands, Kincumba Mountain Reserve and other ridgeland reserves of the Coastal Open Space System. It is considered that the action proposed is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Gang-gang Cockatoo *(Callocephalon fimbriatum)*
The Gang-gang Cockatoo is associated with a variety of woodland and forest habitats, and occasionally more open areas in south–eastern New South Wales and Victoria (NSW Scientific Committee, 2005). This species utilises eucalypt forests and exotic trees, and is known to feed on the seeds of native shrubs and trees, in addition to some exotic species such as the Hawthorn and Cupressus species (Schodde & Tideman 1986).

Suitable foraging and roosting habitat for this species is present across the subject site. This species was not observed during surveys.

The large majority of the subject site is highly disturbed and of low habitat value for this species. There are large areas of suitable habitat for this species adjacent to the subject site and within the local area including habitats reserved within Brisbane Waters and Bouddi National Parks, coastal lagoons and wetlands, Kincumba Mountain Reserve and other ridgeland reserves of the Coastal Open Space System. It is considered that the action proposed is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Little Lorikeet (*Glossopsitta pusilla*)
Little Lorikeets are distributed in forests and woodlands from the coast to the western slopes of the Great Dividing Range, extending westwards to the vicinity of Albury, Parkes, Dubbo and Narrabri. Lorikeets are gregarious, usually foraging in small flocks, often with other species of lorikeet. They feed primarily on nectar and pollen in the tree canopy, particularly on profusely-flowering eucalypts, but also on a variety of other species including, melaleucas and mistletoes (Courtney & Debus 2006).

Suitable foraging and roosting habitat for this species is present within the treed areas of the subject site. This species was observed foraging within the subject site during surveys.

The large majority of the subject site is highly disturbed and of low habitat value for this species. There are large areas of suitable habitat for this species adjacent to the subject site and within the local area including habitats reserved within Brisbane Waters and Bouddi National Parks, coastal lagoons and wetlands, Kincumba Mountain Reserve and other ridgeland reserves of the Coastal Open Space System. It is considered that the action proposed is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Swift Parrot (*Polytelis swainsonii*)
This species feeds mainly on nectar and lerp from eucalypt flowers, particularly Blue Gum (Eucalyptus globulus). On the mainland, the Swift Parrot congregates where winter flowering species such as Red Ironbark (Eucalyptus sideroxylon), White Box (Eucalyptus albens), Yellow Gum (Eucalyptus leucoxylon) and Swamp Gum (Eucalyptus ovata) (Brown, 1989). The Swift Parrot is a migratory species that breeds in Tasmania and its offshore islands in summer. In late March almost the entire population migrates to mainland Australia (Schodde and Tidemann, 1986).

The subject site contains suitable foraging habitat for this species within the winter flowering tree species present. This species was not observed during surveys.

The large majority of the subject site is highly disturbed and of low habitat value for this species. There are large areas of suitable habitat for this species adjacent to the subject site and within the local area including habitats reserved within Brisbane Waters and Bouddi National Parks, coastal lagoons and wetlands, Kincumba Mountain Reserve and other ridgeland reserves of the Coastal Open Space System. It is considered that the action proposed is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Turquoise Parrot (*Neophema pulchella*)
The Turquoise Parrot is a sedentary species inhabiting the foothills of the Great Divide, including steep rocky ridges and gullies, rolling hills, valleys and river-flats, sometimes nearby plains (Higgins (Ed) 1999). This species feeds on the ground among seeding grasses or weeds usually beneath trees. It is endemic to eastern Australia, from south east Queensland through eastern New South Wales to north east Victoria (Higgins 1999).

Suitable foraging and roosting habitat is present within the Open Forest, Disturbed Open Forest and Grassland areas of the subject site. This species was not observed during surveys.

The large majority of the subject site is highly disturbed and of low habitat value for this species. There are large areas of suitable habitat for this species adjacent to the subject site and within the local area including habitats reserved within Brisbane Waters and Bouddi National Parks, coastal lagoons and wetlands, Kincumba Mountain Reserve and other ridgeland reserves of the Coastal Open Space System. It is considered that the action proposed is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Powerful Owl (*Ninox strenua*)
The Powerful Owl breeds in open or closed sclerophyll forests and woodlands, including wet sclerophyll forest and dry sclerophyll forest and woodlands. They nest in hollows in large old trees; usually living Eucalyptus, within or below canopy – rarely in dead stags, stumps or broken-off trunks (Higgins 1999). Powerful Owls are sedentary within home ranges of about 1,000 hectares within open eucalypt, casuarina or Callitris pine forest and woodlands, though they often roost in denser vegetation, including rainforest or exotic pine plantations (Garnett & Crowley 2000). Powerful Owls feed mainly on those medium-sized species of arboreal marsupials that are most readily available at any given locality (Lavazanian et.al. 1994).

Suitable foraging and roosting habitat is present within the Riparian Vegetation, Disturbed Open Forest and Open Forest areas of the subject site. This species was observed during surveys in the open forest areas within the southern part of the site.

The large majority of the subject site is highly disturbed and of low habitat value for this species. There are large areas of suitable habitat for this species adjacent to the subject site and within the local area including habitats reserved within Brisbane Waters and Bouddi National Parks, coastal lagoons and wetlands, Kincumba Mountain Reserve and other ridgeland reserves of the Coastal Open Space System. It is considered that the action proposed is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Barking Owl (*Ninox connivens*)
The Barking Owl mainly inhabits area of savannah woodland, open eucalypt wetland and riverine forest. It is generally absent from the arid interior (Lindsey 1992). This species breeds in large hollows in large, live trees; near or on floodplains; associated with forest types and sparse groundcover; dry forest woodland with dense thickets of eucalypt, paperbark or viny scrub (Environment Australia 2000).

Suitable foraging and roosting habitat is present within the Riparian Vegetation, Disturbed Open Forest and Open Forest areas of the subject site. This species was not observed during surveys.

The large majority of the subject site is highly disturbed and of low habitat value for this species. There are large areas of suitable habitat for this species adjacent to the subject site and within the local area including habitats reserved within Brisbane Waters and Bouddi National Parks, coastal lagoons and wetlands, Kincumba Mountain Reserve and other ridgeland reserves of the Coastal Open Space System. It is considered that the action proposed is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Sooty Owl (*Tyto tenebricosa*)
The Sooty Owl is generally associated with tall, dense, wet closed and open forests (Schodde & Tidemann 1986). Available evidence indicates narrow habitat requirements for nesting, with very large hollows being essential (Hyem 1979). The large majority of the subject site is highly disturbed and of low habitat value for this species.

The Sooty Owl was observed within the subject site after responding to owl call playback in August 2004. It is likely that the presence of this species within the area indicates that the subject site forms part of the home range of a local Sooty Owl or pair. Suitable foraging and roosting habitat is present within the Riparian Vegetation, Disturbed Open Forest and Open Forest areas of the subject site.

The rezoning and subsequent development will include the retention of suitable vegetated riparian and closed forest habitat areas for this species. There are large areas of suitable habitat for this species adjacent to the subject site and within the local area including habitats reserved within Brisbane Waters and Bouddi National Parks, coastal lagoons and wetlands, Kincumba Mountain Reserve and other ridgeland reserves of the Coastal Open Space System. It is considered that the action proposed is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Masked Owl (*Tyto novaehollandiae*)
The Masked Owl is widespread through forests and woodlands, utilising caves for shelter in treeless country. The Masked Owl is known to utilise forest margins and isolated stands of

trees within agricultural land. This species is often found in heavily disturbed forest where its prey of small and medium sized mammals can be readily obtained. The Masked Owl is dependent upon hollow bearing trees all year round requiring old mature trees with large hollows for breeding and as diurnal roosting sites.

Suitable foraging and roosting habitat is present within the Riparian Vegetation, Grassland, Disturbed Open Forest and Open Forest areas of the subject site. This species was not observed during surveys.

The large majority of the subject site is highly disturbed and of low habitat value for this species. There are large areas of suitable habitat for this species adjacent to the subject site and within the local area including habitats reserved within Brisbane Waters and Bouddi National Parks, coastal lagoons and wetlands, Kincumba Mountain Reserve and other ridgeland reserves of the Coastal Open Space System. It is considered that the action proposed is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Regent Honeyeater (*Xanthomyza phrygia*)
The Regent Honeyeater inhabits mostly dry eucalypt woodlands and forests dominated by box ironbark eucalypts; on inland slopes of Great Divide, especially associations in moister more fertile sites, along creeks, broad river valleys and on lower slopes of foothills (Higgins et al 2001). Nectar is the principle food but sugary exudates from insects are also used (Oliver 1998, 2000). The Regent Honeyeater is known to breed along the western Slopes of the Great Dividing Range in New South Wales (Bundarra-Barraba district, Capertee Valley).

Suitable foraging habitat is present within the Disturbed Open Forest, Open Forest and Grassland areas of the subject site. This species was not observed during surveys.

The large majority of the subject site is highly disturbed and of low habitat value for this species. There are large areas of suitable habitat for this species adjacent to the subject site and within the local area including habitats reserved within Brisbane Waters and Bouddi National Parks, coastal lagoons and wetlands, Kincumba Mountain Reserve and other ridgeland reserves of the Coastal Open Space System. It is considered that the action proposed is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Varied Sittella (*Daphoenositta chrysoptera*)
This species inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and *Acacia* woodland (Higgins & Peter 2002).

Suitable foraging and roosting habitat for this species is present within Disturbed Open Forest, Open Forest and Grassland areas of the subject site. This species was not observed during surveys.

The large majority of the subject site is highly disturbed and of low habitat value for this species. There are large areas of suitable habitat for this species adjacent to the subject site and within the local area including habitats reserved within Brisbane Waters and Bouddi National Parks, coastal lagoons and wetlands, Kincumba Mountain Reserve and other ridgeland reserves of the Coastal Open Space System. It is considered that the action proposed is not likely to have an

adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Scarlet Robin (*Petroica boodang*)
This species inhabits mainly dry eucalypt forest and woodlands with open shrubby and grassy understorey on ridges and slopes during the spring-summer breeding season, dispersing during autumn–winter into open habitats including urban areas (Higgins and Peter 2002).

Suitable foraging and roosting habitat for this species is present within the Disturbed Open Forest, Open Forest and Grassland areas of the subject site. This species was not observed during surveys.

The large majority of the subject site is highly disturbed and of low habitat value for this species. There are large areas of suitable habitat for this species adjacent to the subject site and within the local area including habitats reserved within Brisbane Waters and Bouddi National Parks, coastal lagoons and wetlands, Kincumba Mountain Reserve and other ridgeland reserves of the Coastal Open Space System. It is considered that the action proposed is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Spotted-tailed Quoll (*Dasyurus maculata*)
The Spotted-tailed Quoll inhabits a range of forest communities including wet and dry open forest and rainforest. It appears to prefer moist forest types and riparian habitat. It has been recorded from dry sclerophyll forest, open woodland and coastal heathland, and despite its occurrence in inland riparian areas, it also ranges over dry ridges (NPWS 1999).

Suitable foraging and shelter habitat for this species is present within the Disturbed Open Forest, Open Forest and Grassland areas of the subject site and in particular within those areas that adjoin the Kincumba Mountain Reserve. This species was not observed during surveys.

The large majority of the subject site is highly disturbed and of low habitat value for this species. There are large areas of suitable habitat for this species adjacent to the subject site and within the local area including habitats reserved within Brisbane Waters and Bouddi National Parks, coastal lagoons and wetlands, Kincumba Mountain Reserve and other ridgeland reserves of the Coastal Open Space System. It is considered that the action proposed is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Eastern Pygmy-possum (*Cercatetus nanus*)
The Eastern Pygmy-possum is found from rainforest through sclerophyll forest to tree heath. Banksia and myrtaceous shrubs and trees are favoured (Turner and Ward, 1995). Eastern Pygmy-possums usually shelter alone in tree cavities, rotten stumps, holes in the ground, disused bird nests and possum dreys and in vegetation thickets such as Xanthorrhoea species (Menkhorst, 1996). The home ranges of males, about 0.65 hectares are larger than those of females, about 0.35 hectares and not exclusive with home ranges broadly overlapping. Apart from females with young in the nest, individuals may utilise a number of nest sites within the home range (Turner and Ward, 1995; Menkhorst, 1996).

Suitable foraging and shelter habitat for this species is present within the Disturbed Open Forest, Open Forest, Riparian Vegetation and Grassland areas of the subject site. This species was not observed during surveys.

The large majority of the subject site is highly disturbed and of low habitat value for this species. There are large areas of suitable habitat for this species adjacent to the subject site and within the local area including habitats reserved within Brisbane Waters and Bouddi National Parks, coastal lagoons and wetlands, Kincumba Mountain Reserve and other ridgeland reserves of the Coastal Open Space System. It is considered that the action proposed is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Yellow-bellied Glider (*Petaurus australis*)
The Yellow-bellied Glider is an arboreal tree-dwelling mammal. It is restricted to tall mature eucalypt forests found within high rainfall regions of temperate through to sub-tropical eastern Australia (Russell 1988). The bulk of the diet of the Yellow-bellied Glider consists of plant and insect exudates including sap, nectar, honeydew and manna while arthropods and pollen are also eaten (Goldingay and Kavanagh 1991). Yellow-bellied Gliders occupy large exclusive home ranges between 30 and 65 hectares in size (Goldingay and Kavanagh 1991).

The Yellow-bellied Glider was observed several times within the subject site and within Kincumba Mountain Reserve. The Yellow-bellied Gliders observed during surveys are likely to be part of a local population known to inhabit Kincumba Mountain Reserve and other connected bushland areas. The subject site contains suitable foraging habitat for this species within the Disturbed Open Forest and Open Forest areas. The Yellow-bellied Glider was observed within and adjacent to the subject site during surveys.

The large majority of the subject site is highly disturbed and of decreased habitat value for this species. The rezoning and subsequent development will include the retention of suitable vegetated habitat areas for this species particularly along the drainage lines and reserve areas. There are large areas of suitable habitat for this species adjacent to the subject site and within the local area including habitats reserved within Brisbane Waters and Bouddi National Parks, coastal lagoons and wetlands, Kincumba Mountain Reserve and other ridgeland reserves of the Coastal Open Space System. It is considered that the action proposed is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Squirrel Glider (*Petaurus norfolcensis*)
The Squirrel Glider inhabits dry sclerophyll forest and woodland nesting in small tree hollows (Suckling, 1995). The presence of mature, hollow-bearing eucalypts is a critical characteristic of habitat occupied by Squirrel Gliders as they are utilised for nesting and breeding (Suckling, 1995).

Suitable foraging and shelter habitat for this species is present within the Disturbed Open Forest and Open Forest areas of the subject site. This species was not observed during surveys.

The large majority of the subject site is highly disturbed and of decreased habitat value for this species. There are large areas of suitable habitat for this species adjacent to the subject site and within the local area including habitats reserved within Brisbane Waters and Bouddi National Parks, coastal lagoons and wetlands, Kincumba Mountain Reserve and other ridgeland reserves of the Coastal Open Space System. It is considered that the action proposed is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Long-nosed Potoroo (*Potorus tridactylus)*
The Long-nosed Potoroo occupies a wide range of habitats, from heath to dry and moist hardwood forests usually where rainfall exceeds 760mm. It requires thick groundcover and may be commoner on light sandy soils (Johnston, 1991; Newsome and Catling, 1979). The Long-nosed Potoroo has a diet consisting of sporocarps of hypogeal fungi, seeds, arthropods, fleshy fruits and leaves (Bennet and Baxter, 1989; Claridge *et al* 1993). Home ranges have been found to vary considerably, from 1.5 to 19 hectares, and may depend upon suitable habitat availability (Seebeck *et al.* 1989).

Suitable foraging and shelter habitat for this species is present within the Grassland, Disturbed Open Forest and Open Forest areas of the subject site. This species was not observed during surveys.

The large majority of the subject site is highly disturbed and of decreased habitat value for this species. There are large areas of suitable habitat for this species adjacent to the subject site and within the local area including habitats reserved within Brisbane Waters and Bouddi National Parks, coastal lagoons and wetlands, Kincumba Mountain Reserve and other ridgeland reserves of the Coastal Open Space System. It is considered that the action proposed is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Parma Wallaby *(Macropus parma*)
The Parma Wallaby lives in wet and dry forests and occasionally rainforests but its optimum habitat appears to be wet and dry sclerophyll forest with a thick shrubby understorey associated with grassy patches (Maynes 1991). Detailed analysis of sites where Parma Wallabies have been sighted indicates that there exists a dense understorey of vegetation with Kangaroo Grass and Tussock Grass (Read & Fox 1991).

Suitable foraging and shelter habitat for this species is present within the Grassland, Disturbed Open Forest and Open Forest areas of the subject site. This species was not observed during surveys.

The large majority of the subject site is highly disturbed and of decreased habitat value for this species. There are large areas of suitable habitat for this species adjacent to the subject site and within the local area including habitats reserved within Brisbane Waters and Bouddi National Parks, coastal lagoons and wetlands, Kincumba Mountain Reserve and other ridgeland reserves of the Coastal Open Space System. It is considered that the action proposed is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Grey-headed Flying-fox (*Pteropus poliocephalus*)
The Grey-headed Flying-fox is found in a variety of habitats including rainforest, mangroves, paperbark swamps, wet and dry sclerophyll forests and cultivated areas (Churchill 1998). Grey-headed Flying Foxes congregate in large camps of up to 200,000 individuals, depending on availability of surrounding blossoming plants, from early until late summer (Churchill, 1998). Camps are commonly formed in gullies, typically not far from water and in vegetation with a dense canopy. Roost sites are an important resource where mating, birth and rearing of young occur as well as providing refuge (Strahan, 1995).

The subject site contains suitable foraging habitat however no roost or camp sites were present on the subject site. This species was observed on a number of occasions flying over the subject site from camp sites to the north and is likely to forage periodically within the site.

The large majority of the subject site is highly disturbed and of decreased habitat value for this species. There are large areas of suitable habitat for this species adjacent to the subject site and within the local area including habitats reserved within Brisbane Waters and Bouddi National Parks, coastal lagoons and wetlands, Kincumba Mountain Reserve and other ridgeland reserves of the Coastal Open Space System. It is considered that the action proposed is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*)
The Yellow-bellied Sheathtail-bat inhabits a wide variety of habitats from wet and dry sclerophyll forest, to open woodland, shrubland, mallee, grassland and desert. They fly fast and straight usually over the canopy, and lower over open spaces and at forest edges. This species roosts in large tree hollows (Churchill 2009).

The subject site contains suitable foraging and roosting habitat for this species. The Yellow-bellied Sheathtail-bat was observed within the site during surveys in September 2007.

The large majority of the subject site is highly disturbed and of decreased habitat value for this species. There are large areas of suitable habitat for this species adjacent to the subject site and within the local area including habitats reserved within Brisbane Waters and Bouddi National Parks, coastal lagoons and wetlands, Kincumba Mountain Reserve and other ridgeland reserves of the Coastal Open Space System. It is considered that the action proposed is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Eastern Freetail Bat (*Mormopterus norfolkensis*)
The Eastern Freetail-bat utilises dry eucalypt forest and woodland on the coastal side of the Great Dividing Range. They show a preference for open spaces in woodland or forest, and are more active in the upper slopes of forest areas rather than in riparian zones. They also forage over large waterways. This species roosts in hollow trees (usually in hollow spouts), under exfoliating bark and in various man made structures (Churchill 2009).

The subject site contains suitable foraging and roosting habitat for this species. The Eastern Freetail-bat was observed within the site during surveys in September 2007 and February 2008.

The large majority of the subject site is highly disturbed and of decreased habitat value for this species. There are large areas of suitable habitat for this species adjacent to the subject site and within the local area including habitats reserved within Brisbane Waters and Bouddi National Parks, coastal lagoons and wetlands, Kincumba Mountain Reserve and other ridgeland reserves of the Coastal Open Space System. It is considered that the action proposed is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Large-eared Pied Bat (*Chalinolobus dwyeri*)
The Large-eared Pied Bat forages for insects below the forest canopy. During the day these bats may roost in caves, mine tunnels and the abandoned nests of Fairy Martins (Dwyer 1991). The Large-eared Pied Bat may also utilise tree hollows (Schultz *et. al.* 1994). The Large-eared

Pied Bat is mainly found in drier habitat including dry sclerophyll and woodland, east and west of the Great Dividing Ranges (Hoye & Dwyer 1995).

The subject site contains suitable foraging and roosting habitat for this species. This species was not observed within the subject site during surveys.

The large majority of the subject site is highly disturbed and of decreased habitat value for this species. There are large areas of suitable habitat for this species adjacent to the subject site and within the local area including habitats reserved within Brisbane Waters and Bouddi National Parks, coastal lagoons and wetlands, Kincumba Mountain Reserve and other ridgeland reserves of the Coastal Open Space System. It is considered that the action proposed is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Eastern False Pipistrelle *(Falsistrellus tasmaniensis)*
The Eastern False Pipistrelle inhabits wet sclerophyll forest, open forest, rainforest and coastal mallee. They generally prefer tall and wet forests where the trees are more than 20 metres high and the understorey is dense. This species predominantly roosts in hollow trunks of eucalypts, however have also been reported to roost in caves and old buildings (Churchill 2009).

The Eastern False Pipistrelle was observed foraging within the subject site during surveys in September 2007 and February 2008. It is likely that this species would forage throughout the extensive areas of bushland adjacent to the subject site and within the local area.

The large majority of the subject site is highly disturbed and of decreased habitat value for this species. There are large areas of suitable habitat for this species adjacent to the subject site and within the local area including habitats reserved within Brisbane Waters and Bouddi National Parks, coastal lagoons and wetlands, Kincumba Mountain Reserve and other ridgeland reserves of the Coastal Open Space System. It is considered that the action proposed is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Little Bentwing-bat (*Miniopterus australis*)
The Little Bentwing-bat forages below the canopy within well timbered areas including rainforest, vine thicket, wet and dry melaleuca swamps and coastal forests. This species is a cave dweller with individuals congregating during the summer months in maternity colonies and disperse during the winter. Other roost sites used by this species include abandoned mines, tunnels, stormwater drains and occasionally in buildings, banana trees and tree hollows (Churchill 2009).

The Little Bentwing-bat was observed foraging within the subject site during surveys in September 2007 and February 2008. It is likely that this species would forage throughout the extensive areas of bushland adjacent to the subject site and within the local area.

The large majority of the subject site is highly disturbed and of decreased habitat value for this species. There are large areas of suitable habitat for this species adjacent to the subject site and within the local area including habitats reserved within Brisbane Waters and Bouddi National Parks, coastal lagoons and wetlands, Kincumba Mountain Reserve and other ridgeland reserves of the Coastal Open Space System. It is considered that the action proposed is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis)*
Preferred habitats for this species include rainforest, wet and dry sclerophyll forest, open woodland, Melaleuca forests and open grassland. The Eastern Bentwing-bat forages high in forested areas from just above canopy height to many times canopy height. In more open areas such as grasslands, flight may be within a few metres of the ground. Eastern Bentwing-bats are cave dwellers, but will also roost in man made structures such as road culverts and mines (Churchill 2009).

The Eastern Bentwing-bat was observed foraging within the subject site during surveys in February 2008. It is likely that this species would forage throughout the extensive areas of bushland within the local area.

The large majority of the subject site is highly disturbed and of decreased habitat value for this species. There are large areas of suitable habitat for this species adjacent to the subject site and within the local area including habitats reserved within Brisbane Waters and Bouddi National Parks, coastal lagoons and wetlands, Kincumba Mountain Reserve and other ridgeland reserves of the Coastal Open Space System. It is considered that the action proposed is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Southern Myotis (*Myotis macropus*)
The Southern Myotis has a strong association with streams and permanent waterways, most commonly within vegetated areas at lower elevations and in flat undulating country. This species forages over water for small insects, fish and invertebrates and have a preference for large pools rather than flowing streams. Roost habitats for this species are near water and include caves, tree hollows, abandoned fairy martin nests, among vegetation, in clumps of Pandanus, and man made structures including under bridges, in mines, tunnels, road culverts and stormwater drains (Churchill 2009).

The subject site contains suitable foraging within the Aquatic Areas and roosting habitat for this species within the Disturbed Open Forest and Open Forest areas. The Southern Myotis was not observed within the subject site during surveys.

The large majority of the subject site is highly disturbed and of decreased habitat value for this species. There are large areas of suitable habitat for this species adjacent to the subject site and within the local area including habitats reserved within Brisbane Waters and Bouddi National Parks, coastal lagoons and wetlands, Kincumba Mountain Reserve and other ridgeland reserves of the Coastal Open Space System. It is considered that the action proposed is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Greater Broad-nosed Bat *(Scoteanax rueppellii)*
A wide variety of habitats are utilised by this species including moist gullies in mature coastal forest, rainforest, open woodland, Melaleuca swamp woodland, wet and dry sclerophyll forest, cleared areas with remnant trees and tree-lined creeks in open areas. The Greater Broad-nosed Bat forages about 5m from the edge of isolated trees, forest remnants or along forest crowns with a slow direct flight pattern. This species is known to roost in tree hollows, cracks and fissures in trunks and dead branches, under exfoliating bark, as well as in man made structures including roofs of old buildings (Churchill 2009).

The Greater Broad-nosed Bat was observed foraging within the subject site during surveys in September 2007 and November 2007. It is likely that this species would forage throughout the extensive areas of bushland within the local area.

The large majority of the subject site is highly disturbed and of decreased habitat value for this species. There are large areas of suitable habitat for this species adjacent to the subject site and within the local area including habitats reserved within Brisbane Waters and Bouddi National Parks, coastal lagoons and wetlands, Kincumba Mountain Reserve and other ridgeland reserves of the Coastal Open Space System. It is considered that the action proposed is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Giant Dragonfly (*Petalura gigantea*)
This species inhabits permanent swamps and bogs with some free water and open vegetation and is known from eastern New South Wales.

The subject site contains suitable habitat for this species within the Aquatic Areas present. This species was not observed within the subject site during surveys.

The large majority of the subject site is highly disturbed and of decreased habitat value for this species. There are large areas of suitable habitat for this species adjacent to the subject site and within the local area including habitats reserved within Brisbane Waters and Bouddi National Parks, coastal lagoons and wetlands, Kincumba Mountain Reserve and other ridgeland reserves of the Coastal Open Space System. It is considered that the action proposed is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

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

No endangered populations have been identified within the local area therefore this matter does not require further consideration at this stage.

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

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

One endangered ecological community, Lowland Rainforest was observed within the subject site. This community is located within the western drainage line within an area of riparian vegetation proposed to be retained. This community will be retained, buffered, protected and restored as part of the vegetation management planning strategies for proposal. Due to its retention and protection it is considered that the proposal is unlikely to have an adverse impact on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

II. Is likely to substantially and adversely modify the composition such that its local occurrence is likely to be placed at risk of extinction,

The endangered ecological community Lowland Rainforest will be wholly retained, restored and protected as part of the proposal. Therefore it is considered that the proposal is unlikely to substantially and adversely modify the composition such that its local occurrence is likely to be placed at risk of extinction.

(d) In relation to the habitat of threatened species, populations or ecological community:

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

I) The development proposes the removal of vegetation and habitats for a number of flora and fauna species. This includes the removal of habitats for a number of threatened fauna species observed within the subject site during surveys. The proposal will require the removal of the approximately 17.38 hectares of vegetation and habitats

All of the Coastal Warm Temperate Rainforest vegetation community will be retained, protected and restored as part of the site riparian vegetation management strategies.

II) The site is part of a fragmented local landscape. The habitats and vegetation within the site are part of the bushland/urban transition zone between the higher quality bushland to the south within Kincumba Mountain Reserve and the residential areas associated with Terrigal to the north, east and west of the site. The removal of vegetation from the site is not likely to result in further fragmentation within the local landscape. The removal of vegetation from the site is not likely to isolate any areas of vegetation or interrupt any current linkages between areas of vegetation or habitat.

The riparian corridors within the site will be retained, protected and restored as part of the site specific ecological design and management strategies. This will provide for contiguous vegetation and habitat areas within the site and also aid in retaining riparian and aquatic connectivity within the local area.

The development has been designed to retain important habitats and movement areas within and through the post development landscape. Any future development application will be accompanied by ecological management planning strategies to minimise potential ecological impacts.

II) The proposed development will require the removal of areas of habitat utilised by a number of threatened species observed within the subject site during surveys. These vegetation and habitat types are of decreased quality due to a history of disturbance including clearing and grazing. It is considered that the trees to be removed as part of the proposal are of some importance to threatened microchiropteran bat species as foraging and potential roosting habitat and of lesser significance to the Powerful Owl, Sooty Owl and Yellow-bellied Glider given the high amount of disturbance. There are

large areas of higher quality vegetation and habitat for these species within adjacent land to the south in Kincumba Mountain Reserve.

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

The site has not been identified as critical habitat within the provisions of the Threatened Species Conservation Act (1995). Therefore, this matter does not require further consideration at this time.

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

The Large Forest Owls, Yellow-bellied Glider and Grey-headed Flying-fox Recovery Plans are relevant to this assessment. A full assessment of the proposal against the objectives and actions of each of the relevant draft or final recovery plans is included as Appendix 3. The proposal is not inconsistent with the objectives of any recovery plan.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process,

The proposed development is likely to result in the operation of or increase the impact of the following Key Threatened Processes:

- Clearing of Native Vegetation;
- Removal of hollow bearing trees;
- Removal of dead wood, dead trees and logs
- Invasion of native plant communities by exotic perennial grasses.

To decrease the potential impact of these Key Threatening Processes approximately 27.28 hectares of the site will be transferred to Council's Coastal Open Space System which will provide for an extension of Kincumba Mountain Reserve. Additionally the preparation of an Ecological Site Management Plan, incorporating the Riparian Vegetation Management Plan will be prepared which will identifies measures proposed to reduce the impact of Key Threatening Processes.

APPENDIX 3

THREATENED SPECIES RECOVERY PLANS

1. ASSESSMENT OF PROPOSAL AGAINST RELEVANT RECOVERY PLANS

The following Threatened Species Recovery Plans are assessed in relation to the proposed development.

- Recovery Plan for the Yellow-bellied Glider (*Petaurus australis*) (NSW NPWS 2003);
- Recovery Plan for the Large Forest Owls Powerful Owl (*Ninox strenua*), Sooty Owl (*Tyto tenebricosa*), Masked Owl (*Tyto novaehollandiae*) (DEC 2006);
- Draft National Recovery Plan for the Grey-headed Flying-fox *(Pteropus poliocephalus)* (DECCW 2009).

An assessment of the proposal against these recovery plans has been prepared due to the recorded presence of the Yellow-bellied Glider, Powerful Owl and Sooty Owl within the subject site. This assessment has been completed in accordance with the requirements of the Department of Planning as part of the specifications for the preparation of the Local Environmental Study for the rezoning of the subject site. The specifications require:

Assessment of the proposal against any approved or draft recovery plans, including recovery plans for:

- Yellow-bellied Glider;
- Large Forest Owls (Powerful Owl, Sooty Owl, Masked Owl);
- Grey-headed Flying-fox.

While a number of other threatened species have been recorded within the subject site, no draft or final recovery plans have been prepared for these species.

Each of the recovery plans contains a number of recovery objectives and aims within those objectives. Many of these aims and objectives relate to initiatives of the Department of Environment and Climate Change and Water in conserving these threatened species within conservation lands. Each of the relevant aims and objectives as they relate to the proposal is assessed within the following sections.

2. CONSIDERATION OF RECOVERY PLAN FOR THE YELLOW-BELLIED GLIDER (*Petaurus australis*)

Objective 1: To Coordinate the recovery of the Yellow-Bellied Glider in NSW

Action: The NPWS will coordinate the implementation of the actions outlined in this Recovery Plan.

This action is not relevant to the proposal and therefore will not be further addressed.

Action: The NPWS will integrate recovery actions of the Yellow-bellied Glider with those of other threatened species, populations and ecological communities.

No environmental impact assessment guidelines are available to date. Therefore the proposal cannot be assessed against any standard impact assessment guidelines prepared by the NPWS (DEC, DECC).

Objective 2: To encourage and assist in improving the protection and management of the Yellow-Bellied Glider and its habitat

Action: The NPWS will develop standard survey and environmental impact assessment guidelines for the Yellow-bellied Glider and distribute them to all relevant consent authorities

This action is not relevant to the proposal and therefore will not be further addressed.

Action: The NPWS will provide for Yellow-bellied Glider populations in reserve management and planning.

Kincumba Mountain Reserve contains individuals that are part of a local population of the Yellow-bellied Glider. It is considered that the individuals observed within the subject site are part of the population contained and reserved within Kincumba Mountain Reserve. There are no known specific management programs for the Yellow-bellied Glider within Kincumba Mountain Reserve.

Action: The NPWS will encourage State Government agencies and local governments to consider the inclusion of regional-based Yellow-bellied Glider habitat types, sap trees and sap tree species in planning instruments.

It is considered that the draft LEP will consider the occurrence of Yellow-bellied Glider habitat types within the site as part of any rezoning. A number of sap feeding tree species (*Eucalyptus pilularis, Eucalyptus punctata, Eucalyptus saligna*) are present within the subject site. No sap feeding trees were observed however despite extensive surveys. The areas of land proposed to be transferred to Council for inclusion into Kincumba Mountain Reserve will increase the area of Yellow-bellied Glider habitat in this reserve.

Action: The NPWS will encourage Catchment Management Boards (CMBs), RVCs and Bush Fire Management Committees (BFMCs) to consider regionally significant Yellow-bellied Glider habitat types, sap trees and sap tree species in Catchment Management Blueprints, Regional Vegetation Management Plans, Bush Fire Risk Management Plans and Plans of Operations.

Given the large amount of higher quality habitat within adjacent lands and reserved within Kincumba Mountain Reserve it is not considered that the habitats within the subject site are regionally significant for the Yellow-bellied Glider. The subject site is not known to be part of any Catchment Management Blueprint, Regional Vegetation Management Plan, Bushfire Risk Management Plan or Plan of Operation.

Action: The NPWS will liaise with DLWC to achieve retention of Yellow-bellied Glider sap trees, sap tree species, den trees and a mosaic of forest types when assessing private native forest logging and vegetation clearance applications.

No den trees or sap feeding trees have been identified within the subject site. The proposal is not an application to clear native vegetation or private native forest logging.

Action: The NPWS will liaise with relevant government agencies and utility providers to ensure that appropriate consideration is given to the isolation of Yellow-bellied Glider habitat in

design of roads, easement corridors and other linear clearing (including access and maintenance trails).

This action is not relevant to the proposal and therefore will not be further addressed.

Action: The NPWS will consolidate survey results and records, including existing records that do not appear in the NPWS Atlas of NSW Wildlife, to identify the status of the Yellow-bellied Glider on privately-owned and public forested land.

This action is not relevant to the proposal and therefore will not be further addressed. Information on the recorded occurrence of the Yellow-bellied Glider within the subject site has been provided to the Department of Environment and Climate Change and Water (DECCW) for inclusion on the Atlas of NSW Wildlife for use as part of any updating of owl habitat models.

Objective 3: To identify and monitor significant populations of the species

Action: The NPWS will, on a NPWS directorate basis, identify significant Yellow-bellied Glider populations and the specific management issues associated with them. The NPWS will support monitoring of these populations and, where possible, implement appropriate management.

This action is not relevant to the proposal and therefore will not be further addressed.

Objective 4: To facilitate strategic research into the ecology of the Yellow-Bellied Glider that is relevant to its conservation

Action: The NPWS will liaise with research institutes, tertiary institutions, State Government agencies and other authorities to facilitate strategic ecological research that is relevant to the conservation of the Yellow-bellied Glider.

This action is not relevant to the proposal.

Objective 5: To increase community awareness of the Yellow-Bellied Glider and encourage community involvement in its conservation

Action: The NPWS will develop and distribute an information package to provide guidance to CMBs, RVCs, BFMCs, local governments, Landcare groups and individuals to assist in the identification of Yellow-bellied Glider habitat, sap trees, protection strategies and habitat enhancement as part of conservation and revegetation programs.

The revegetation of the riparian areas of the site will consider any NPWS initiatives for the protection and enhancement of Yellow-bellied Glider habitat as part of the riparian protection and revegetation program.

Action: The NPWS will develop and distribute information on the Yellow-bellied Glider to the general community.

This action is not relevant to the proposal and therefore will not be further addressed.

3. RECOVERY PLAN FOR THE LARGE FOREST OWLS POWERFUL OWL *(Ninox strenua)* SOOTY OWL *(Tyto tenebricosa)* and MASKED OWL *(Tyto novaehollandiae)*

Model and Map Owl Habitat and Validate With Surveys

Objective 1: Assess the distribution and amount of high quality habitat for each owl species across public and private lands to get an estimate of the number and proportion of occupied territories of each species that are, and are not, protected.

Recovery Actions: Recovery actions will be directed towards updating existing owl habitat models, mapping modelled habitat across public and private lands, and carrying out field surveys to validate models and enable estimation of the number of territories for each species supported by public versus private land.

It is considered that this objective and action is not relevant to the proposal. Information on the recorded occurrence of the Sooty Owl and Powerful Owl within the subject site has been provided to the Department of Environment and Climate Change and Water (DECCW) for inclusion on the Atlas of NSW Wildlife for use as part of any updating of owl habitat models.

Monitor Owl Population Parameters

Objective 2: To monitor trends in population parameters (numbers, distribution, territory fidelity and breeding success) across the range of the three species and across different land tenures and disturbance histories).

Recovery Actions: Recovery actions will be directed towards developing and implementing a set of regional monitoring programs for the three species throughout their ranges in NSW that assess occupancy of potential habitat, fidelity to occupied territories and breeding success across a range of land tenures and disturbance histories. Synergies with the field validation component of modelled habitat and monitoring actions will be investigated.

It is considered that this objective and action is not relevant to the proposal. Information on the recorded occurrence of the Sooty Owl and Powerful Owl within the subject site has been provided to the Department of Environment and Climate Change and Water (DECCW) for inclusion on the Atlas of NSW Wildlife for use as part of any regional monitoring programs.

Audit Forestry Prescriptions

Objective 3: To assess the implementation and effectiveness of forest management prescriptions designed to mitigate the impact of timber-harvesting operations on the three owl species and, (if necessary), to use this information to refine the prescriptions so that forestry activities on state forests are not resulting in adverse changes in species abundance and breeding success.

Recovery Actions: Recovery actions will be directed towards assessing the implementation and effectiveness of forest management prescriptions, and if necessary, refining them so that forestry activities on state forests are not resulting in adverse changes in species abundance and breeding success.

It is considered that this objective and action is not relevant to the proposal.

Manage and Protect Habitat Off Reserves and State Forests

Objective 4: Ensure the impacts on large forest owls and their habitats are adequately assessed during planning and environmental assessment processes.

Recovery Actions: Recovery actions are directed towards the development, maintenance and evaluation of tools used by consultants, consent and determining authorities for assessing and mitigating the impact of development activities on large forest owls and their habitats.

No environmental impact assessment guidelines for the large forest owls were available at the time of this report. Surveys for the large forest owls within the site were undertaken in accordance with standard survey methodologies adopted by Gosford City Council (LHCCREMS 2003). The impacts of the proposal upon the large forest owl species were completed in accordance with the 7-part test of significance of Section 5A of the *Environmental Planning and Assessment Act*. It was concluded that the proposed development was not likely to result in a significant impact upon the Powerful Owl, Sooty Owl or Masked Owl.

Objective 5: Minimise further loss and fragmentation of habitat by protection and more informed management of significant owl habitat (including protection of individual nest sites).

Recovery Actions: Recovery actions will be directed towards encouraging the protection and management of significant habitat.

Given the large amount of suitable and higher quality habitat within adjacent lands in Kincumba Mountain Reserve, it is not considered that the vegetation and habitats within the subject are significant for the large forest owl species locally.

The recorded occurrence of the Sooty Owl and Powerful Owl within the subject site suggests that the subject site forms part of the home range of an individual or pair of these species. Given the isolation of bushland to the north, east and west, the subject site is likely to be on the outer edge of the home range of the Sooty Owl and Powerful Owl with the large majority occurring within Kincumba Mountain Reserve to the south and south-west. The higher quality, denser riparian vegetation types (Closed Forest and Tall Moist Forest) will be retained within the site. No roost or breeding hollows were detected within the subject site for these species. It is not considered that the proposed development area does not form significant habitat for the Sooty Owl or Powerful Owl.

The proposal to incorporate areas within the riparian protection area and transfer 27.28 hectares to Council will ensure that the main areas of Sooty Owl and Powerful Owl habitat will be protected and retained within larger habitat areas.

Undertake Research

Objective 6: To improve the recovery and management of the three large forest owls based on an improved understanding of key areas of their biology and ecology.

Recovery Actions: Recovery actions will be directed towards encouraging and facilitating scientific investigation into key aspects of the biology and ecology of the three large forest owls that are likely to provide information that is valuable to the recovery and/or management of these species.

It is considered that this objective and action is not relevant to the proposal.

Increase Community Awareness and Involvement in Owl Conservation

Objective 7: To raise awareness of the conservation requirements of the three large forest owls amongst the broader community, to involve the community in owl conservation efforts and in doing so increase the information base about owl habitats and biology.

Recovery Actions: Recovery actions will be directed towards raising awareness within the community about the conservation requirements of the three large forest owls and encouraging community involvement in recovery actions and information gathering.

It is considered that this objective and action is not relevant to the proposal.

Provide Organisational Support and Integration

Objective 8: To coordinate the implementation of the recovery plan and continually seek to integrate actions in this plan with actions in other recovery plans or conservation initiatives.

It is considered that this objective and action is not relevant to the proposal.

4. DRAFT RECOVERY PLAN FOR THE GREY-HEADED FLYING-FOX

The overall objectives of the draft recovery plan are:

- *To reduce the impact of threatening process on Grey-headed Flying-foxes and arrest decline throughout the species range.*
- *To conserve the functional roles of Grey-headed Flying-foxes in seed dispersal and pollination.*
- *To improve the standard of information available to guide recovery of the Grey-headed Flying-fox, in order to increase community knowledge of the species and reduce the impact of negative public attitudes on the species.*

The specific objectives of the recovery plan and the performance criteria are address in relation to the proposed development as follows:

Objective 1. To identify and protect foraging habitat critical to the survival of Grey-headed Flying-foxes throughout their range;

Criterion 1. Foraging habitat critical to the survival of Grey-headed Flying-foxes identified and the extent of this habitat that is protected under conservation management programs increased

The proposed development will provide in the form of offset lands of 18 ha of Grey-headed Flying-fox foraging resource. These lands adjoin Kincumba Mountain Reserve and will increase the reserve size by approximately 3%. Riparian areas within the site will be retained and restored enhancing foraging resources for this species.

Objective 2. To protect and increase the extent of key winter and spring foraging habitat of Grey-headed Flying-foxes;

Criterion 2. The extent of Grey-headed Flying-fox winter and spring foraging habitat that is protected under conservation management programs increased, and tree-planting and habitat rehabilitation programs to extend winter and spring foraging habitat implemented.

The majority of flowering trees within the subject site are not wintering flowering species and consist mostly of the summer flowering *Eucalyptus pilularis* (Blackbutt). However the proposed development will allow for the rehabilitation of the Riparian areas and other areas of retained vegetation which will further enhance Grey-headed Flying-fox foraging resources.

Objective 3. To identify roosting habitat critical to the survival of Grey-headed Flying-foxes;

Criterion 3. Camps critical to the survival of Grey-headed Flying-foxes identified and mapped.

There are no known Grey-headed Flying-fox camps within the subject site.

Objective 4. To protect and enhance roosting habitat critical to the survival of Grey-headed Flying-foxes;

Criterion 4. The number of Grey-headed Flying-fox camps critical to survival that are protected under conservation management programs increased.

It is considered that this objective and criterion is not relevant to the proposal.

Objective 5. To substantially reduce deliberate destruction of Grey-headed Flying-foxes in fruit crops;

Criterion 5. Damage to orchard industries by Grey-headed Flying-foxe reduced and deliberate destruction in crops substantially reduced.

Criterion 6. Increase in uptake of effective non-lethal flying-fox control practices by orchard industries.

It is considered that this objective and criterion is not relevant to the proposal.

Objective 6. To reduce negative public attitudes towards Grey-headed Flying-foxes and reduce conflict with humans;

Criterion 7. Both negative public attitudes toward Grey-headed Flying-foxes and conflict with humans reduced.

It is considered that this objective and criterion is not relevant to the proposal.

Objective 7. To increase public awareness and understanding of Grey-headed Flying-foxes and the recovery program, and to involve the community in recovery actions, where appropriate, to reduce the threat of negative public attitudes and conflicts with humans;

Criterion 8. Educational material for increasing public awareness and understanding of Grey-headed Flying-foxes and the recovery program developed and circulated, and members of the general community involved in recovery actions.

It is considered that this objective and criterion is not relevant to the proposal.

Objective 8. To monitor population trends in Grey-headed Flying-foxes so as to monitor the species' national distribution and status;

Criterion 9. Methods for assessing abundance in Grey-headed Flying-foxes improved, error in abundance measures estimated, and population trends monitored.

It is considered that this objective and criterion is not relevant to the proposal.

Objective 9. To assess and reduce the impact on Grey-headed Flying-foxes of electrocution on powerlines and entanglement in netting and on barbed-wire;

Criterion 10. The incidence of Grey-headed Flying-fox electrocution on powerlines and entanglement in netting and on barbed-wire assessed and reduced.

The development will provide underground power and will not be using barbed-wire as a fencing material.

Objective 10. To improve knowledge of the demographics and population structure of Grey-headed Flying-foxes in order to increase understanding of the ecological requirements of the species;

Criterion 11.Knowledge of the demographics and population structure of Grey-headed Flying-foxes improved.

All records of Grey-headed Flying-fox observations have been supplied to DECCW for inclusion on the NPWS Atlas of NSW Wildlife to information for future and current species demography.

Objective 11. To increase the effectiveness and efficiency of recovery initiatives for Grey-headed Flying-foxes by working cooperatively with conservation and management programs with overlapping objectives to remove or reduce the impact of threatening processes on the species;

Criterion 12. Cooperative alliances formed with appropriate conservation programs.

It is considered that this objective and criterion is not relevant to the proposal.

Objective 12. To maintain an effective Grey-headed Flying-fox National Recovery Team to oversee the implementation of the Grey-headed Flying-fox National Recovery Plan to remove or reduce the impact of threatening processes on the species.

Criterion 13. Strategic direction and coordination between State and Australian Government agencies for implementation of the Grey-headed Flying-fox National Recovery Plan.

It is considered that this objective and criterion is not relevant to the proposal.

Objective 13. To provide long-term economic benefits associated with the protection of ecosystem services, promotion of sustainable forest management, improved crop protection regimes, promotion of sustainable agricultural practices and increased viability of some commercial fruit industries.

It is considered that this objective and criterion is not relevant to the proposal.

REFERENCES

Department of Environment and Conservation (NSW) (2006). NSW Recovery Plan for the Large Forest Owls: Powerful Owl *(*Ninox strenua), Sooty Owl (Tyto tenebricosa) and Masked Owl (Tyto novaehollandiae). DEC, Sydney.

Environmental Planning and Assessment Act (1979). New South Wales Government.

\Lower Hunter Central Coast Regional Environmental Management (2003) *Flora and Fauna Survey Guidelines* Lower Hunter Central Coast Region.

NSW National Parks and Wildlife Service (2003). *Recovery Plan for the Yellow-bellied Glider* (Petaurus australis). NSW National Parks and Wildlife Service, Hurstville.

APPENDIX 4

HOLLOW BEARING TREE SURVEY
AND
AMELIORATION MEASURES
FOR THE REMOVAL OF HOLLOW BEARING TREES

1. SURVEY METHODOLOGY

To detect the presence of hollow bearing trees within the subject site each tree within the site that appear significantly mature enough to contain hollows was inspected. Inspection involved a systematic search of bushland areas for suspected trees

Once a suspected hollow bearing tree was located the surveyor encircled the tree inspecting the branches and the trees trunk for hollows using binoculars to enable closer inspection.

Hollows detected are then assessed for aperture size and position of hollow within the tree (see attached diagram for hollow description). All tree and hollow details are recorded in the field data sheet. Hollow aperture size is measured in increments to a maximum of >30cm. Hollows are separated into categories based on where they are positioned within the tree such as on the trunk or the branches. All hollows or other features of the tree which may act as shelter areas for fauna species, such as split bark, split trunks or arboreal termite nests which have been hollowed out by prior bird nesting activity, were be noted.

Hollow bearing trees were than clearly tagged, numbered and locations plotted by GPS and on an air photo of the site in areas where satellite coverage was poor.

Signs of fauna activity such as nesting birds, bee's hives, trunk scratches or evidence of hollow usage such as visible nesting material protruding from the hollow are all recorded on the field data sheet. If fauna is sighted using the tree hollows the species name is also recorded i.e. Galahs nesting in trunk hollow.

As visible inspection is undertaken from ground level it is difficult to accurately assess the depth of some hollows. Some hollows may in fact be actually full of termite nesting material and may not be hollow at all. Often where a branch as fallen from the tree, the tree wound left may appear as hollow from ground level when in fact no hollow has formed. In these cases it is best practice to assume that a hollow exist.

2. SURVEY RESULTS

A total of 123 hollow bearing trees were identified within the subject site. The hollow bearing trees to be removed were subjected to detailed survey as described above. The remaining hollowing bearing trees located within areas not proposed for development and are to be retained. Attachment 1 provides details of assessed hollow bearing trees and Figures 1A and 1B identify the location of hollow bearing trees throughout the subject site within both the proposed development and non-development areas surveyed.

Ninety six of the hollow bearing trees surveyed, representing 78%, were outside of the proposed development area. It is likely that more trees are present within the non development areas in locations where access is constrained.

Twenty seven of the hollow bearing trees surveyed, representing 22%, were located within the proposed development area and contain a total of 48 hollows of varying sizes and types. These trees will require removal. Table 1 below provides details on the type and size of hollows to be removed.

TABLE 1 HOLLOWS TO BE REMOVED		
Hollow Type	Hollow Size	Number removed
Broken Trunk	20-25cm	1
	25-30cm	2
	30+	1
Branch	0-10cm	13
	10-15cm	3
	15-20cm	6
	20-25cm	5
	25-30cm	4
	30+	2
Trunk	20-25cm	1
	25-30cm	2
	30+	1 (in base)
Splits	20-25cm	1
	25-30cm	2
	30+	6
Cracked Bark	30+	1
Total Hollows to be Removed		48

3. AMELIORATION MEASURES

As an amelioration measure for the loss of the 27 hollow bearing trees and the associated 48 hollows contained within these trees, compensatory nest boxes will be installed within the subject sites retained trees positioned outside of the proposed development area to provide alternative shelter and roosting sites for the locally occurring hollow dependant fauna.

As the hollow bearing tree assessment is undertaken from ground level it is impossible to sight all hollows within the tree due to hollows been obscured by foliage or other branches. To compensate for these undetected hollows the number of hollows detected (48) has been increased by 100% (48) and rounded to up to the next 10 thereby equaling 100 nest boxes to be installed.

Nest boxes provided will be of varying types, as shown in Table 2, and will be installed throughout the subject site outside of the proposed development area as identified in Figure 2. Different nest box types (see Attachment 2, pictures A-F) will be installed to compensate for the loss of potential roosting habitat.

The size / classes of hollows being removed generally corresponds to the nest box sizes proposed for installation. The replacement ratios of nest box types recommended are generally acceptable ratios similar to other replacement regimes that have been approved for other projects undertaken by Conacher Environmental Group in the past. While the recommended replacement ratio is not based on arithmetical calculations they do reflect the overall composition of hollow types lost.

The species likely to utilize the different types of nest boxes are outlined in Table 2. These species have all been observed within the subject site during surveys.

TABLE 2 SCHEDULE OF NEST BOX INSTALLATION			
Nest Box Type		**Targeted Species**	**No.**
A	Micro-bat	All micro-bat species	25
B	Glider	Sugar Glider, Pardalotes, Micro-bats, Small Lorikeets	19
C	Small Parrot	Ringtail Possum, Gliders, Rosella, Large Lorikeets	18
D	Large Parrot	Brushtail & Ringtail Possum, Galahs, Boobook Owls,	20
E	Possum	Brushtail & Ringtail Possum, Large Cockatoos	16
F	Owls	Brushtail & Ringtail Possum, Large Cockatoos, Large Owls	2
		Total:	**100**

Areas outside of the proposed development footprint have been divided into 4 areas representing the various conservation zones, these areas have been assigned numbers of nest boxes based on the overall size of the respective conservation zone and current level of hollows within these areas (Figure 2). Nest box types will be distributed throughout these areas by a qualified ecologist who will consider the biology of the species targeted for each box in respect to home range, box location etc. It is recommended that a qualified ecologist supervise the installation of each nest box.

Hollows removed from fallen hollow trees will be placed on the ground throughout the subject site outside of the development area to compensate for terrestrial fauna habitat lost. The hollow logs will be spaced such that they do not form a log-pile. It is recommended that hollows be spaced at a density of not more than 1 log per 900m2 area (30 x 30m).

4. NEST BOX CONSTRUCTION AND INSTALLATION DETAIL

i Nest boxes are to be constructed of marine grade 5 ply, using marine grade stainless steel screws or suitably strong adhesive. The lid is to be securely hinged and be able to be opened easily. Technical design details are shown in Attachment 2.

ii Nest boxes are to be secured to trees using 100mm marine grade stainless steel coach bolts using stainless steel nut and washers as spacers between the nest box and the host tree.

iii Nest boxes are to be positioned a minimum height of four metres above ground level and positioned no higher than eight metres. Nest boxes should be facing the east to north east direction. An experienced ecologist is required to supervise the installation of nest boxes.

iv An Ecologist is to locate appropriate trees and locations for installing the nest boxes. The specific locations of nest boxes within the locality are to be determined by the Ecologist within each of the designated locations.

v The location of nest boxes is to be logged by GPS. Details of the host tree are also to be recorded.

vi Nest boxes are to be erected by a qualified arborist with an assistant qualified tree climber under the supervision of the Ecologist.

vii Nest boxes are to be monitored by a qualified and experienced Ecologist for fauna usage at the following intervals from date of installation: 3 months, 6months, 12 months than each 12 months for a further 4 years.

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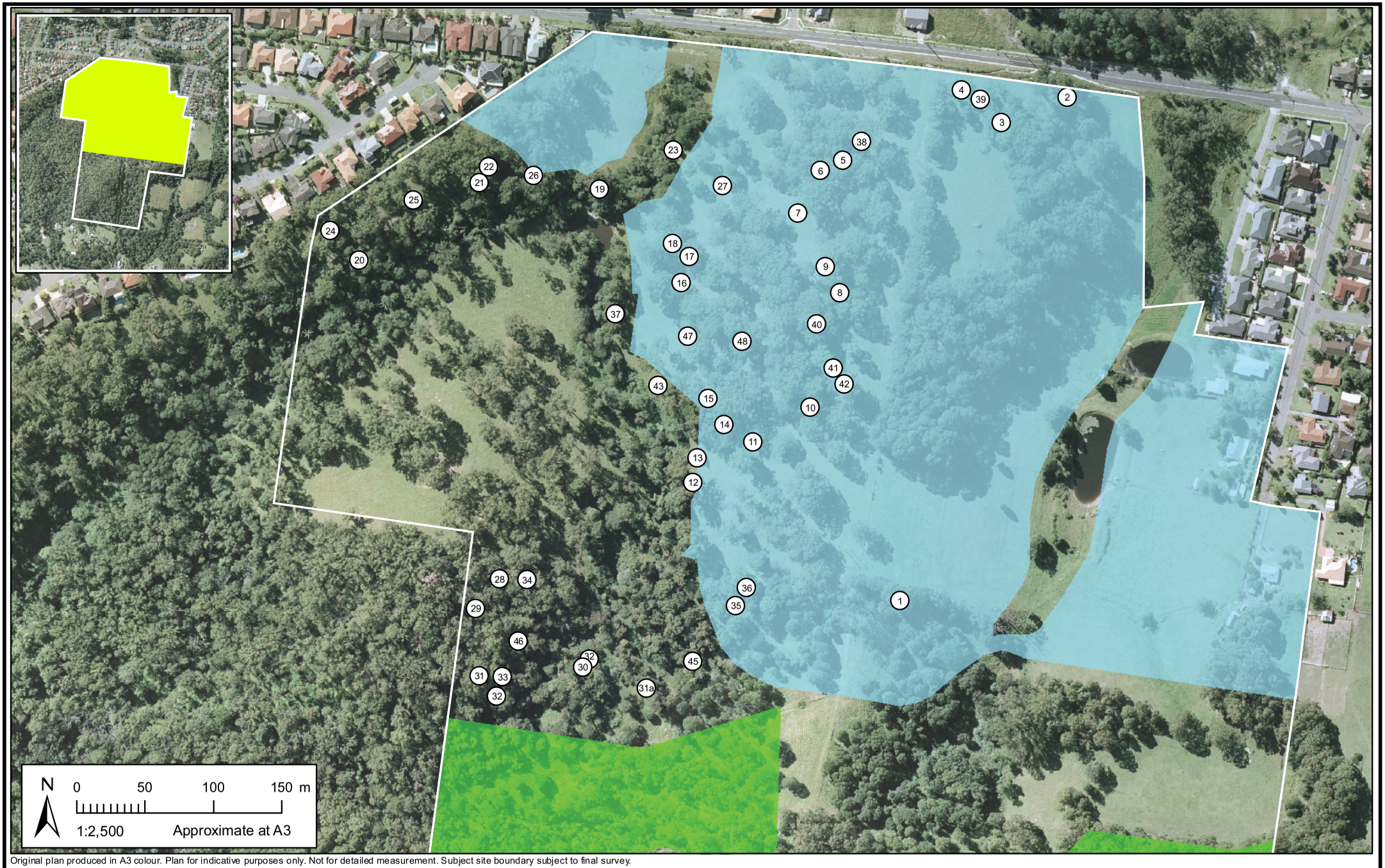

Original plan produced in A3 colour. Plan for indicative purposes only. Not for detailed measurement. Subject site boundary subject to final survey.

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Legend

- Subject Site Boundary
- (1) Surveyed Hollow Bearing Tree Locations
- Proposed Development Area
- Areas Not Surveyed
- Site Area Shown on Plan

Drawing No.	10050	Date 6/12/10
Drawn By	JM	
Amendment		Date
A		
B		
C		

Figure 1-A

Hollow Bearing Tree Locations North

Kings Avenue, Terrigal

Original plan produced in A3 colour. Plan for indicative purposes only. Not for detailed measurement. Subject site boundary subject to final survey.

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Legend

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- (1) Surveyed Hollow Bearing Tree Locations
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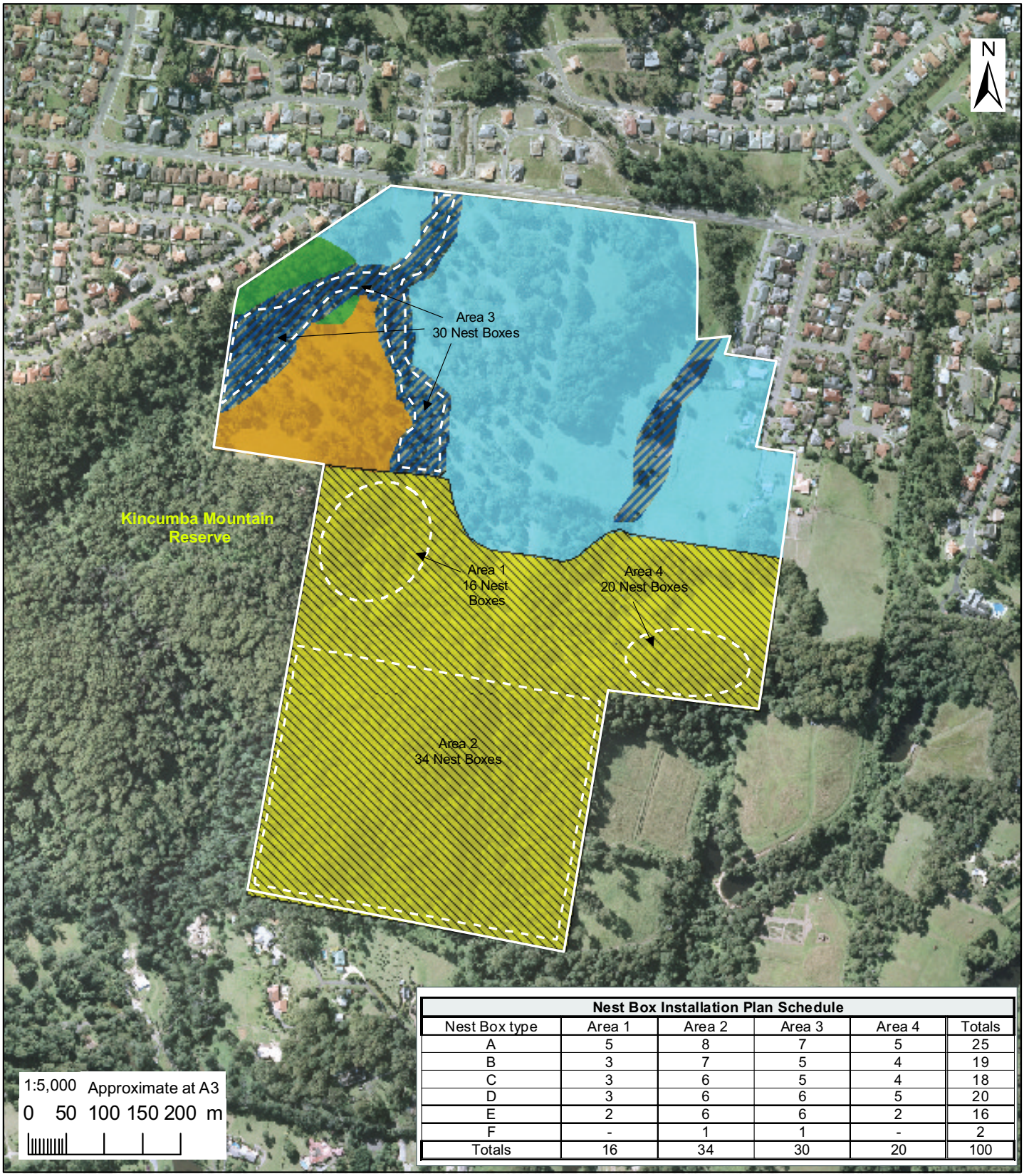
Drawing No.	10050	Date 6/12/10
Drawn By	JM	
Amendment		Date
A		
B		
C		

Figure 1-B

Hollow Bearing Tree Locations North

Kings Avenue, Terrigal



Nest Box Installation Plan Schedule					
Nest Box type	Area 1	Area 2	Area 3	Area 4	Totals
A	5	8	7	5	25
B	3	7	5	4	19
C	3	6	5	4	18
D	3	6	6	5	20
E	2	6	6	2	16
F	-	1	1	-	2
Totals	16	34	30	20	100

*Subject Site boundary subject to final survey.
Survey locations are approximate and have not been fixed by land survey. Plan for indicative purposes only.
Not for detailed measurement. Original plan produced in A3 colour.

Legend

- Subject Site Boundary
- Area Subject to Management Plan
- Development Area
- Buffer to Rainforest Vegetation
- Environment Conservation
- Transfer to Council
- Riparian/Drainage Reserve

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Figure 2
Nest Box Installation Plan

Kings Avenue, Terrigal

Ver.F3 By.JM
6/12/10
Ref.No.10050

Source: Aerial © Department of Lands (2007)

ATTACHMENT 1

HOLLOW BEARING TREE SURVEY RESULTS
FOR TREES TO BE REMOVED

TABLE A1.1 HOLLOW BEARING TREE SURVEY – TREES TO BE REMOVED

CLIENT. Crighton Properties...REF NO....8065.... DATE.....17 August 2007.....ASSESSOR…….Paul Shelley……..SHEET NO.....1....of.....5.....

TREE LOCATIONS RECORDED ON MAP Y/N SITE SURVEY SHEET COMPLETED Y/N

Tree Tag Number		1	2	3	4	5	6	7	8
Species		*E.deanii*	*Stag*	*E.pilularis*	*E.pilularis*	*Stag*	*E.pilularis*	*E.pilularis*	*E.pilularis*
DBH (cm)		60	50	100	85	70	130	120	120
Spread (m)		12	5	25	10	6	15	30	25
Height (m)		20	18	25	18	20	20	30	30
Position		Top slope	Low slope	Mid slope	Mid slope	Top slope	Top slope	Top slope	Top slope
% Health		80	0	60	70	0	60	80	80
Fauna Use									
HOLLOWS									
	0-10cm								
I Broken Trunk	10-15cm								
	15-20cm								
	20-25cm								
	25-30cm	1							1
	30+					1			
	0-10cm		2						
II Branch	10-15cm								
	15-20cm			2					
	20-25cm								
	25-30cm						1	1	
	30+								
	0-10cm								
III Trunk	10-15cm								
	15-20cm								
	20-25cm								
	25-30cm						1		
	30+						Base		
	0-10cm								
IV Splits	10-15cm								
	15-20cm								
	20-25cm								
	25-30cm		2						
	30+				1		1		
	0-10cm								
V Cracked Bark	10-15cm								
	15-20cm								
	20-25cm								
	25-30cm								
	30+								
Targeted fauna survey									

POSITIONS: Topographical location - ridge, slope, gully etc .**HEALTH:** Record % of healthy growth compared to dead limbs.

TABLE A1.1 HOLLOW BEARING TREE SURVEY- TREES TO BE REMOVED

CLIENT. Crighton Properties...REF NO....8065.... DATE.....17 August 2007.....ASSESSOR……Paul Shelley……..SHEET NO.....2....of.....5.....

TREE LOCATIONS RECORDED ON MAP Y/N SITE SURVEY SHEET COMPLETED Y/N

Tree Tag Number		9	10	11	13	14	15	16	17
Species		*E.pilularis*	*E.pilularis*	*E.pilularis*	*E.pilularis*	*S. glomulifera*	*E.pilularis*	*S. glomulifera*	*E.pilularis*
DBH (cm)		100	100	130	120	65	85	80	120
Spread (m)		30	18	20	15	5	12	12	18
Height (m)		25	28	20	30	12	23	20	28
Position		Top slope	Top slope	Mid slope	Low slope	Low slope	Mid slope	Mid slope	Top slope
% Health		70	70	50	40	20	50	70	
Fauna Use									
HOLLOWS									
	0-10cm								
I Broken Trunk	10-15cm								
	15-20cm								
	20-25cm							1	
	25-30cm								
	30+								
	0-10cm			4	4				
II Branch	10-15cm								
	15-20cm		1		1		1		1
	20-25cm								1
	25-30cm	1							
	30+								
	0-10cm								
III Trunk	10-15cm								
	15-20cm								
	20-25cm								
	25-30cm								
	30+								
	0-10cm								
IV Splits	10-15cm								
	15-20cm								
	20-25cm								
	25-30cm								
	30+					1			
	0-10cm								
V Cracked Bark	10-15cm								
	15-20cm								
	20-25cm								
	25-30cm								
	30+								
Targeted fauna survey									

POSITIONS: Topographical location - ridge, slope, gully etc .**HEALTH:** Record % of healthy growth compared to dead limbs